VA Hudson Valley Health Care System

Project Number: 620-23-206

Montrose VAMC

Montrose Renovate Building 14CD For Homeless Residential Program

ISSUED FOR BIDDING

PROJECT MANUAL

Prepared For:	Prepared By:	Project Team:
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MONTROSE RENOVATE BUILDING 14CD FOR HOMELESS RESIDENTIAL PROGRAM

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NOT USED

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NOT USED

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NOT USED

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REFERENCE: 06 06 60

ITEM: Resinous Wall Panel

VENDOR: 3 Form

MODEL: Varia Bear Grass 4'x8'

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 09 51 00

ITEM: Acoustical Ceiling Tile

VENDOR: Armstrong

MODEL: Ultima Health Zone High NRC
Beveled Tegular 24”x24”

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 09 51 00

ITEM: Acoustical Ceiling Tile

VENDOR: Autex

MODEL: Wood works Linear Veneer Planks

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 09 91 00

ITEM: Concrete

VENDOR: Electraseal

MODEL: Hygroscopic ESD Control Concrete Sealer
Translucent

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 10 26 00

ITEM: Corner Guard

VENDOR: In Pro

MODEL: EnviroGT G2-150F Flush Mount Chino

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 10 26 00

ITEM: Corner Guard

VENDOR: In Pro

MODEL: Stainless steel
3 ½" legs

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 09 65 19

ITEM: Luxury Vinyl Tile

VENDOR: Armstrong

MODEL: Biome Collection

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 09 91 00

ITEM: Painting

VENDOR: Sherwin Williams

MODEL: SW7042 Shoji White

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 09 91 00

ITEM: Painting

VENDOR: Sherwin Williams

MODEL: SW7757 High Reflective White

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 09 91 00

ITEM: Painting

VENDOR: Sherwin Williams

MODEL: SW7017 Dorian Gray

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 09 91 00

ITEM: Painting

VENDOR: Sherwin Williams

MODEL: SW6205 Comfort Gray

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 09 91 00

ITEM: Painting

VENDOR: Sherwin Williams

MODEL: SW6240 Windy Blue

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 09 91 00

ITEM: Painting

VENDOR: Sherwin Williams

MODEL: SW9012 Polvo De Oro

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 09 91 00

ITEM: Painting

VENDOR: Sherwin Williams

MODEL: SW6219 Rain

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 09 91 00

ITEM: Painting

VENDOR: Sherwin Williams

MODEL: SW4084 Safety Yellow

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 06 20 00

ITEM: Plastic Laminate

VENDOR: Formica

MODEL: 5785 Ashwood Beige

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 06 20 00

ITEM: Plastic Laminate

VENDOR: Formica

MODEL: Winter Sky 8792

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 09 30 13

ITEM: Porcelain Tile

VENDOR: Daltile

MODEL: Keystones
Urban Putty D161 2”x2”

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 09 30 13

ITEM: Porcelain Tile

VENDOR: Daltile

MODEL: Degrees Silver
Volume 1.012”x24”

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 09 30 13

ITEM: Porcelain Tile

VENDOR: Crossville

MODEL: Par Avion
Handwritten 3”x12”

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 09 65 13

ITEM: Resilient Base

VENDOR: Roppe

MODEL: Pinnacle Lunar dust

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 10 26 00

ITEM: Rigid Wall Covering

VENDOR: C/S Acrovyn

MODEL: Rigid Sheet

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 12 24 00

ITEM: Roller Shades

VENDOR: Mecho Shade

MODEL: ThermoVeil Dense Basket Weave
1500 Series – 1519 Silver Birch

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 06 20 00

ITEM: Solid Surface

VENDOR: Avonite

MODEL: Arctica 9015 & KoKura

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 07 46 46

ITEM: Siding

VENDOR: James Hardie

MODEL: HardiePlank –Artisan - primed

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 09 30 13

ITEM: Tile Trim

VENDOR: Schluter Systems

MODEL: Dilex-AHK
Satin Nickel Anodized Aluminum

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 09 30 13

ITEM: Tile Trim

VENDOR: Schluter Systems

MODEL: Jolly
Satin Nickel Anodized Aluminum

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____ MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 09 30 13

ITEM: Tile Trim

VENDOR: Schluter Systems

MODEL: Reno-U
Satin Nickel Anodized Aluminum

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____ MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 09 30 13

ITEM: Tile Trim

VENDOR: Schluter Systems

MODEL: Deco
Stainless Steel

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____ MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 27 51 16

ITEM: MIXER POWER AMPLIFIERS

VENDOR: TOA

MODEL: 900 SERIES A-906MK2

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____ MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 27 51 16

ITEM: AUX MODULE

VENDOR: TOA

MODEL: U-13S

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____ MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 27 31 00

ITEM: CAT6 UPT Jacks In wall plates (red)

VENDOR: Leviton

MODEL: 61110-RC6

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____ MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 27 31 00

ITEM: CAT6 UPT Jacks In wall plates (yellow)

VENDOR: Leviton

MODEL: 61110-RY6

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____ MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 27 51 16

ITEM: CEILING SPEAKER

VENDOR: CLARITY BY VALCOM

MODEL: S-522B-2

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____ MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 27 51 16

ITEM: BALANCE LINE INPUT MODULE MUTE-RECIEVE

VENDOR: TOA

MODEL: L-11S

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____ MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 27 51 16

ITEM: BALANCE LINE INPUT MODULE MUTE-SEND

VENDOR: TOA

MODEL: L-41S

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____ MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 26 51 00

ITEM: LIGHT FIXTURE A

VENDOR: Lithonia

MODEL: 2BLT2 60L 120V EZ1 LP835 2X2 RECESSED

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____ MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 26 51 00

ITEM: LIGHT FIXTURE B

VENDOR: LITHONIA
MODEL: LITHONIA LDN6 27/15 L06 AR LSS MVOLT EZ10 USPOM 6" DOWNLIGHT

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____ MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 26 51 00

ITEM: LIGHT FIXTURE B1

VENDOR: LITHONIA
MODEL: LDN6 35/15 L06 AR LSS
MVOLT EZ10 USPOM
6" DOWNLIGHT

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____ MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 26 51 00

ITEM: LIGHT FIXTURE C

VENDOR: LITHONIA

MODEL: FMVCCLS 36IN MVOLT 35K 90 36" VANITY

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____ MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 26 51 00

ITEM: LIGHT FIXTURE D

VENDOR: LITHONIA
MODEL: LITHONIA CLX L48 4000LM FDL 120 GZ10 40K 80CRI WH 4' STRIP,

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____ MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 26 51 00

ITEM: LIGHT FIXTURE G

VENDOR: LUMENS
MODEL: LUMENS PIXO OPTICAL LED WALL SCONCE PAB567762
BEDSIDE LIGHTING, SWING BAR

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____ MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 26 51 00

ITEM: LIGHT FIXTURE H

VENDOR: WAC LIGHTING
MODEL: WAC LIGHTING PD 52310 10" PENDANT, 100% - 10% ELV BRUSHED NICKEL, DAMP LISTED

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____ MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 26 51 00

ITEM: LIGHT FIXTURE J

VENDOR: LITHONIA
MODEL: LITHONIA LDN6CYL 35/40 L0AR LSS 120
EZ10 ACC USPOM 6" PENDANT DOWNLIGHT

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____ MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 26 51 00

ITEM: LIGHT FIXTURE X

VENDOR: LITHONIA

MODEL: LQM S W 3 R 120/277 AC

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____ MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 23 64 00

ITEM: Packaged Air Cooled Chiller (CH-01, CH-02)

VENDOR: Trane

MODEL: ACSA

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____ MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 23 73 00

ITEM: Chilled Water Air Handler (AH01)

VENDOR: Trane

MODEL:

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 23 22 23

ITEM: Clean Stream Generator (CSG01)

VENDOR: Marlo

MODEL: MRO-2500-2.5 Single

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 23 22 23

ITEM: Water Treatment System for Clean Steam Generator

VENDOR: Ashberry Water

MODEL: Marlo ACA-10G01 Single Carbon Filtration System
Marlo Model MAT-45M-1 Twin Alternating Softener System
Marlo model MRO-2500-2.5 Reverse Osmosis System
Marlo Tank Assy RO 160 Titan 3/4HP

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 23 22 23

ITEM: 13-0-CRU Steam Condensate Pump (CRU-1,2,3)

VENDOR: Spriax Sarco

MODEL: VC (CRU-2,3), VE (CRU-1)

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE:

ITEM: Ductless Split System

VENDOR: Mitsubishi

MODEL: MSZ-FE12NA & MUZ-FE12NA

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 23 34 00

ITEM: Fans

VENDOR: Greenheck

MODEL: SE1-12-436-VG

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 23 37 00

ITEM: Grille, Register and Diffuser

VENDOR: Price

MODEL: ASPD
610
630

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 23 21 23

ITEM: Hydronic Pumps

VENDOR: Taco

MODEL:

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER

NAME: _____

BRAND: _____

NO.:

REFERENCE: 27 31 00

ITEM: Patch Panel

VENDOR: Leviton

MODEL: 69586-C48

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____ MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 22 11 00

ITEM: Water Monitoring System

VENDOR: Phigenics

MODEL: WME-1175 PWA Advanced Monitoring System 2.0

WME-3802 Water Sample Cooler Assembly

WME-2910 WME-2910 Water Temperature Sensor with 4 – 20mA and thermowell

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 22 40 00

ITEM: P-111 Water Closet

VENDOR: Sloan

MODEL:

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE:	22 40 00
ITEM:	P-114 Water Closet
VENDOR:	American Standard; Sloan
MODEL:	American Standard 3641.001 Sloan Royal 111-1.28

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER NAME: _____

BRAND: _____

NO.: _____

REFERENCE:	22 40 00
ITEM:	P-408 Lavatory
VENDOR:	American Standard; Watts
MODEL:	American Standard 0475.047 Watts 1070A5

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER NAME: _____

BRAND: _____

NO.: _____

REFERENCE:	22 40 00
ITEM:	P-501 Service Sink
VENDOR:	Fiat Products, Chicago Faucets
MODEL:	Fiat MSB 2424 Chicago Faucet 540-LD897SCP

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE:	22 40 00
ITEM:	P-505 Clinical Service Sink
VENDOR:	American Standard; Zurn
MODEL:	American Standard 9512999.020 Zurn Z60842AV-H

REFERENCE: 22 40 00

ITEM: P-524 Two Compartment Sink

VENDOR: Elkay

MODEL: Elkay PSR3322
Elkay HDFAV1411

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE:	22 40 00
ITEM:	P-529 Single Compartment Sink
VENDOR:	Elkay
MODEL:	Elkay DRKR220R Elkay HDFAV1411

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 22 40 00

ITEM: P-701 Shower

VENDOR: American Standard

MODEL: 1662607 Shower system kit

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 22 40 00

ITEM: P-708 Emergency Eye Wash

VENDOR: Bradley

MODEL: S19224Y

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 22 40 00

ITEM: P-801 Wall Hydrant

VENDOR: Woodford

MODEL: Model 74

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 23 09 23

ITEM: Direct Digital Controls Building Management system

VENDOR: Johnson Controls

MODEL: compatible with Station's existing system

Westchester office
8 skyline Drive #2
Hawthorne, NY 10532
Contact: Bill chang
(866) 854 4572

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 27 31 00

ITEM: Standard Rack

VENDOR: Chatsworth Products

MODEL: 66353-703

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____ MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 27 51 16

ITEM: VOLUME CONTROL ATTENUATORS

VENDOR: TOA

MODEL: AT-025

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____ MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 27 31 00

ITEM: Clarity 5E 100-Pair 110 Block Kit with legs, 110C4s and 110C5s connecting blocks

VENDOR: ORTRONICS

MODEL: 110ABC5E100

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____ MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 27 52 23

ITEM: Nurse Call and Code Blue Systems

VENDOR: Baxter Voalte Nurse Call System

MODEL: compatible with stations existing system

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____ MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 28 13 00

ITEM: Physical Access Control System

VENDOR: Johnson Controls C-Cure 9000

MODEL: compatible with existing system

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 28 13 00

ITEM: Physical Access Control System Wander management

VENDOR: Securitas

MODEL: Wanderguard Blue

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 28 13 53

ITEM: Security Access detection

VENDOR: Avigilon, Lynx

MODEL: compatible with Station's existing system

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____ MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 28 23 00

ITEM: Video Surveillance

VENDOR: Avigilon Cameras and Network Video Recorder

MODEL: compatible with Station's existing system

Please reference attached product data sheet for further information.

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____ MANUFACTURER

NAME: _____

BRAND: _____

NO.: _____

REFERENCE: 28 31 00

ITEM: Fire Detection and Alarm

VENDOR: Notifier Non-Proprietary Addressable System with Mass Evacuation

MODEL: compatible with Station's existing system

Preferred vendors:

Sirina Fire Protection (516) 942 0400
AFA Protective Systems (914) 347 5481
Hurtvet Subcontracting (251) 548 3210

All characteristics are for reference purposes only and the VA will consider similar substitutions provided the intent of this project is still met and no federal, state or VA standards are violated.

BIDDING ON: _____

MANUFACTURER

NAME: _____

RAND: _____

NO.: _____

SECTION 01 00 00

GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 SAFETY REQUIREMENTS

A. Refer to section 01 35 26, SAFETY REQUIREMENTS for safety and infection control requirements.

1.2 GENERAL INTENTION

A. Contractor shall completely prepare site for building operations, including demolition and removal of existing structures, and furnish labor and materials and perform work for Montrose Renovate Building 14CD For Homeless Residential Program as required by drawings and specifications. **Period of performance is projected to be 580 calendar days.**

B. Visits to the site by Bidders may be made only by appointment with the Contract Officer.

C. Offices of Triple C - The A/E Group, as Architect-Engineers, will render certain technical services during construction. Such services shall be considered as advisory to the Government and shall not be construed as expressing or implying a contractual act of the Government without affirmations by Contracting Officer or his duly authorized representative.

D. Prime Contractor Personal Minimum Requirements:
   1. As Required in other parts of the Project Manual and Contract Requirements the following are minimum requirements:
      a. The Superintendent shall be an employee of the Prime Contractor with authority to act as the contractor, responsible for the day-to-day operations at the construction site, planning, quality control, verification of delivery of approved material and equipment, subcontractor coordination responsibilities and execution of the complete project as per the contract documents.
         1) Superintendent shall have no hands-on construction interaction. In addition, the superintendent shall provide proof to the COR regarding completion of 30 hour OSHA within the last 5 years from the date of contract award.
         2) Superintendent assigned to this project shall not be assigned to any other project and shall only have duties on one project at a time.
         3) The Superintendent shall sign-in at the beginning of each day of work and Sign-out at the end of the work day at the Office of Engineering Service. No work shall be performed by any contractors or subcontractors without the presence of the superintendent at the actual work site.
         4) The Superintendent shall be responsible for submitting daily work logs to the COR at the **beginning** of every work day.
      b. Site Safety and Health Officer (SSHO) shall be a separate qualified individual from the Prime Contractor's Superintendent or CQC System Manager with duties only as the SSHO. See 01 35 26 SAFETY REQUIREMENTS for more information on roles and responsibilities for General Contractor's staff.
      c. CQC System Manager shall be a separate qualified individual from the Prime Contractor's Superintendent or Site Safety and Health Officer (SSHO) with duties only as the CQC System Manager. See Section 01 45 00 Quality Control for more information on roles and responsibilities for CQC Personnel.
      d. The Prime contractor shall provide services of a Project Manager whose responsibilities would include but not be limited to providing support to the Superintendent at the job site and shall be responsible for finance related tasks and scheduling.

E. Dig Permit
   1. The contractor shall complete the VA dig permit with the COR and submit the Dig Safe notification prior to start of any excavation work.
   2. The contactor is responsible to perform their own utility GPRS as part of the dig permit application. Reference is made to SOP 138-22HV Attachment E in section 01 35 26 SAFETY REQUIREMENTS.

F. Electrical Work Permit
   1. The contractor shall complete the VA Electrical Work Permit with the COR and submit to the COR a minimum of 72 hours prior to start of electrical work within the facility.
   2. Reference is made to SOP 138-22HV Attachment F in section 01 35 26 SAFETY REQUIREMENTS.

G. Welding and Cutting
   1. A Hot Work Permit is required. See Section 01 35 26, SAFETY REQUIREMENTS for requirements.

H. Contract Work Hours
   1. Normal working hours are 8:00 am to 4:30 pm. Contractors who wish to work other than "normal working hours" for work to be done during those hours must submit a written request to the Contracting Officer for approval. The request must state that the Contractor is requesting to work other than normal working hours at no additional expense to the Government. Such requests shall be coordinated with the COR and must be submitted to the CO two (2) working days in advance.
   2. For certain aspects of work the Contractor shall be required to work off duty hours to perform that part of the work, for continued operations of the Medical Center. After duty hours work shall be coordinated with and approved by the COR.
      a. Noisy demolition work, work at building entrances, electrical or other utility work necessary to pass within, above, traverse hallway corridors, temporary shutdowns of utilities for tie-in.

I. Contractor shall perform work in accordance with requirements of **"ASHE Construction in a Healthcare Facility".**

J. Contractor shall use Autodesk Build for this project as per VHA VISN 2 CAM policy. See 01 32 00 CONSTRUCTION DOCUMENTATION. Contractor will provide VA access to the site. Contractor will keep this site current and will use it for all submittals, RFIs, change documents, Record Drawing, electronic file management, and communication logs for the duration of the contract.

K. Contractor shall provide Infection Control Plan as required by Memorandum 111-40, Subj: VHA Directive 7715 Safety and Health During Construction dated April 6, 2017. Amended Sept 5, 2023. Submit to COR for approval prior to the start of work.

L. Prior to commencing work, general contractor shall provide proof that an OSHA designated "competent person" (CP) (29 CFR 1926.20(b)(2) will maintain a presence at the work site whenever the general or subcontractors are present. CP will have authority letter.

M. Per VA Directive 1085, smoking, vaping and smokeless tobacco are prohibited on the grounds of VA facilities, including in vehicles. This Directive applies to all Prime Contractor and Subcontractor employees.

N. Pricing Proposal transparency requirements:
   1. This project requires pricing proposals to include breakdown pricing for the General Contractor and all subcontractors.
   2. All price proposals, shall including subcontractor pricing must include a breakdown of pricing per the format included with this Project Manual. See example at the end of Section 00 41 13 BID FORM.

O. Contractor is responsible for Asbestos Containing Materials (ACM) removal and mitigation where it occurs inside the area of work. There will be no cost to the Government for any

removal, testing, oversight, or clearance of ACM. Traditional and Glovebag Abatement methods as stipulated in Specification Sections 02 82 11 and 02 82 13.13, are the only allowable methods of abatement. No alternate abatement methods will be considered.

P. The VA has arranged with a third-party individual, company, or firm to act as the Commissioning Agent. The Commissioning Agent is the designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. The Contractor shall employ or appoint staff to act as a Commissioning Manager to carry out all commissioning tasks (see 01 91 00 for Contractor's Commissioning responsibilities) including managing submittal requirements and resolution of the issues log, and coordination with the third party Commissioning Agent. There will be no cost to the Government for any coordination or testing required by the Commissioning Agent.

Q. .

1. The Firm and designated Commissioning Authority shall have been the principal commissioning authority on a least three (3) comparable projects that have been completed within the previous five (5) years.
2. The proposed commissioning firm should be certified by at least one of the following agencies:
   a. National Environmental Balancing Bureau (NEBB)
   b. AABC Commissioning Group (AGC)
   c. Building Commissioning Association (BCxA)
3. The Fire Protection Commissioning Specialist should be a registered Fire Protection Engineer in at least one state.
   a. He/she should have a minimum of 5 years' experience with design, installation, inspection, or testing of fire protection systems, and/or smoke control systems.
4. The Building Envelope Commissioning Specialist should be a Registered Architect in at least one state.
   a. He/she should also have a minimum of five (5) years' experience with design, installation, or inspection of building envelope components.
5. The Controls Commissioning Specialist should have a minimum of 5 years' experience in design, installation, programming, inspection, or testing of direct digital control systems for HVAC systems.
6. Key members of the Commissioning Authority's commissioning team should have:
   a. Bachelor's degree in Mechanical, Electrical, Architectural engineering.
   b. Professional Engineer license in at least one jurisdiction is desired.
   c. Over 5 years field experience in building systems operations, maintenance, and troubleshooting, HVAC system installation, maintenance, and troubleshooting, HVAC Direct Digital Control system installation, programming, maintenance, and troubleshooting, electrical system installation, maintenance, and troubleshooting, other applicable trade contracting experience may be deemed equivalent experience for the bachelor's degree.
7. Commissioning Services will be provided in accordance with the Department of Veterans Affairs Commissioning Process Manual. Prospective proposers shall review the Whole Building Commissioning Process Manual available on the VA Technical Information Library at http://www.cfm.va.gov/til/.
   a. The following tables describe the commissioning services and deliverables to be provided by the Commissioning Agent:

Commissioning Team Task/Deliverables Description Construction Phase		
Project Phase/ Cx Task	**Commissioning Task Description**	**Commissioning Deliverables**
Commissioning Kick Off Meeting (Construction Phase) (The kickoff meeting should occur within 60 days of Notice to Proceed.)	Conduct a "Commissioning Kickoff Meeting" with the Construction Team Establish the purpose and process for commissioning the project. Establish the individual roles of each participating commissioning team member. Review the Construction Phase Commissioning Plan and Commissioning Specifications. Review the Commissioning Documents Review the Project Schedule and discuss how commissioning activities will be incorporated into the master schedule. Review Draft PFC and FPT; identify pre-requisites for functional testing. ATTENDEES: Commissioning Agent, A/E Design Team Representatives, Contractor's Commissioning Representative, Subcontractor's Commissioning Representatives, VA RE.	Meeting Minutes Revised Project Commissioning Plan (Include Names/Contact Information for selected Commissioning Team Members)
Duration Schedule for Commissioning Activities	Based on the Construction Phase Commissioning Plan, prepare a duration schedule for the commissioning activities required by the commissioning plan. This duration schedule should be incorporated into the contractor's project schedule to track all commissioning activities of the commissioning team.	Commissioning Duration Schedule (Schedule shall be periodically updated to reflect changes in the project schedule and/or scope.)

Commissioning Team Task/Deliverables Description Construction Phase		
Project Phase/ Cx Task	**Commissioning Task Description**	**Commissioning Deliverables**
Submittal & Shop Drawing Review	Review all pertinent project shop drawings necessary to support the Commissioning Process. Review of the shop drawings is for the purpose of developing appropriate Pre-Functional Checklists and Systems Functional Performance Test Procedures. Submittals & Shop drawings shall be reviewed for commissionability, maintainability and for compliance to the Construction Documents. Note any issues identified in the Shop Drawing Review that might compromise the final commissioned system on the 'Commissioning Review Log' and submit comment to the Design Team and the RE contemporaneously with the A/E review for resolution. Comments shall be submitted in accordance with the contractual submittal review time. Comments shall be provided to the Design Team no less than 7 days prior to the Submittal Review Due Date provided that the Cx Agent has no less than 7 days to review the submittals. **ANY ISSUES IDENTIFIED IN THE SUBMITTAL REVIEW THAT MIGHT REQUIRE A CONTRACT CHANGE BUT IS NECESSARY TO MEET DESIGN INTENT SHOULD BE SPECIFICALLY REFERRED TO THE RE.**	Shop Drawing Cx Review List Shop Drawing Review Comments
Construction Phase Commissioning Plan	Based on the work completed in the items above, the Construction Phase Commissioning Plan for the project shall be periodically reviewed with the Commissioning Team and updated to reflect changes in project equipment, sequences of operations, scope or schedule and with project personnel.	Revised Project Commissioning Plan

Commissioning Team Task/Deliverables Description Construction Phase		
Project Phase/ Cx Task	**Commissioning Task Description**	**Commissioning Deliverables**
Commissioning Construction Observations	During the course of construction, the Commissioning Agent will visit the site to observe the progress of construction with respect to the systems being commissioned. The focus of the observations will be to verify that systems being installed comply with the Construction Documents and can be successfully configured, operated and maintained. In addition, site observations visits will be scheduled to include ● Witnessing factory testing and/or contractor equipment/system start up activities; ● Verification of Completed Pre Functional Checklists ● Verification that the Contractor and his subcontractors are completing and documenting Pre-Test procedures required by the specifications. ● Clarification and technical support for understanding and resolving Commissioning Issues.	Site Observation Reports Updated Commissioning Issues Log

Commissioning Team Task/Deliverables Description Construction Phase		
Project Phase/ Cx Task	**Commissioning Task Description**	**Commissioning Deliverables**
Commissioning Team Meetings	The Commissioning Agent will hold regular commissioning team meetings to review progress of the commissioning effort and reinforce individual responsibilities. The team will review schedule, construction sequence, and completed work (PFC, PFT and FPT's) and outstanding issues on the Commissioning Issues Log. Commissioning Team Meetings may be held at the jobsite or by teleconference depending upon the status of construction. While it is imperative that many of the Commissioning Team Meetings be held in person, during early construction phases, some meetings may be more cost effectively conducted remotely. Scheduling and location of meetings shall occur by consultation between the Commissioning Agent and the VA-RE. The Prime Contractor's scheduler should attend approximately every other Commissioning Team Meeting to review the master schedule and any changes that will affect commissioning activities.	Commissioning Meeting Agenda and Minutes Updated Commissioning Issues Log
Develop Final Pre-Functional Checklists (PFC's)	The Commissioning Agent will prepare Pre-Final Pre Functional Checklists (PFC) for the project and distribute to all Cx Team members for review and comment. The Commissioning Agent will incorporate review comments and prepare Final PFCs. An executed PFC submitted by the Prime Contractor indicates the system and its related equipment is ready for Systems Functional Performance Testing. The requirements for Pre Functional Checklists shall be coordinated with the startup requirements specified for each commissioned system. The PFC's shall be constructed to leverage the specified contractor and vendor start activities to avoid unnecessary duplication.	Pre Functional Checklists (PFC's)

Commissioning Team Task/Deliverables Description Construction Phase		
Project Phase/ Cx Task	**Commissioning Task Description**	**Commissioning Deliverables**
Final Systems Functional Performance Test (FPT's) Procedures	Based on construction documents and approved submittals, the Commissioning Agent will prepare Pre-Final Systems Functional Performance Test Procedures (FPT's) for systems to be commissioned. Completed Final FPT's will be distributed to all appropriate members of the Commissioning Team for review and comment. Final FPT's will be issued once comments are reviewed and incorporated into final documents as appropriate.	Pre-Final and Final Systems Functional Performance Test Procedures (FPT's)
Review Operations & Maintenance Manuals	The Commissioning Agent shall review Operations and Maintenance Manuals submitted by contractors for general conformance with specifications and VA's requirements, including: If provided with the manuals, Review Preventive Maintenance Schedules provided as part of the O&M Manuals for completeness. Verify that data is provided in a manner consistent with VA process for managing Preventive Maintenance tasks. Review of O&M Manuals will include a review of system and component warranties to confirm conformance with contract requirements and adequate documentation of warranty contact information and VA obligations. Review of O&M Manuals shall be completed in accordance with the Submittal Review schedule requirements.	Updated Commissioning Issues Log
Review Contractor Equipment Startup Checklists, TAB Reports and PFC's	The Commissioning Agent will review all contractor prepared Equipment Startup Checklists, TAB Reports (including "pencil" daily test results) and PFC's to confirm that the systems have been subject to appropriate Quality Control and Start Up procedures prior to initiation of Functional Performance Testing. Incomplete work, inadequate preparation and deficiencies will note noted and tracked on the Commissioning Issues Log.	Commissioning Issues Log

Commissioning Team Task/Deliverables Description Construction Phase		
Project Phase/ Cx Task	**Commissioning Task Description**	**Commissioning Deliverables**
TAB Verification	The Commissioning Agent shall work with the TAB Contractor to verify that all Testing and Balancing work is conducted in strict accordance with the specified Procedural Standards for Testing, Adjusting and Balancing by either NEBB or AABC. The Commissioning Agent shall execute the following tasks: ● Review the TAB Agenda provided by the TAB Contractor to verify that it is complete, thorough and in compliance with the specification and Procedural Standards requirements. ● On the project site, the CxA shall review the calibration certificates for the instrumentation being used by the TAB Contractor during the execution of TAB activities to confirm that the instrumentation meets the requirements of the spec and the appropriate Procedural Standard. ● The CxA shall periodically visit the project site and review the TAB documentation for method, reasonable values, and compliance with the specification, Procedural Standard and TAB Agenda. ● Upon completion of the TAB activities, the CxA shall visit the project site with the TAB Contractor and the RE. The TAB Contractor shall demonstrate readings selected by the CxA that demonstrate that the system performance is consistent with the submitted values on the TAB report. Readings shall include Air Handling Unit total flows, static pressure control values, select outlet flows, building, and space pressures selected by the CxA as critical system operating values.	TAB Agenda Review Comments TAB Agenda Review Meeting Minutes Field Observation Reports of TAB Inspections Summary Report of TAB Verification Readings

Commissioning Team Task/Deliverables Description Construction Phase		
Project Phase/ Cx Task	**Commissioning Task Description**	**Commissioning Deliverables**
Systems Functional Performance Testing	The Commissioning Agent will oversee, facilitate, and document all FPT testing. Execution of FPT's shall be executed in accordance with the Functional Testing Procedures published by the Commissioning Agent. All systems tested in accordance with the FPT's shall be operated by the contractors in accordance with the approved FPT. Contractors shall retain responsibility for the installed systems during and after functional testing until substantial completion or final acceptance as determined by the VA. The Commissioning Agent, in collaboration with the control contractor shall include long term trends (greater than 7 days) of integrated system performance once all systems have been commissioned. The Commissioning Agent shall provide analysis of these trends to confirm that the installed systems are stable and reliable	Executed Functional Performance Tests and support documentation. Long Term Trend Data and Analysis
Prepare Systems Manuals	The Commissioning Agent shall work with the design team, contractor and VA to develop Systems Manuals. Manuals will contain system design, operations and sequence information that describes the design intent, operational features and appropriate operational practices necessary to sustain the system operation in accordance with the Design Narrative and the VA's overall objectives for the facility. Systems Manual will include sections for each major system included in the commissioning process.	Project Systems Manual

Commissioning Team Task/Deliverables Description Construction Phase		
Project Phase/ Cx Task	**Commissioning Task Description**	**Commissioning Deliverables**
Training Plan Review	The Commissioning Agent shall collaborate with the Prime Contractor and installing subcontractors to develop effective contractor and manufacturer training plans and agendas for general conformance with specifications and VA's requirements. Observe training for quality of training and for general conformance with the training plan and agenda. The CxA shall observe contractor and vendor training for critical systems. The Contractor shall provide and the CxA shall maintain all attendance records and associated agendas and presentations for all training sessions. Attendance records shall be written original sign in sheets for each training session.	Compiled Training Plan Individual Training Agendas Training Attendance Sign In Sheets
Systems Training	The Commissioning Agent will conduct training sessions to provide systems-level training for O&M personnel. Training will include: ● Review of system design, capacity, and equipment selection ● Review of system operating sequences ● Review of interconnection with other systems ● Review of Emergency operating procedures ● Review of the Project Systems Manual and its Use ● Student Evaluation forms The number, duration and scope of the Systems Training sessions shall be determined by the specific requirements of the project. The training provided by the CxA does not in any way relieve the Contractor from any specified training obligations.	Systems Training Presentations (electronic)

Commissioning Team Task/Deliverables Description Construction Phase		
Project Phase/ Cx Task	**Commissioning Task Description**	**Commissioning Deliverables**
Final Commissioning Report	The Commissioning Agent shall compile a comprehensive commissioning report documenting all commissioning activities, including but not limited to the following: ● Executive Summary ● Commissioning Scope of Work ● Test methods and results ● Outstanding commissioning issues ● Comprehensive Commissioning Issues Log, including resolved items and a description of their resolution, ● Commissioning plan, ● Field Observation Reports, Status reports and other field activity documentation, ● Submittal and O&M manual reviews ● Training record ● Completed Pre Functional Checklists ● Completed Functional Performance Test protocols and support documentation ● Other support documentation developed as part of the execution of the project Construction Phase Commissioning Process	Final Commissioning Report

Commissioning Team Task/Deliverables Description Construction Phase		
Project Phase/ Cx Task	**Commissioning Task Description**	**Commissioning Deliverables**
Deferred and/or Seasonal Testing	The Commissioning Agent shall witness and document Systems Functional Performance Testing that was deferred to allow systems to be tested in appropriate seasonal conditions. Testing will be conducted in accordance with Systems Functional Performance Test Procedures. Testing support will be required from the installing contractors, EMCS Vendor and VA. Requirement for seasonal testing will be incorporated into the project specifications. As part of the Seasonal Testing Effort, the Commissioning Agent shall review systems operations with the onsite operations team and reinforce training and best operating practices of the operations team.	Executed Functional Performance Test and Support Documents Commissioning Issues Log
Warranty Period Site Visits	The Commissioning Agent shall make quarterly visits to the project site to reinforce training, evaluate performance of the installed systems and provide technical support to the operating team to sustain commissioned performance of the systems.	Warranty Site Visit Reports

Commissioning Team Task/Deliverables Description Construction Phase		
Project Phase/ Cx Task	**Commissioning Task Description**	**Commissioning Deliverables**
Post-Occupancy Inspection	Return to the project approximately 10 months after substantial completion to review the building operation with the facility occupants and O&M staff, and to discuss outstanding issues related to commissioning. Provide suggestions for improvements to systems operation including, ● Measurement & Verification Issues, ● Re-Commissioning Tasks, and ● Improvements in Preventive Maintenance or Operational Strategies Assist facility staff in developing warranty issues, documents and requests for service to remedy outstanding problems. As part of the Post Occupancy Inspection, the Commissioning Agent shall analyze the energy consumption records from the project site (both utility and system generated reports) and provide the team with an analysis of actual system energy performance versus predicted performance. To the extent possible, deficiencies in performance shall be analyzed to provide an understanding of the systems, components or operating strategies that may be operating outside predicted parameters.	Post Occupancy Field Visit Report Commissioning Issues Log Warranty Issues Report Systems Energy Review Report
Final Commissioning Report Amendment	Amend Final Commissioning Report to document the Warranty Phase commissioning activities.	Final Report Amendment

1.3 STATEMENT OF BID ITEMS

Contractor shall completely prepare project site for operations, including demolition and removal of existing site elements, and furnish labor and materials and perform work for the Montrose VAMC Project 620-23-206, Montrose Renovate Building 14CD For Homeless Residential Program as required by drawings and specifications. For Period of performance refer to solicitation documents.

The work will require renovation of 16,950 square feet (1,574.6 square meters) on the first floor to provide temporary living accommodations for homeless veterans. The ground floor will remain in its current function as office space and will be occupied during the full duration of construction. There will be work in the ground floor ceiling plenum for plumbing connections above and chases for piping. This work will occur on WHEN hours (outside of normal business hours) and at no additional cost to the government. The Second floor will remain

un-occupied. There will be limited work on the Second floor to install chases for ductwork and plumbing, and work in the Attic and a small section of roof to install new Mechanical equipment.

All work associated with the renovation of Building 14 AB to accommodate this program will be considered part of the contractor's scope of work. The contractor shall complete mechanical, electrical, plumbing and abatement work in the pipe basement, the ground floor, the first floor (AB), the second floor (CD), and the attic/roof as part of this contract.
.

A. Work includes general construction, alterations, and certain other items. Contractor shall provide services including, but not limited to, furnishing all supervision, labor, equipment, materials, and transportation necessary to accomplish work for the demolition and replacement as required by specifications and drawings.

B. Electrical Work: Electrical work includes all labor, material, equipment and supervision to perform the required electrical construction work on this project including materials and construction equipment to provide new electrical, communications and security systems to the new addition detailed by the construction drawings and specifications.

C. Provide access control for all the required doors, coordinate with the door hardware schedule for additional requirements.

D. Mechanical, Plumbing and Fire Protection Work: Work includes all labor, material, equipment and supervision to perform the required Mechanical, Plumbing and Fire Protection construction work on this project including provide materials and construction equipment as detailed by the construction drawings and specifications.
   1. All new mechanical systems shall be addressable and controllable via the existing Engineering Control Center (ECC) and HVAC Shop. The ECC system shall monitor space conditions and unit status and shall alarm the boiler plant operator or HVAC shop as detailed by the mechanical control drawings and specifications.

E. New Fire Protection systems shall be provided, and existing systems modified per the construction drawings and specifications.

F. Contractor shall reconfigure plumbing piping and provide new plumbing piping and fixtures as required by the construction drawings and specifications.

G. Site Work: Site work includes all labor, material, equipment and supervision to perform the required hardscape and landscape construction work on this project including materials and construction equipment to provide new concrete walkways, planting beds, artificial turf, fencing, trees and additional landscape materials to the additions and renovation detailed by the construction drawings and specifications.
   1. Protection for existing plantings, trees and hardscape to remain shall be installed, maintained and enforced by contractor.

H. Inspections: Comprehensive Third-Party inspections, testing and written reports for all Divisions are required and paid by the Construction Contract. An Independent third party inspection consultant shall be employed to perform all inspections required by this contract.

I. All new and existing systems within the Scope of Work shall be commissioned (or recommissioned) per Specification 01 91 00.

J. The Architectural & Engineering firm shall appoint a third-party individual, company, or firm to act as the Commissioning Agent. The Commissioning Agent is the designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. The Contractor shall appoint a Commissioning Manager to coordinate contractor and subcontractor tasks.

K. ITEM I, GENERAL CONSTRUCTION: Work includes general construction, alterations, walks, grading, drainage and necessary removal of existing structures and construction and certain other items.

L. Provide Unit pricing in the construction bids for:
   1. Rock Excavation
   2. Removal of Hidden Plaster ceilings (some areas of plaster ceiling may be uncovered above existing ceilings, These ceilings (and mastic for attaching ceiling tiles) have been verified asbestos free. Therefore, no abatement required.
   3. Abatement by category
   4. Repair of Cracked Concrete topping slab
   5. Repair of Delaminated Concrete topping slab

M. The expected **construction period duration (refer to solicitation documents)** includes all pre-construction activity, construction, and post-construction testing, third-party inspections, Owner inspections, and commissioning. Contractor shall submit a comprehensive schedule of work in compliance with 01 32 16.15 PROJECT SCHEDULES (SMALL PROJECTS DESIGN/BID/BUILD).
   1. Contractor shall submit and obtain approval for all project submittals including coordination drawings prior to beginning physical construction.
   2. Contractor shall perform Commissioning of all new systems and existing systems impacted by the project according to requirements in sections:
      a. 01 91 00 – GENERAL COMMISSIONING REQUIREMENTS.
         21 08 00 – COMMISSIONING OF FIRE SUPPRESSION SYSTEMS.
      b. 22 08 00 – COMMISSIONING OF PLUMBING SYSTEMS.
      c. 23 08 00 – COMMISSIONING OF HVAC SYSTEMS.
      d. 26 08 00 – COMMISSIONING OF ELECTRICAL SYSTEMS.
      e. 27 08 00 – COMMISSIONING OF COMMUNICATIONS SYSTEMS.
      f. 28 08 00 – COMMISSIONING OF SECURITY SYSTEMS.
      g. 33 08 00 – COMMISSIONING OF SITE UTILITIES.
   3. A detailed commissioning plan is required to ensure that all systems are calibrated, programmed, and all graphic displays are accurate and approved by applicable VA staff.

1.4 SPECIFICATIONS AND DRAWINGS FOR CONTRACTOR

A. Drawings and contract documents may be obtained from the website where the solicitation is posted. Additional copies will be at Contractor's expense.

B. Refer to specifications for installation requirements for each Division. Refer to drawings for estimated quantities and schematic layouts/locations. Contractor shall provide a complete, commissioned, functioning systems. Contractor shall provide all testing reports prior to the start of commissioning. This project will require night and weekend work, Renovation includes requirements for Testing and Balancing the HVAC for the existing and new systems configuration.

1.5 CONSTRUCTION SECURITY REQUIREMENTS

A. Security Plan:
   1. The security plan defines both physical and administrative security procedures that will remain effective for the entire duration of the project.
   2. The General Contractor is responsible for assuring that all sub-contractors working on the project and their employees also comply with these regulations.

B. Security Procedures:
   1. General Contractor’s employees shall not enter the project site without appropriate badge. They may also be subject to inspection of their personal effects when entering or leaving the project site.
      a. All employees of general contractor and subcontractors shall comply with VA security management program and obtain permission of the VA police, be identified by project and employer, and restricted from unauthorized access.
   2. Before starting work the General Contractor shall give one week’s notice to the Contracting Officer so that security arrangements can be provided for the employees.

This notice is separate from any notices required for utility shutdown described later in this section.

3. No photography of VA premises is allowed without written permission of the Contracting Officer. Patients and staff are not to be photographed at any time.
4. VA reserves the right to close down or shut down the project site and order General Contractor's employees off the premises in the event of a national emergency. The General Contractor may return to the site only with the written approval of the Contracting Officer.

C. Montrose VAMC Badging Process:
1. Every employee MUST have a valid Department of Veterans Affairs issued security flash badge. For employees who do not have this badge already, a background check must be requested and passed. This is performed by the VA Personnel Security Adjudication Center. Employees shall be required to pass a Tier-1 background check pursuant to VHA Security Directive in order to be permitted entry to the facility. The following documents, subject to periodic updates, shall be required to be filled out by EVERY SINGLE EMPLOYEE performing work on the job site (unless they already have a valid badge issued by VHA Personnel Security Adjudication Center):
   a. Department of Veterans Affairs VHA 106A WMC HROO Per Sec Contractor Team Contractor Request Form
   b. U.S. Office of Personnel Management Optional Form 306
   c. Department of Veterans Affairs Personnel Security Adjudication Center Self Certification of Continuous Service Form
   d. Montrose VAMC Fingerprint Request Form
   e. Example forms are provided as appendices to the 01 00 00 specification section. These forms are subject to change at the discretion of the VA. Coordinate with COR to ensure use of current versions.

2. Badging Process
   a. The above forms a through d are filled out and submitted to the COR. They shall be typed up with wet signatures, and all instructions properly followed. If they are not adequate they will be returned and not to be processed until corrections made and resubmitted.
   b. Once the forms are complete and submitted, the applicant will receive an email to schedule their appointment for fingerprinting. They are to bring the following two valid forms of government-issued picture ID: state "Enhanced" or "Real" driver's license, and U.S. Government issued passport.
   c. Once the applicant is fingerprinted, their application will be submitted to VHA 106A WMC HROO PerSec Contractor Team by the contract COR. They will be required to fill out a federal government "e-APP" in order to allow the Personnel Security team to perform their investigation.
   d. A determination should be made in 2-4 weeks of successful submission of the "e-APP" issued to the applicant from the Personnel Security Team. In that time the contractor is NOT PERMITTED to work on site.
3. It is the responsibility of the General Contractor to submit employees for badging with enough time for the VA COR to process their application. The Government shall not be held liable for any delays to the project as a result of a lack of adequate and timely paperwork processing by the General Contractor and their sub contractors.
4. Note: Foreign Nationals ARE PERMITTED to work on this contract. However they follow a slightly different process which will take approximately 1-2 months to complete. Reach out to the COR for the appropriate paperwork and process in that instance.

D. Key Control:
1. The General Contractor shall provide duplicate keys and lock combinations to the Contracting officers representative (COR) for the purpose of security inspections of every

area of project including tool boxes and parked machines and take any emergency action.

2. The General Contractor shall turn over all permanent lock cylinders to the VA locksmith for permanent installation. See Section 08 71 00, DOOR HARDWARE and coordinate.

E. Document Control:

1. Before starting any work, the General Contractor/Sub Contractors shall submit an electronic security memorandum describing the approach to following goals and maintaining confidentiality of “sensitive information”.
2. The General Contractor is responsible for safekeeping of all drawings, project manual and other project information. This information shall be shared only with those with a specific need to accomplish the project.
3. Certain documents, sketches, videos or photographs and drawings may be marked “Law Enforcement Sensitive” or “Sensitive Unclassified”. Secure such information in separate containers and limit the access to only those who will need it for the project. Return the information to the Contracting Officer upon request.
4. These security documents shall not be removed or transmitted from the project site without the written approval of Contracting Officer.
5. All paper waste or electronic media such as CD’s and diskettes shall be shredded and destroyed in a manner acceptable to the VA.
6. Notify Contracting Officer and Site Security Officer immediately when there is a loss or compromise of “sensitive information”.
7. All electronic information shall be stored in specified location following VA standards and procedures using an Engineering Document Management Software (EDMS).
   a. Security, access and maintenance of all project drawings, both scanned and electronic shall be performed and tracked through the EDMS system.
   b. “Sensitive information” including drawings and other documents may be attached to e-mail provided all VA encryption procedures are followed.

F. Motor Vehicle Restrictions

1. Vehicle authorization request shall be required for any vehicle entering the site and such request shall be submitted 24 hours before the date and time of access. Access shall be restricted to picking up and dropping off materials and supplies.
2. A limited number of(2 to 5) permits shall be issued for General Contractor and its employees for parking in designated areas only. Contractor to coordinate with VA Medical Center Facility Manager.

1.6 OPERATIONS AND STORAGE AREAS (FAR 52.236-10)

A. The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the Contracting Officer. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.

B. Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be erected by the Contractor only with the approval of the Contracting Officer and shall be built with labor and materials furnished by the Contractor without expense to the Government. The temporary buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at its expense upon completion of the work. With the written consent of the Contracting Officer, the buildings and utilities may be abandoned and need not be removed.

C. The Contractor shall, under regulations prescribed by the Contracting Officer, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting Officer. When materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.

D. Working space and space available for storing materials shall be as shown on the drawings.

E. Workers are subject to rules of Medical Center applicable to their conduct.
   a.

F. Execute work in such a manner as to interfere as little as possible with work being done by others. Keep roads clear of construction materials, debris, standing construction equipment and vehicles at all times.

G. Execute work so as to interfere as little as possible with normal functioning of Medical Center as a whole, including operations of utility services, fire protection systems and any existing equipment, and with work being done by others. Use of equipment and tools that transmit vibrations and noises through the building structure, are not permitted in buildings that are occupied, during construction, jointly by patients or medical personnel, and Contractor's personnel, except as permitted by COR where required by limited working space
   1. Do not store materials and equipment in other than assigned areas.
   2. Schedule delivery of materials and equipment to immediate construction working areas within buildings in use by Department of Veterans Affairs in quantities sufficient for not more than two workdays. Provide unobstructed access to Medical Center areas required to remain in operation.
   3. Where access by Medical Center personnel to vacated portions of buildings is not required, storage of Contractor's materials and equipment will be permitted subject to fire and safety requirements.
   4. Work on areas outside the building and/or construction site during any given phase shall require off hours work, nights and weekends, as the Medical Center are operated 24/7 for continued operations to support the Medical Center. Work affecting areas outside the designated building and/or construction site (including bringing materials onsite) shall be scheduled with COR per 1.6 and shall be performed after normal work shifts including nights and weekends.
      a. The work will have to be carefully planned and phased for minimal disruption to Medical Center activities. Under no circumstances will any area of the building be shut down and all services must remain operational. Under no circumstances shall there be utility outages, including brief cutovers, anywhere on the campus without the express written consent of the COR. The contractor shall plan and forecast upcoming work which may disrupt normal operations or interfere with staff or patients and report these in the weekly meetings.
         1) Contractor shall provide temporary services, including temporary Air Handlers. and Generators.
            a) See Construction drawings for temporary equipment.
      b. It may be necessary to postpone or reschedule work to accommodate the needs of the Medical Center. All such time shall be included in the base bid and shall not be billable to the government.

H. Utilities Services: Where necessary to cut existing pipes, electrical wires, conduits, cables, etc., of utility services, or of fire protection systems or communications systems (except telephone), they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by COR. All such actions shall be coordinated with the COR or Utility Company involved
   1. Whenever it is required that a connection fee be paid to a public utility provider for new permanent service to the construction project, for such items as water, sewer, electricity, gas or steam, payment of such fee shall be the responsibility of the Government and not the Contractor.

I. Phasing:
   1. The Medical Center must maintain its operation 24 hours a day 7 days a week. Therefore, any interruption in service must be scheduled and coordinated with the COR to ensure that no lapses in operation occur. It is the CONTRACTOR'S responsibility to develop a work plan and schedule detailing, at a minimum, the procedures to be

employed, the equipment and materials to be used, the interim life safety measure to be used during the work, and a schedule defining the duration of the work with milestone subtasks. The work to be outlined shall include, but not be limited to:

J. Building No14 will be occupied during performance of work but immediate areas of alterations will be vacated.
   1. Certain areas of Building No. 14 will be occupied by Medical Center personnel for various periods as listed below:

	AREA	PERIOD
a.	Ground Floor	Full Time

   2. Contractor shall take all measures and provide all material necessary for protecting existing equipment and property in affected areas of construction against dust and debris, so that equipment and affected areas to be used in the Medical Centers operations will not be hindered. Contractor shall permit access to Department of Veterans Affairs personnel and patients through other construction areas which serve as routes of access to such affected areas and equipment. These routes whether access or egress shall be isolated from the construction area by temporary partitions and have walking surfaces, lighting etc. to facilitate patient and staff access. Coordinate alteration work in areas occupied by Department of Veterans Affairs so that Medical Center operations will continue during the construction period.
   3. Immediate areas of alterations not mentioned in preceding Subparagraph 1 will be temporarily vacated while alterations are performed.

K. Construction Fence: Before construction operations begin, Contractor shall provide a chain link construction fence, 2.44m (eight feet) minimum height, around the construction area indicated on the drawings. Provide gates as required for access with necessary hardware, including hasps and padlocks. Fasten fence fabric to terminal posts with tension bands and to line posts and top and bottom rails with tie wires spaced at maximum 375mm (15 inches). Bottom of fences shall extend to 25mm (one inch) above grade. Remove the fence when directed by COR .

L. When a building and/or construction site is turned over to Contractor, Contractor shall accept entire responsibility including upkeep and maintenance therefore:
   1. Contractor shall maintain a minimum temperature of 4 degrees C (40 degrees F) at all times, except as otherwise specified.
   2. Contractor shall maintain in operating condition existing fire protection and alarm equipment. In connection with fire alarm equipment, Contractor shall make arrangements for pre-inspection of site with Fire Department or Company (Department of Veterans Affairs or municipal) whichever will be required to respond to an alarm from Contractor's employee or watchman.

M. Utilities Services: Maintain existing utility services for Medical Center at all times. Provide temporary facilities, labor, materials, equipment, connections, and utilities to assure uninterrupted services. Where necessary to cut existing water, steam, gases, sewer or air pipes, or conduits, wires, cables, etc. of utility services or of fire protection systems and communications systems (including telephone), they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by COR.
   1. No utility service such as water, gas, steam, sewers or electricity, or fire protection systems and communications systems may be interrupted without prior approval of COR. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished, work on any energized circuits or equipment shall not commence without a detailed work plan, the Medical Center Director’s prior knowledge and written approval. Refer to specification Sections 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, 27 05 11 REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS and 28 05 00, COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY for additional requirements.

2. Contractor shall submit a request to interrupt any such services to COR, in writing, 7 days in advance of proposed interruption. Request shall state reason, date, exact time of, and approximate duration of such interruption.
3. Contractor will be advised (in writing) of approval of request, or of which other date and/or time such interruption will cause least inconvenience to operations of Medical Center. Interruption time approved by Medical Center may occur at other than Contractor's normal working hours.
4. Major interruptions of any system must be requested, in writing, at least 15 calendar days prior to the desired time and shall be performed as directed by the COR .
5. In case of a contract construction emergency, service will be interrupted on approval of COR . Such approval will be confirmed in writing as soon as practical.
6. Whenever it is required that a connection fee be paid to a public utility provider for new permanent service to the construction project, for such items as water, sewer, electricity, gas or steam, payment of such fee shall be the responsibility of the Government and not the Contractor.

N. Abandoned Lines: All service lines such as wires, cables, conduits, ducts, pipes and the like, and their hangers or supports, shall be removed back to their source. Those which are indicated to be abandoned but are not required to be entirely removed, shall be sealed, capped or plugged at the main, branch or panel they originate from. The lines shall not be capped in finished areas, but shall be removed and sealed, capped or plugged in ceilings, within furred spaces, in unfinished areas, or within walls or partitions; so that they are completely behind the finished surfaces.

O. To minimize interference of construction activities with flow of Medical Center traffic, comply with the following:
1. Keep roads, walks and entrances to grounds, to parking and to occupied areas of buildings clear of construction materials, debris and standing construction equipment and vehicles. Wherever excavation for new utility lines cross existing roads, at least one lane must be open to traffic at all times with approval.
2. Method and scheduling of required cutting, altering and removal of existing roads, walks and entrances must be approved by the COR.

P. Coordinate the work for this contract with other construction operations as directed by COR. This includes the scheduling of traffic and the use of roadways, as specified in Article, USE OF ROADWAYS.

1.7 ALTERATIONS

A. Survey: Before any work is started, the Contractor shall make a thorough survey with the COR and a representative of VA Supply Service, of building in which alterations occur and areas which are anticipated routes of access, and furnish a report, signed by all three, to the Contracting Officer. This report shall list by rooms and spaces:
1. Existing condition and types of resilient flooring, doors, windows, walls and other surfaces not required to be altered throughout affected areas of building.
2. Existence and conditions of items such as plumbing fixtures and accessories, electrical fixtures, equipment, venetian blinds, shades, etc., required by drawings to be either reused or relocated, or both.
3. Shall note any discrepancies between drawings and existing conditions at site.
4. Shall designate areas for working space, materials storage and routes of access to areas within buildings where alterations occur and which have been agreed upon by Contractor and COR.

B. Any items required by drawings to be either reused or relocated or both, found during this survey to be nonexistent, or in opinion of COR and Supply Representative, to be in such condition that their use is impossible or impractical, shall be furnished and/or replaced by Contractor with new items in accordance with specifications which will be furnished by Government. Provided the contract work is changed by reason of this subparagraph B, the

contract will be modified accordingly, under provisions of clause entitled "DIFFERING SITE CONDITIONS" (FAR 52.236-2) and "CHANGES" (FAR 52.243-4).

C. Re-Survey: Thirty days before expected partial or final inspection date, the Contractor and COR together shall make a thorough re-survey of the areas of buildings involved. They shall furnish a report on conditions then existing, of resilient flooring, doors, windows, walls and other surfaces as compared with conditions of same as noted in first condition survey report:
   1. Re-survey report shall also list any damage caused by Contractor to such flooring and other surfaces, despite protection measures; and will form basis for determining extent of repair work required of Contractor to restore damage caused by Contractor's workers in executing work of this contract.

D. Protection: Provide the following protective measures:
   1. Wherever existing roof surfaces are disturbed they shall be protected against water infiltration. In case of leaks, they shall be repaired immediately upon discovery.
   2. Temporary protection against damage for portions of existing structures and grounds where work is to be done, materials handled, and equipment moved and/or relocated.
   3. Protection of interior of existing structures at all times, from damage, dust and weather inclemency. Wherever work is performed, floor surfaces that are to remain in place shall be adequately protected prior to starting work, and this protection shall be maintained intact until all work in the area is completed.

1.8 DISPOSAL AND RETENTION

A. Materials and equipment accruing from work removed and from demolition of buildings or structures, or parts thereof, shall be disposed of as follows:
   1. Reserved items which are to remain property of the Government are identified by attached tags or noted on drawings or in specifications as items to be stored. Items that remain property of the Government shall be removed or dislodged from present locations in such a manner as to prevent damage which would be detrimental to re-installation and reuse. Store such items where directed by COR.
   2. Items not reserved shall become property of the Contractor and be removed by Contractor from Medical Center.
   3. Items of portable equipment and furnishings located in rooms and spaces in which work is to be done under this contract shall remain the property of the Government. When rooms and spaces are vacated by the Department of Veterans Affairs during the alteration period, such items which are NOT required by drawings and specifications to be either relocated or reused will be removed by the Government in advance of work to avoid interfering with Contractor's operation.
   4. PCB Transformersand Capacitors : The Contractor shall be responsible for disposal of the Polychlorinated Biphenyl (PCB) transformersand capacitors . The transformers and capacitors shall be taken out of service and handled in accordance with the procedures of the Environmental Protection Agency (EPA) and the Department of Transportation (DOT) as outlined in Code of Federal Regulation (CFR), Titled 40 and 49 respectively. The EPA's Toxic Substance Control Act (TSCA) Compliance Program Policy Nos. 6-PCB-6 and 6-PCB-7 also apply. Upon removal of PCB transformers and capacitors for disposal, the "originator" copy of the Uniform Hazardous Waste Manifest (EPA Form 8700-22), along with the Uniform Hazardous Waste Manifest Continuation Sheet (EPA Form 8700-22A) shall be returned to the Contracting Officer who will annotate the contract file and transmit the Manifest to the Medical Center's Chief.
      a. Copies of the following listed CFR titles may be obtained from the Government Printing Office:

40 CFR 261 ..... Identification and Listing of Hazardous Waste

40 CFR 262 ..... Standards Applicable to Generators of Hazardous Waste

40 CFR 263 ..... Standards Applicable to Transporters of Hazardous Waste

40 CFR 761 ..... PCB Manufacturing, Processing, Distribution in Commerce, and use Prohibitions

49 CFR 172 ..... Hazardous Material tables and Hazardous Material Communications Regulations

49 CFR 173 ..... Shippers - General Requirements for Shipments and Packaging

49 CRR 173..... Subpart A General

49 CFR 173 ..... Subpart B Preparation of Hazardous Material for Transportation

49 CFR 173 ..... Subpart J Other Regulated Material; Definitions and Preparation

TSCA..... Compliance Program Policy Nos. 6-PCB-6 and 6-PCB-7

1.9 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS (FAR 52.236-9)

A. The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, which are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workers, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the Contracting Officer.

B. The Contractor shall protect from damage all existing improvements and utilities at or near the work site and on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.

C. Refer to Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS, for additional requirements on protecting vegetation, soils and the environment. Refer to Articles, "Alterations", "Restoration", and "Operations and Storage Areas" for additional instructions concerning repair of damage to structures and site improvements.

D. Refer to FAR clause 52.236-7, "Permits and Responsibilities," which is included in General Conditions. A National Pollutant Discharge Elimination System (NPDES) permit is required for this project. The Contractor is considered an "operator" under the permit and has extensive responsibility for compliance with permit requirements. VA will make the permit application available at the (appropriate medical center) office. The apparent low bidder, contractor and affected subcontractors shall furnish all information and certifications that are required to comply with the permit process and permit requirements. Many of the permit requirements will be satisfied by completing construction as shown and specified. Some requirements involve the Contractor's method of operations and operations planning and the Contractor is responsible for employing best management practices. The affected activities often include, but are not limited to the following
   1. Designating areas for equipment maintenance and repair;
   2. Providing waste receptacles at convenient locations and provide regular collection of wastes;
   3. Locating equipment wash down areas on site, and provide appropriate control of wash-waters;
   4. Providing protected storage areas for chemicals, paints, solvents, fertilizers, and other potentially toxic materials; and
   5. Providing adequately maintained sanitary facilities.

1.10 RESTORATION

A. Remove, cut, alter, replace, patch and repair existing work as necessary to install new work. Except as otherwise shown or specified, do not cut, alter or remove any structural work, and do not disturb any ducts, plumbing, steam, gas, or electric work without approval of the COR . Existing work to be altered or extended and that is found to be defective in any way, shall be reported to the COR before it is disturbed. Materials and workmanship used in restoring work, shall conform in type and quality to that of original existing construction, except as otherwise shown or specified.

B. Upon completion of contract, deliver work complete and undamaged. Existing work (walls, ceilings, partitions, floors, mechanical and electrical work, lawns, paving, roads, walks, etc.) disturbed or removed as a result of performing required new work, shall be patched, repaired, reinstalled, or replaced with new work, and refinished and left in as good condition as existed before commencing work.

C. At Contractor's own expense, Contractor shall immediately restore to service and repair any damage caused by Contractor's workers to existing piping and conduits, wires, cables, etc., of utility services or of fire protection systems and communications systems (including telephone) which are not scheduled for discontinuance or abandonment.

D. Expense of repairs to such utilities and systems not shown on drawings or locations of which are unknown will be covered by adjustment to contract time and price in accordance with clause entitled "CHANGES" (FAR 52.243-4) and "DIFFERING SITE CONDITIONS" (FAR 52.236-2).

1.11 LAYOUT OF WORK

A. The Contractor shall lay out the work from Government established base lines and bench marks, indicated on the drawings, and shall be responsible for all measurements in connection with the layout. The Contractor shall furnish, at Contractor's own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the work. The Contractor shall be responsible for executing the work to the lines and grades that may be established or indicated by the Contracting Officer. The Contractor shall also be responsible for maintaining and preserving all stakes and other marks established by the Contracting Officer until authorized to remove them. If such marks are destroyed by the Contractor or through Contractor's negligence before their removal is authorized, the Contracting Officer may replace them and deduct the expense of the replacement from any amounts due or to become due to the Contractor.

(FAR 52.236-17)

B. Establish and plainly mark column center lines for each building and corner of column lines and/or addition to each existing building and such other lines and grades that are reasonably necessary to properly assure that location, orientation, and elevations established for each such structure and/or addition, are in accordance with lines and elevations shown on contract drawings.

C. Following completion of general mass excavation and before any other permanent work is performed, establish and plainly mark (through use of appropriate batter boards or other means) sufficient additional survey control points or system of points as may be necessary to assure proper alignment, orientation, and grade of all major features of work. Survey shall include, but not be limited to, location of lines and grades of footings, exterior walls, center lines of columns in both directions, major utilities and elevations of floor slabs:

1. Such additional survey control points or system of points thus established shall be checked and certified by a registered land surveyor or registered civil engineer. Furnish such certification to the COR before any work (such as footings, floor slabs, columns, walls, utilities and other major controlling features) is placed.

D. Whenever changes from contract drawings are made in line or grading requiring certificates, record such changes on a reproducible drawing bearing the registered land surveyor or registered civil engineer seal, and forward these drawings upon completion of work to COR.

E. The Contractor shall perform the surveying and layout work of this and other articles and specifications in accordance with the provisions of Article "Professional Surveying Services".

1.12 AS-BUILT DRAWINGS

A. The contractor shall maintain two full size sets of as-built drawings which will be kept current during construction of the project, to include all contract changes, modifications and clarifications.

B. All variations shall be shown in the same general detail as used in the contract drawings. To ensure compliance, as-built drawings shall be made available for the COR review, as often as requested.

C. Contractor shall deliver two approved completed sets of as-built drawings in the electronic version (scanned PDF) to the COR within 15 calendar days after each completed phase and after the acceptance of the project by the COR .

D. Paragraphs A, B, & C shall also apply to all shop drawings.

1.13 WARRANTY MANAGEMENT

A. Warranty Management Plan: Develop a warranty management plan which contains information relevant to FAR 52.246-21 Warranty of Construction in at least 30 days before the planned pre-warranty conference, submit four sets of the warranty management plan. Include within the warranty management plan all required actions and documents to assure that the Government receives all warranties to which it is entitled. The plan must be in narrative form and contain sufficient detail to render it suitable for use by future maintenance and repair personnel, whether tradesman, or of engineering background, not necessarily familiar with this contract. The term “status” as indicated below must include due date and whether item has been submitted or was approved. Warranty information made available during the construction phase must be submitted to the Contracting Officer for approval prior to each monthly invoice for payment. Assemble approved information in a binder and turn over to the Government upon acceptance of the work. The construction warranty period will begin on the date of the project acceptance and continue for the product warranty period. A joint 4 month and 9 month warranty inspection will be conducted, measured from time of acceptance, by the Contactor and the Contracting Officer. Include in the warranty management plan, but not limited to, the following:

1. Roles and responsibilities of all personnel associated with the warranty process, including points of contact and telephone numbers within the company of the Contractor, subcontractors, manufacturers or suppliers involved.
2. Furnish with each warranty the name, address and telephone number of each of the guarantor’s representatives nearest project location.
3. Listing and status of delivery of all Certificates of Warranty for extended warranty items, to include roofs, HVAC balancing, pumps, motors, transformers and for all commissioned systems such as fire protection and alarm systems, sprinkler systems and lightning protection systems, etc.
4. A list for each warranted equipment item, feature of construction or system indicating:
   a. Name of item.
   b. Model and serial numbers.
   c. Location where installed.
   d. Name and phone numbers of manufacturers and suppliers.
   e. Name and phone numbers of manufacturers or suppliers.
   f. Names, addresses and phone numbers of sources of spare parts.
   g. Warranties and terms of warranty. Include one-year overall warranty of construction, including the starting date of warranty of construction. Items which have extended warranties must be indicated with separate warranty expiration dates.

h. Starting point and duration of warranty period.
i. Summary of maintenance procedures required to continue the warranty in force.
j. Cross-reference to specific pertinent Operation and Maintenance manuals.
k. Organizations, names and phone numbers of persons to call for warranty service.
l. Typical response time and repair time expected for various warranted equipment.

5. The plans for attendance at the 4 and 9-month post construction warranty inspections conducted by the government.
6. Procedure and status of tagging of all equipment covered by extended warranties.
7. Copies of instructions to be posted near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

B. Performance & Payment Bonds: The Performance & Payment Bonds Bond must remain effective throughout the construction period

1. In the event the Contractor fails to commence and diligently pursue any construction warranty work required, the Contracting Officer will have the work performed by others, and after completion of the work, will charge the remaining construction warranty funds of expenses incurred by the Government while performing the work, including, but not limited to administrative expenses.
2. In the event sufficient funds are not available to cover the construction warranty work performed by the Government at the contractor's expenses, the Contracting Officer will have the right to recoup expenses from the bonding company.
3. Following oral or written notification of required construction warranty repair work, the Contractor shall respond in a timely manner. Written verification will follow oral instructions. Failure to respond will be cause for the Contracting Officer to proceed against the Contractor.

C. Pre-Warranty Conference: Prior to contract completion, and at a time designated by the Contracting Officer, the Contractor shall meet with the Contracting Officer to develop a mutual understanding with respect to the requirements of this section. Communication procedures for Contractor notification of construction warranty defects, priorities with respect to the type of defect, reasonable time required for Contractor response, and other details deemed necessary by the Contracting Officer for the execution of the construction warranty will be established/ reviewed at this meeting. In connection with these requirements and at the time of the Contractor's quality control completion inspection, furnish the name, telephone number and address of a licensed and bonded company which is authorized to initiate and pursue construction warranty work action on behalf of the Contractor. This point of contract will be located within the local service area of the warranted construction, be continuously available and be responsive to Government inquiry on warranty work action and status. This requirement does not relieve the Contractor of any of its responsibilities in conjunction with other portions of this provision.

D. Contractor's Response to Construction Warranty Service Requirements:

1. Following oral or written notification by the Contracting Officer, the Contractor shall respond to construction warranty service requirements in accordance with the "Construction Warranty Service Priority List" and the three categories of priorities listed below. Submit a report on any warranty item that has been repaired during the warranty period. Include within the report the cause of the problem, date reported, corrective action taken, and when the repair was completed. If the Contractor does not perform the construction warranty within the timeframe specified, the Government will perform the work and back charge the construction warranty payment item established.
   a. First Priority Code 1. Perform onsite inspection to evaluate situation, and determine course of action within 4 hours, initiate work within 6 hours and work continuously to completion or relief.
   b. Second Priority Code 2. Perform onsite inspection to evaluate situation, and determine course of action within 8 hours, initiate work within 24 hours and work continuously to completion or relief.

c. Third Priority Code 3. All other work to be initiated within 3 work days and work continuously to completion or relief.

d. The “Construction Warranty Service Priority List” is as follows:

1) Code 1-Life Safety Systems
   a) Fire suppression systems.
   b) Fire alarm system(s).
2) Code 1-Air Conditioning Systems
   a) Air conditioning leak in part of the building, if causing damage.
   b) Air conditioning system not cooling properly.
3) Code 1 Doors
   a) Overhead doors not operational, causing a security, fire or safety problem.
   b) Interior, exterior personnel doors or hardware, not functioning properly, causing security, fire or safety problem.
4) Code 3-Doors
   a) Overhead doors not operational.
   b) Interior/exterior personnel doors or hardware not functioning properly.
5) Code 1-Electrical
   a) Power failure (entire area or any building operational after 1600 hours).
   b) Security lights.
   c) Smoke detectors.
6) Code 2-Electrical
   a) Power failure (no power to a room or part of building). Receptacle and lights not operational (in a room or part of building).
7) Code 3-Electrical
   a) Exterior lights not operational.
8) Code 1-Gas
   a) Leaks and pipeline breaks.
9) Code 1-Heat
   a) Power failure affecting heat.
10) Code 1-Plumbing
   a) Hot water heater failure.
   b) Leaking water supply pipes
11) Code 2-Plumbing
   a) Flush valves not operating properly
   b) Fixture drain, supply line or any water pipe leaking.
   c) Toilet leaking at base.
12) Code 3- Plumbing
   a) Leaky faucets.
13) Code 3-Interior
   a) Floors damaged.
   b) Paint chipping or peeling.
   c) Casework damaged.
14) Code 1-Roof Leaks
   a) Damage to property is occurring.
15) Code 2-Water (Exterior)
   a) No water to facility.
16) Code 2-Water (Hot)
   a) No hot water in portion of building listed.
17) Code 3
   a) All work not listed above.

E. Warranty Tags: At the time of installation, tag each warranted item with a durable, oil and water-resistant tag approved by the Contracting Officer. Attach each tag with a copper wire and spray with a silicone waterproof coating. Also submit two record copies of the warranty tags showing

the layout and design. The date of acceptance and the QC signature must remain blank until the project is accepted for beneficial occupancy. Show the following information on the tag.

Warranty Tags	
Type of product/material	
Model number	
Serial number	
Contract number	
Warranty period from/to	
Inspector's signature	
Construction Contractor	
Address	
Telephone number	
Warranty Contact	
Address	
Telephone number	
Warranty response time priority code	

1.14 USE OF ROADWAYS

A. For hauling, use only established public roads and roads on Medical Center property and, when authorized by the COR , such temporary roads which are necessary in the performance of contract work. Temporary roads shall be constructed and restoration performed by the Contractor at Contractor's expense. When necessary to cross curbing, sidewalks, or similar construction, they must be protected by well-constructed bridges.

1.15 TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT

A. Use of new installed mechanical and electrical equipment to provide heat, ventilation, plumbing, light and power will be permitted subject to written approval and compliance with the following provisions:

1. Permission to use each unit or system must be given by COR in writing. If the equipment is not installed and maintained in accordance with the written agreement and following provisions, the COR will withdraw permission for use of the equipment.
2. Electrical installations used by the equipment shall be completed in accordance with the drawings and specifications to prevent damage to the equipment and the electrical systems, i.e. transformers, relays, circuit breakers, fuses, conductors, motor controllers and their overload elements shall be properly sized, coordinated and adjusted. Installation of temporary electrical equipment or devices shall be in accordance with NFPA 70, National Electrical Code, (2020 Edition), Article 590, *Temporary Installations.* Voltage supplied to each item of equipment shall be verified to be correct and it shall be determined that motors are not overloaded. The electrical equipment shall be thoroughly cleaned before using it and again immediately before final inspection including vacuum cleaning and wiping clean interior and exterior surfaces.
3. Units shall be properly lubricated, balanced, and aligned. Vibrations must be eliminated.
4. Automatic temperature control systems for preheat coils shall function properly and all safety controls shall function to prevent coil freeze-up damage.

5. The air filtering system utilized shall be that which is designed for the system when complete, and all filter elements shall be replaced at completion of construction and prior to testing and balancing of system.
6. All components of heat production and distribution system, metering equipment, condensate returns, and other auxiliary facilities used in temporary service shall be cleaned prior to use; maintained to prevent corrosion internally and externally during use; and cleaned, maintained and inspected prior to acceptance by the Government. Boilers, pumps, feedwater heaters and auxiliary equipment must be operated as a complete system and be fully maintained by operating personnel. Boiler water must be given complete and continuous chemical treatment.

B. Prior to final inspection, the equipment or parts used which show wear and tear beyond normal, shall be replaced with identical replacements, at no additional cost to the Government.

C. This paragraph shall not reduce the requirements of the mechanical and electrical specifications sections.

D. Any damage to the equipment or excessive wear due to prolonged use will be repaired replaced by the contractor at the contractor's expense.

1.16 TEMPORARY USE OF EXISTING ELEVATORS

A. Use of existing elevators for handling building materials and Contractor's personnel will be permitted subject to following provisions:
1. Contractor makes all arrangements with the COR for use of elevators. The COR will ascertain that elevators are in proper condition. Contractor may use only the freight elevator in Building No. 14. Coordinate with other maintenance taking place in the building. Personnel for operating elevators will not be provided by the Department of Veterans Affairs.
2. Contractor covers and provides maximum protection of following elevator components:
   a. Entrance jambs, heads soffits and threshold plates.
   b. Entrance columns, canopy, return panels and inside surfaces of car enclosure walls.
   c. Finish flooring.
3. Government will accept hoisting ropes of elevator and rope of each speed governor if they are worn under normal operation. However, if these ropes are damaged by action of foreign matter such as sand, lime, grit, stones, etc., during temporary use, they shall be removed and replaced by new hoisting ropes at the contractors expense.
4. If brake lining of elevators are excessively worn or damaged during temporary use, they shall be removed and replaced by new brake lining at the contractors expense.
5. All parts of main controller, starter, relay panel, selector, etc., worn or damaged during temporary use shall be removed and replaced with new parts at the contractors expense, if recommended by elevator inspector after elevator is released by Contractor.
6. Place elevator in condition equal, less normal wear, to that existing at time it was placed in service of Contractor as approved by Contracting Officer.

1.17 TEMPORARY TOILETS

A. Provide where directed, (for use of all Contractor's workers) ample temporary sanitary toilet accommodations with suitable sewer and water connections; or, when approved by COR, provide suitable dry closets where directed. Keep such places clean and free from flies and all connections and appliances connected therewith are to be removed prior to completion of contract, and premises left perfectly clean.

1.18 AVAILABILITY AND USE OF UTILITY SERVICES

A. The Government shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract. The amount to be paid by the Contractor for chargeable electrical services shall be the prevailing rates charged to the Government. The Contractor shall carefully conserve any utilities furnished without charge.

B. The Contractor, at Contractor's expense and in a workmanlike manner, in compliance with code and as satisfactory to the Contracting Officer, shall install and maintain all necessary temporary connections and distribution lines, and all meters required to measure the amount of electricity used for the purpose of determining charges. Before final acceptance of the work by the Government, the Contractor shall remove all the temporary connections, distribution lines, meters, and associated paraphernalia and repair restore the infrastructure as required.

C. Contractor shall install meters at Contractor's expense and furnish the Medical Center a monthly record of the Contractor's usage of electricity as hereinafter specified.

D. Heat: Furnish temporary heat necessary to prevent injury to work and materials through dampness and cold. Use of open salamanders or any temporary heating devices which may be fire hazards or may smoke and damage finished work, will not be permitted. Maintain minimum temperatures as specified for various materials:
   1. Obtain heat by connecting to Medical Center heating distribution system.
      a. Steam is available at no cost to Contractor.

E. Electricity (for Construction and Testing): Furnish all temporary electric services.
   1. Obtain electricity by connecting to the Medical Center electrical distribution system. The Contractor shall meter and pay for electricity required for electric cranes and hoisting devices, electrical welding devices Electricity for all other uses is available at no cost to the Contractor. Note that temporary Electrical heat is not allowed – Heat shall be provided via use of temporary steam only.

F. Water (for Construction and Testing): Furnish temporary water service.
   1. Obtain water by connecting to the Medical Center water distribution system. Provide reduced pressure backflow preventer at each connection as per code. Water is available at no cost to the Contractor.
   2. Maintain connections, pipe, fittings and fixtures and conserve water-use so none is wasted. Failure to stop leakage or other wastes will be cause for revocation at COR discretion) of use of water from Medical Center's system.

1.19 NEW TELEPHONE EQUIPMENT

A. The contractor shall coordinate with the work of installation of telephone equipment by others. This work shall be completed before the building is turned over to VA.

1.20 TESTS AND THIRD-PARTY INSPECTIONS

A. All testing shall be by certified testing laboratories and Third-Party Inspection subcontracted by the Architecture & Engineering firm per Section 01 45 29, TESTING LABORATORY SERVICES.
   1. The VA shall not be required to contract testing for any trade.

B. Inspections:
   1. The VA does not provide courtesy, pre-inspections of construction area and systems during the construction. The Contractor shall request progress inspections and communicate requests for inspections at least one week in advance.
   2. Comprehensive 3rd party inspections, testing and written reports for all Divisions (paid by the Architecture & Engineering firm).
      a. The Architecture & Engineering firm shall employ third party inspection consultants to perform all inspections required by this contract. The VA has no inspection capability. Any reference to VA inspections shall be by a third-party inspector qualified to perform the work. Credentials shall be supplied to the VA/AE as required by this contract. All inspections, testing, certifications, and permits are to be paid for by the General Contractor. The VA will not pay for or perform any required inspections. VA inspections are for VA use only, when performed, and do not reduce the inspection burden on the Contractor for conformance to the Contract Documents. Third-party inspection services must be submitted for acceptance by the VA after award. Submission to include resumes of inspectors,

with alternates, projected days on site, qualifications of inspectors showing similar projects, related portfolio, and description of communication protocol with Owner.

b. Contractor shall notify VA COR minimum (7) days in advance of each third-party inspection to allow coordination with VA personnel.

c. Third-Party Inspectors shall have minimum qualifications as detailed in "01 45 00 Quality Control CQC Part 3.2 Personnel Experience Matrix".

d. Acceptable Third-Party inspectors include the following examples:

1) Exact Engineering and Commissioning, LLC
   a) 1200 7th Street S, Safety Harbor, FL 34695
2) Parsons Brinckerhoff
   a) http://www.wsp-pb.com/en/WSP-USA/What-we-do-USA/Services/All-Services-A-Z/Bridge-Engineering/Construction-Inspection/
3) Booz Allen
   a) http://www.boozallen.com
4) US Army Corps of Engineers
   a) http://www.usace.army.mil/
5) Bureau Veritas
   a) http://www.bureauveritas.com/
6) Stantec
   a) http://www.stantec.com/our-work/services/construction-qa-qc-monitoring-inspection- services.html
7) HDR, Inc.
   a) http://www.hdrinc.com/
8) Gilbane
   a) http://www.gilbaneco.com.
9) The individuals or specified technical companies shall be subject to acceptance by the Contracting Officer or Authorized designee.

e. Minimum inspections required:

1) Structural.
2) Mechanical.
3) Electrical.
4) Plumbing.
5) Fire Protection.
6) Low Voltage Systems.
7) Communications and Security Systems.
8) Controls System Integration.
9) Commissioning Support.
10) Framing, Interior Finishes and Doors/Hardware.

3. Special Inspections per Section 01 45 35, SPECIAL INSPECTIONS.
4. All third-party Inspections Reports shall be recorded and submitted before Commissioning Systems Functional Performance Test start.

C. System Testing Requirements:

1. As per specification section 23 05 93 the contractor shall provide a written testing and commissioning plan complete with component level, equipment level, sub-system level and system level breakdowns. The plan will provide a schedule and a written sequence of what will be tested, how and what the expected outcome will be. This document will be submitted for approval prior to commencing work. The contractor shall document the results of the approved plan and submit for approval with the as built documentation.
2. Pre-test mechanical and electrical equipment and systems and make corrections required for proper operation of such systems before requesting final tests. Final test will not be conducted unless pre-tested.
3. Conduct final tests required in various sections of specifications in presence of an authorized representative of the Contracting Officer. Contractor shall furnish all labor, materials, equipment, instruments, and forms, to conduct and record such tests.

4. Mechanical and electrical systems shall be balanced, controlled and coordinated. A system is defined as the entire system which must be coordinated to work together during normal operation to produce results for which the system is designed. For example, air conditioning supply air is only one part of entire system which provides comfort conditions for a building. Other related components are return air, exhaust air, steam, chilled water, refrigerant, hot water, controls and electricity, etc. Another example of a system which involves several components of different disciplines is a boiler installation. Efficient and acceptable boiler operation depends upon the coordination and proper operation of fuel, combustion air, controls, steam, feedwater, condensate and other related components.
5. All related components as defined above shall be functioning when any system component is tested. Tests shall be completed within a reasonably period of time during which operating and environmental conditions remain reasonably constant and are typical of the design conditions.
6. Individual test result of any component, where required, will only be accepted when submitted with the test results of related components and of the entire system.

1.21 INSTRUCTIONS

A. Contractor shall furnish Maintenance and Operating manuals (hard copies and electronic) and verbal instructions when required by the various sections of the specifications and as hereinafter specified.

B. Manuals: Maintenance and operating manuals and one compact disc (four hard copies and one electronic copy each) for each separate piece of equipment shall be delivered to the COR coincidental with the delivery of the equipment to the job site. Manuals shall be complete, detailed guides for the maintenance and operation of equipment. They shall include complete information necessary for starting, adjusting, maintaining in continuous operation for long periods of time and dismantling and reassembling of the complete units and sub-assembly components. Manuals shall include an index covering all component parts clearly cross-referenced to diagrams and illustrations. Illustrations shall include "exploded" views showing and identifying each separate item. Emphasis shall be placed on the use of special tools and instruments. The function of each piece of equipment, component, accessory and control shall be clearly and thoroughly explained. All necessary precautions for the operation of the equipment and the reason for each precaution shall be clearly set forth. Manuals must reference the exact model, style and size of the piece of equipment and system being furnished. Manuals referencing equipment similar to but of a different model, style, and size than that furnished will not be accepted.

C. Instructions: Contractor shall provide qualified, factory-trained manufacturers' representatives to give detailed training to assigned Department of Veterans Affairs personnel in the operation and complete maintenance for each piece of equipment. All such training will be at the job site. These requirements are more specifically detailed in the various technical sections. Instructions for different items of equipment that are component parts of a complete system, shall be given in an integrated, progressive manner. All instructors for every piece of component equipment in a system shall be available until instructions for all items included in the system have been completed. This is to assure proper instruction in the operation of inter-related systems. All instruction periods shall be at such times as scheduled by the COR and shall be considered concluded only when the COR is satisfied in regard to complete and thorough coverage. The contractor shall submit a course outline with associated material to the COR for review and approval prior to scheduling training to ensure the subject matter covers the expectations of the VA and the contractual requirements. The Department of Veterans Affairs reserves the right to request the removal of, and substitution for, any instructor who, in the opinion of the COR, does not demonstrate sufficient qualifications in accordance with requirements for instructors above.

1.22 GOVERNMENT-FURNISHED PROPERTY

A. The Government shall deliver to the Contractor, the Government-furnished property shown on the drawings.

B. Equipment furnished by Government to be installed by Contractor will be furnished to Contractor at the Medical Center.

C. Contractor shall be prepared to receive this equipment from Government and store or place such equipment not less than 90 days before Completion Date of project.

D. Notify Contracting Officer in writing, 60 days in advance, of date on which Contractor will be prepared to receive equipment furnished by Government. Arrangements will then be made by the Government for delivery of equipment.
   1. Immediately upon delivery of equipment, Contractor shall arrange for a joint inspection thereof with a representative of the Government. At such time the Contractor shall acknowledge receipt of equipment described, make notations, and immediately furnish the Government representative with a written statement as to its condition or shortages.
   2. Contractor thereafter is responsible for such equipment until such time as acceptance of contract work is made by the Government.

E. Equipment furnished by the Government will be delivered in a partially assembled (knock down) condition in accordance with existing standard commercial practices, complete with all fittings, fastenings, and appliances necessary for connections to respective services installed under contract. All fittings and appliances (i.e., couplings, ells, tees, nipples, piping, conduits, cables, and the like) necessary to make the connection between the Government furnished equipment item and the utility stub-up shall be furnished and installed by the contractor at no additional cost to the Government.

F. Completely assemble and install the Government furnished equipment in place ready for proper operation in accordance with specifications and drawings.

G. Furnish supervision of installation of equipment at construction site by qualified factory trained technicians regularly employed by the equipment manufacturer.

1.23 RELOCATED EQUIPMENT AND ITEMS

A. Contractor shall disconnect, dismantle as necessary, remove and reinstall in new location, all existing equipment and items indicated or otherwise shown to be relocated by the Contractor.

B. Perform relocation of such equipment or items at such times and in such a manner as directed by the COR.

C. Suitably cap existing service lines, such as steam, condensate return, water, drain, gas, air, vacuum and/or electrical, at the main whenever such lines are disconnected from equipment to be relocated. Remove abandoned lines in finished areas and cap as specified herein before under paragraph "Abandoned Lines".

D. Provide all mechanical and electrical service connections, fittings, fastenings and any other materials necessary for assembly and installation of relocated equipment; and leave such equipment in proper operating condition.

E. All service lines such as noted above for relocated equipment shall be in place at point of relocation ready for use before any existing equipment is disconnected. Make relocated existing equipment ready for operation or use immediately after reinstallation.

1.24 SAFETY SIGN

A. Provide a Safety Sign where directed by COR. Face of sign shall be 19 mm (3/4 inch) thick exterior grade plywood. Provide two 100 mm by 100 mm (four by four inch) posts extending full height of sign and 900 mm (three feet) into ground. Set bottom of sign level at 1200 mm (four feet) above ground.

B. Paint all surfaces of Safety Sign and posts with one prime coat and two coats of white gloss paint. Letters and design shall be painted with gloss paint of colors noted.

C. Maintain sign and remove it when directed by COR.

D. Drawing details in VA Signage Design Manual, Section 11 Specialty Signs (found on VA TIL) show required legend and other characteristics of sign and are shown on the drawings.

E. Post the number of accident free days on a daily basis.

1.25 [PHOTOGRAPHIC DOCUMENTATION]

A. During the construction period through completion, provide photographic documentation of construction progress and at selected milestones including electronic indexing, navigation, storage and remote access to the documentation, as per these specifications. The commercial photographer or the subcontractor used for this work shall meet the following qualifications:
   1. Demonstrable minimum experience of three (3) years in operation providing documentation and advanced indexing/navigation systems including a representative portfolio of construction projects of similar type, size, duration and complexity as the Project.
   2. Demonstrable ability to service projects throughout North America, which shall be demonstrated by a representative portfolio of active projects of similar type, size, duration and complexity as the Project.

B. Photographic documentation elements:
   1. Each digital image shall be taken with a professional grade camera with minimum size of 6 megapixels (MP) capable of producing 200x250mm (8 x 10 inch) prints with a minimum of 2272 x 1704 pixels and 400x500mm (16 x 20 inch) prints with a minimum 2592 x 1944 pixels.
   2. Indexing and navigation system shall utilize actual AUTOCAD construction drawings, making such drawings interactive on an on-line interface. For all documentation referenced herein, indexing and navigation must be organized by both time (date-stamped) and location throughout the project.
   3. Documentation shall combine indexing and navigation system with inspection-grade digital photography designed to capture actual conditions throughout construction and at critical milestones. Documentation shall be accessible on-line through use of an internet connection. Documentation shall allow for secure multiple-user access, simultaneously, on-line.
   4. Before construction, the building pad, adjacent streets, roadways, parkways, driveways, curbs, sidewalks, landscaping, adjacent utilities, and adjacent structures surrounding the building pad and site shall be documented. Overlapping photographic techniques shall be used to ensure maximum coverage. Indexing and navigation accomplished through interactive architectural drawings. If site work or pad preparation is extensive, this documentation may be required immediately before construction and at several pre-determined intervals before building work commences.
   5. Construction progress for all trades shall be tracked at pre-determined intervals, but not less than once every thirty (30) calendar days (“Progressions”). Progression documentation shall track both the exterior and interior construction of the building. Exterior Progressions shall track 360 degrees around the site and each building. Interior Progressions shall track interior improvements beginning when stud work commences and continuing until Project completion.
   6. As-built condition of pre-foundation utilities and site utilities shall be documented prior to pouring footers, placing concrete and/or backfilling. This process shall include all underground and in-slab utilities within the building(s) envelope(s) and utility runs in the immediate vicinity of the building(s) envelope(s). This may also include utilities enclosed in slab-on-deck in multi-story buildings. Overlapping photographic techniques shall be used to ensure maximum coverage. Indexing and navigation accomplished through interactive site utility plans.
   7. As-built conditions of mechanical, electrical, plumbing and all other systems shall be documented post-inspection and pre-insulation, sheet rock or dry wall installation. This process shall include all finished systems located in the walls and ceilings of all buildings

at the Project. Overlapping photographic techniques shall be used to ensure maximum coverage. Indexing and navigation accomplished through interactive architectural drawings.

8. As-built conditions of exterior skin and elevations shall be documented with an increased concentration of digital photographs as directed by the COR in order to capture pre-determined focal points, such as waterproofing, window flashing, radiused steel work, architectural or Exterior Insulation and Finish Systems (EIFS) detailing. Overlapping photographic techniques shall be used to ensure maximum coverage. Indexing and navigation accomplished through interactive elevations or elevation details.
9. As-built finished conditions of the interior of each building including floors, ceilings and walls shall be documented at certificate of occupancy or equivalent, or just prior to occupancy, or both, as directed by the COR. Overlapping photographic techniques shall be used to ensure maximum coverage. Indexing and navigation accomplished through interactive architectural drawings.
10. Miscellaneous events that occur during any Contractor site visit, or events captured by the Department of Veterans Affairs independently, shall be dated, labeled and inserted into a Section in the navigation structure entitled “Slideshows,” allowing this information to be stored in the same “place” as the formal scope.
11. Customizable project-specific digital photographic documentation of other details or milestones. Indexing and navigation accomplished through interactive architectural plans.
12. Monthly (29 max) exterior progressions (360 degrees around the project) and slideshows (all elevations and building envelope). The slideshows allow for the inclusion of Department of Veterans Affairs pictures, aerial photographs, and timely images which do not fit into any regular monthly photo path.
13. Weekly (21 Max) Site Progressions - Photographic documentation capturing the project at different stages of construction. These progressions shall capture underground utilities, excavation, grading, backfill, landscaping and road construction throughout the duration of the project.
14. Regular (8 max) interior progressions of all walls of the entire project to begin at time of substantial framed or as directed by the COR through to completion.
15. Detailed Exact-Built of all Slabs for all project slab pours just prior to placing concrete or as directed by the COR.
16. Detailed Interior exact built overlapping photos of the entire building to include documentation of all mechanical, electrical and plumbing systems in every wall and ceiling, to be conducted after rough-ins are complete, just prior to insulation and or drywall, or as directed by COR.
17. Finished detailed Interior exact built overlapping photos of all walls, ceilings, and floors to be scheduled by COR prior to occupancy.
18. In event a greater or lesser number of images than specified above are required by the COR, adjustment in contract price will be made in accordance with clause entitled "CHANGES" (FAR 52.243-4).

C. Images shall be taken by a commercial photographer and must show distinctly, at as large a scale as possible, all parts of work embraced in the picture.

D. Coordination of photo shoots is accomplished through COR. Contractor shall also attend construction team meetings as necessary. Contractor’s operations team shall provide regular updates regarding the status of the documentation, including photo shoots concluded, the availability of new Progressions or Exact-Builts viewable on-line and anticipated future shoot dates.

E. Contractor shall provide all on-line domain/web hosting, security measures, and redundant server back-up of the documentation.

F. Contractor shall provide technical support related to using the system or service.

G. Upon completion of the project, final copies of the documentation (the “Permanent Record”) with the indexing and navigation system embedded (and active) shall be provided in an electronic

media format, typically a DVD or external hard-drive. Permanent Record shall have Building Information Modeling (BIM) interface capabilities. On-line access terminates upon delivery of the Permanent Record.

1.26 FINAL ELEVATION DIGITAL IMAGES

A. A minimum of four (4) images of each elevation shall be taken with a minimum 6 MP camera, by a professional photographer with different settings to allow the COR to select the image to be printed. All images are provided to the RE on a CD.

B. Photographs shall be taken upon completion, including landscaping. They shall be taken on a clear sunny day to obtain sufficient detail to show depth and to provide clear, sharp pictures. Pictures shall be 400 mm x 500 mm (16 by 20 inches), printed on regular weight paper, matte finish archival grade photographic paper and produced by a RA4 process from the digital image with a minimum 300 PPI. Identifying data shall be carried on label affixed to back of photograph without damage to photograph and shall be similar to that provided for final construction photographs.

C. Furnish six (6) 400 mm x 500 mm (16 by 20 inch) color prints of the following buildings constructed under this project (elevations as selected by the RE from the images taken above). Photographs shall be artistically composed showing full front elevations. All images shall become property of the Government. Each of the selected six prints shall be place in a frame with a minimum of 2 inches of appropriate matting as a border. Provide a selection of a minimum of 3 different frames from which the SRE will select one style to frame all six prints. Photographs with frames shall be delivered to the COR in boxes suitable for shipping.
   1. Hospital Building No. 14.

1.27 HISTORIC PRESERVATION

A. Where the Contractor or any of the Contractor's employees, prior to, or during the construction work, are advised of or discover any possible archeological, historical and/or cultural resources, the Contractor shall immediately notify the COR verbally, and then with a written follow up.

1.28 INSPECTION AND APPROVAL

A. Contractor shall notify the COR at least 48 hours in advance to schedule the following Inspections:
   1. Note: Third party inspections will require more than 48 hours notice.
   2. ELECTRICAL/TELECOM/SECURITY:
      a. Underground work
      b. Rough-in
      c. Service
      d. Final inspection
   3. PLUMBING AND GAS:
      a. Underground work inspection
      b. Plumbing rough–in inspection
      c. Gas pressure / Leak inspection
      d. Final inspection
   4. HVAC
      a. Rough-in
      b. TAB
      c. Leak Inspection
      d. Final inspection
   5. STRUCTURAL:
      a. Footing
      b. Foundation reinforcement
      c. Foundation
      d. Concrete slab base
   6. FIRE PROTECTION:
      a. Sprinkler hydrostatic

7. CARPENTRY:
   a. Framing
8. ENERGY EFFICIENCY:
   a. Insulation
   b. Commissioning and Sequences of Operation
9. All above work shall be approved by COR prior to closure of walls, ceilings, floors, trenches, etc.

1.29 BID FORM

A. See Section 00 41 13, BID FORM.

APPENDIX A - Hazardous Materials Survey Report from Terracon –dated August 21, 2021.

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Hazardous Materials Survey Report

Project: Building 14 Renovations

VA Project No.: J2217018

VA Medical Center - Montrose

2094 Albany Post Road

Montrose, New York 10548

August 21, 2021

Terracon Project No. J2217018

Prepared for:

Triple C – The A&E Group
Laramie, Wyoming

Prepared by:

Terracon Consultants, Inc.
Rocky Hill, Connecticut

August 21, 2021

Triple C – The A&E Group
410 Grand Ave, Suite 201C
Laramie, Wyoming 82070

Attn: Mr. Mat Perkins
Vice President
P: (307) 460-2054
E: mat.perkins@triplecaeg.com

Re: Hazardous Materials Survey Report
Project: Building 14 Renovations – VAMC Montrose, New York
VA Project No.: J2217018
VA Medical Center – Montrose
2094 Albany Post Road
Montrose, New York 10548

Dear Mr. Perkins,

Terracon Consultants, Inc. (Terracon) is pleased to submit this hazardous materials survey report to Triple C – The A&E Group for the above-referenced renovation project at the Montrose, New York VA Medical Center (VAMC). The scope of the hazardous materials survey included asbestos-containing materials (ACM), lead-containing paint (LCP), and polychlorinated biphenyls (PCBs) which may be located within the renovation project boundaries of Building 14. Such materials would need to be properly addressed per applicable federal, state, and local regulations and VAMC specifications as part of the renovation project. The survey was performed at the site on May 24, 25, and 26, 2021. This survey was conducted in accordance with our Master Services Agreement dated June 15, 2007, and our proposal dated May 7, 2021.

ACM and LCP were identified as a result of sampling and laboratory analysis. PCBs were assumed present in fluorescent lighting ballasts which did not have a “No PCBs” label. PCBs were not identified by laboratory analysis in caulk material samples collected and not identified in surface wipe samples collected adjacent to caulk materials. Please refer to the report for further details.

We trust this report meets your needs at this time. If you have any questions regarding this report, please feel free to contact us.

Sincerely,
Terracon Consultants, Inc.

Adam Frey
Licensed Asbestos Inspector

Joseph Tussey, CHMM
Authorized Project Reviewer

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APPENDIX G PRIOR REPORT, EGAN ENVIRONMENTAL CONSULTING, INC

Chain of custody sample report - Not included in Specifications - Available upon request

HAZARDOUS MATERIALS SURVEY REPORT
Project: Building 14 Renovations
VA Project No.: J2217018
VA Medical Center – Montrose
2094 Albany Post Road
Montrose, New York 10548
Terracon Project No. J2217018
August 21, 2021

1.0 INTRODUCTION

Terracon Consultants, Inc. (Terracon) conducted a Hazardous Materials Survey for the above-referenced renovation project at the Veterans Affairs Medical Center (VAMC) located at 2094 Albany Post Road in Montrose, New York. The scope of the hazardous materials survey included asbestos-containing materials (ACM), lead-containing paint (LCP), and polychlorinated biphenyls (PCBs) which may be located within the renovation project boundaries of Building 14. The survey was conducted at the project site on May 24, 25, and 26 by United States Environmental Protection Agency (USEPA) Asbestos Hazard Emergency Response Act (AHERA)- accredited and state of New York certified asbestos building inspectors in general accordance with our Master Services agreement dated June 15, 2007, and our proposal dated May 7, 2021. Accessible interior components within the boundaries of the renovation project were surveyed and homogenous areas of suspect asbestos-containing materials (ACM) were visually identified and documented. Although reasonable effort was made to survey accessible suspect materials, additional suspect but un-sampled materials could be located in walls, voids, or other concealed areas. Suspect ACM samples were collected in general accordance with the sampling protocols outlined in USEPA 40 Code of Federal Regulations (CFR) Part 763 Subpart E 763.86, known as AHERA. Samples were delivered to an accredited laboratory for analysis by Polarized Light Microscopy (PLM), PLM-non-friable organically bound (PLM-NOB), and Transmission Electron Microscopy (TEM)-NOB (required by New York State regulations).

The asbestos survey scope included reviewing a prior report (see Appendix G), identifying and sampling suspect asbestos-containing materials (ACM) for laboratory analysis and providing information regarding the identity, location, condition, and approximate quantities of ACM, if any, located within renovation project boundaries. The PCBs scope included visually assessing a representative number of light ballasts for the potential presence of PCBs (i.e., ballasts without “NO PCBs” labels), sampling caulking and adjacent mortar materials for laboratory analysis to determine the presence of lack of PCBs, and collecting surface wipes for laboratory analysis to determine potential PCBs on surfaces adjacent to electrical equipment The LCP scope included collecting

paint chip samples from representative homogenous areas of paint for laboratory analysis to determine lead-content.

1.1 Project Objective

We understand this hazardous materials survey scope was requested by the Client to identify the presence, locations, and approximate quantities of ACM, LCP, PCBs in caulk and adjacent mortar, PCBs on surfaces adjacent to electrical equipment, and visually assessing light ballasts for potential PCBs which may be located within the boundaries and scope of the renovation project. Our scope of services was limited to the proposed renovation areas as indicated on drawing numbers: HC-001, H-101, H-102, H-103, HC101, and HC102, dated, May 4, 2021, as provided by Triple C – The A&E Group.

2.0 PROJECT DESCRIPTION

Our scope of services for this project was limited to the areas to be renovated within the service basement 13C, electrical room 8Z (ground level), the ground floor, the first floor, and the second floor of Building 14 at the Montrose, New York VAMC facility. As previously noted in Section 1.1 above, the proposed renovation plans for which our survey scope of services is applicable are shown on drawing numbers provided by Triple C – The A&E Group.

3.0 FIELD ACTIVITIES

3.1 Asbestos Survey

The survey was conducted by Mr. Jason Lopez, Mr. Jujuan Rivera, and Mr. Timothy Donohoe, New York state certified asbestos building inspectors (Inspector Certification Nos. 95-13559, 19-11971, 89-09236, respectively). A copy of each inspector's asbestos inspector certificate is attached in Appendix E. The survey was conducted in general accordance with the sample collection protocols established in EPA regulation 40 CFR 763 (AHERA). A summary of survey activities is provided below.

Prior to the survey, Terracon was provided an "Asbestos Field Re-survey and Assessment" for Building 14 on the Montrose VA Campus, prepared by Egan Environmental Consulting, Inc. (Egan), dated 2017, for review. Based on the Egan report findings, ACM was previously identified within Building 14. Egan's report identified the presence of asbestos-containing pipe insulation, pipe fitting insulation, floor tiles, and radiator panels. Based on Terracon's opinion of a lack of good material descriptions and sample locations in some instances in the Egan report, some floor tile and floor tile mastic materials were re-sampled during this survey for confirmation of asbestos-content. A copy of Egan's report is attached in Appendix G.

3.1.1 Visual Assessment

The asbestos survey activities were initiated with visual observation of the accessible renovation project spaces to identify homogeneous areas of suspect ACM. A homogeneous area (HA) consists of building materials that appear similar throughout in terms of color and texture with consideration given to the date of application and are individual to each building surveyed. The assessment was conducted in physically accessible areas of the building. Building materials identified as glass, wood, masonry, metal or rubber were not considered suspect ACM.

3.1.2 Physical Assessment

A physical assessment of each HA of suspect ACM was conducted to assess the friability and condition of the materials. A friable material is defined by the USEPA as a material, which can be crumbled, pulverized or reduced to powder by hand pressure when dry. Friability was assessed by physically touching suspect materials.

3.1.3 Sample Collection

Based on results of the visual and physical observation, bulk samples of suspect ACM were collected in general accordance with USEPA AHERA sampling protocols. Samples of suspect materials were collected from randomly selected locations in each HA. Bulk samples were collected using wet methods as applicable to reduce the potential for fiber release by breaking off a small portion of the suspect material and placing it in a sealable container. The sample was then labeled with unique sample numbers using an indelible marker. The selection of sample locations and frequency of sampling were based on Terracon's observations and the assumption that like materials in the same area are homogenous in content.

Terracon did not perform sampling requiring demolition or destructive activities such as knocking holes in walls, dismantling equipment or removal of protective coverings that would create large disturbances of building materials. However, Terracon did create isolated damage by breaking small sections of the material for the purpose of sample collection. Where multi-layered flooring systems were identified in each space Terracon removed isolated sections of the flooring until the underlying non-suspect concrete substrate was observed. Electrical systems in the building were energized at the time of the survey, and therefore, were not sampled.

Terracon collected a total of 422 bulk samples from 131 homogenous areas (HA) of suspect ACM. A table with a summary of samples collected is included in Appendix B. A diagram with approximate sample locations is included in Appendix F.

3.1.4 Sample Analysis

Bulk samples were submitted under chain of custody to EMSL Analytical, Inc. (EMSL) of Cinnaminson, New Jersey, a New York State Department of Health (NYSDOH) Environmental Laboratory Accreditation Program (ELAP) accredited laboratory, accreditation number 180179. EMSL is also accredited under the National Voluntary Laboratory Accreditation Program (NVLAP), accreditation number 101147-0.

As per NYSDOH-ELAP, the friable material samples were analyzed by polarized light microscopy (PLM) Method 198.1., non-friable-organically bound (NOB) materials (e.g., floor tiles, mastics) were analyzed using PLM-NOB Method 198.6, and inconclusive NOBs were additionally analyzed using transmission electron microscopy (TEM) for a conclusive result as required by the State of New York. The asbestos analytical report is included in Appendix C.

3.2 Lead-Containing Paint Sampling

In conjunction with the asbestos survey, Terracon collected paint samples from dominant-type building components in representative renovation project areas to determine lead-content by laboratory analysis. The paint sampling was conducted by Mr. Sammy Marrero (Lead Training Certificate No. LBP-I-128920-2) on May 24, 26, and 26, 2021. This sampling was not a surface-by-surface inspection intended to meet the requirement of the HUD Guidelines for the Evaluation and control of Lead-Based Paint Hazards which is applicable for HUD-funded residential housing.

3.2.1 Visual Assessment

The lead paint activities began with visual observation of to assess the condition of dominant type paint coatings and assign a condition of intact, fair, or poor. No dominant areas of damaged, peeling, or flaking paint were readily observed.

3.2.2 Sample Collection

Paint chip samples were collected from representative, dominant type painted surfaces throughout the renovation area. The inspector chose their sample locations based on combinations of paint color correlating to each representative substrate identified throughout the renovation area. Chip sampling resulted in damage to a small area (approximately four-square inches) of the painted surface at each sample location. Paint chip sampling was performed by scraping/chipping away each layer of paint in an approximate 2”x2” area down to the underlying substrate (e.g., metal, wood or plaster etc.) to ensure all layers of paint were collected and submitted for laboratory analysis. Terracon was not responsible for repainting sampled surfaces.

Paint chip samples were collected from a total of 11 homogenous painted surfaces from various dominant type building components within the renovation project boundaries.

3.2.3 Sample Analysis

The paint chip samples were submitted for lead-content analysis to EMSL of Cinnaminson, New Jersey. EMSL is accredited by the AIHA Laboratory Programs, LLC under the Environmental Lead Laboratory Accreditation Program (ELLAP; accreditation number 180179). The paint chip samples were analyzed for lead content via EPA SW-846 Methods 3051A / 7000B, *Flame Atomic Absorption Spectrophotometry*. A copy of the lead analytical report is included in Appendix C.

3.3 PCB-Bulk Sampling

Terracon visually assessed the renovation area and performed a PCB-containing caulk and mortar sampling that consisted of collecting bulk samples of caulking that were identified during the asbestos survey. Three (3) caulk samples and one (1) mortar sample were collected from a total of four (4) homogenous areas in the renovation area.

3.3.1 Sample Analysis

The bulk caulk and mortar samples were submitted for PCB-content analysis to EMSL of Cinnaminson, New Jersey. Samples were analyzed for PCB content via EPA Methods 3546 *Microwave Extraction and 8082A Polychlorinated Biphenyls (PCBs) by Gas Chromatography*. A copy of the PCB caulk analytical report is included in Appendix C.

3.4 PCB Wipe Sampling

Terracon collected surface wipe samples in electric room 8Z and service basement 13C for PCB-content analysis. Wipe samples were collected from eight (8) surface areas adjacent to electrical equipment in the aforementioned rooms.

3.4.1 Sample Analysis

The wipe samples were submitted for PCB-content analysis to EMSL of Cinnaminson, New Jersey. EMSL is accredited under the National Voluntary Laboratory Accreditation Program (NVLAP; accreditation number NJ 101147-0). Samples were analyzed for PCB-content via EPA Methods SW-846 *3550B/8082A by Gas Chromatography*. A copy of the PCB surface wipe analytical report is included in Appendix C.

3.5 PCB-Containing Equipment Visual Assessment

Terracon conducted a visual assessment of electrical equipment and light fixtures to characterize for potential PCB-content. PCBs are typically contained in electrical light ballasts and "wet" electrical transformers manufactured prior to 1979 unless clearly marked as containing "No PCBs". Electrical transformers and light ballasts that do not have a "No PCBs" label are presumed to be PCB-containing. Please note that Terracon inspected random light ballasts for "No PCBs" labels; most light ballasts observed during our assessment did not have a "No PCBs" label, and therefore, it should be assumed all fluorescent light fixture ballasts in the renovation area contain PCBs.

4.0 REGULATORY OVERVIEW

4.1 Asbestos-Containing Materials

The federal asbestos National Emission Standards for Hazard Air Pollutants (NESHAP; 40 CFR Part 61, Subpart M) regulates asbestos fiber emissions and asbestos waste disposal practices. NESHAP requires an asbestos survey of structures prior to renovation projects and has specific requirements for the removal of certain categories of ACM prior to renovation projects. Friable ACM is a material containing more than 1% asbestos that, when dry, may be crumbled, pulverized or reduced to powder by hand pressure. All friable ACM is considered regulated asbestos-containing material (RACM).

The NESHAP regulation classifies ACM as either RACM, Category I non-friable ACM or Category II non-friable ACM. RACM includes all friable ACM, along with Category I and Category II non-friable ACM that has become friable or will be or has been subjected to sanding, grinding, cutting or abrading, or ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder in the course of renovation activity. Category I non-friable ACM are exclusively asbestos-containing packings, gaskets, resilient floor coverings, resilient floor covering mastics and asphalt roofing products that contain more than 1% asbestos. Category II non-friable ACM are all other non-friable materials other than Category I non-friable ACM that contain more than 1% asbestos.

In the State of New York, asbestos abatement activities are regulated by the New York State Department of Labor (NYSDOL) under the Part 56 of Title 12 of the Official Compilation of Codes, Rules and Regulations of the State of New York (12 NYCRR Part 56). New York regulations require that any asbestos-related activity conducted in the state be performed by personnel licensed by NYSDOL. NYSDOL 12 NYCRR has instituted nine different certifications for asbestos related activities that include: Handler; Allied Trades; Air Sampling Technician; Inspector; Operations and Maintenance; Supervisor; Project Designer; Project Monitor; and Management Planner. The owner or operator must provide the NYSDOL with written notification of planned asbestos removal activities at least 10 working days prior to the commencement of a large project (greater than or equal to 160 square feet or 260 linear feet). Removal of ACM must be conducted by a State of New York certified asbestos abatement contractor.

NYSDOL enforces the federal Occupational Safety and Health Administration (OSHA) standards at 29 CFR 1910.1001 and 29 CFR 1926.1101, which regulates employee exposure to asbestos. The OSHA standard requires that employee exposure to airborne asbestos fibers be maintained at or below 0.1 fibers per cubic centimeter of air (0.1 f/cc) as an eight-hour time weighted average (TWA) and not exceed 1.0 fibers per cubic centimeter of air (1.0 f/cc) over a 30-minute time period known as an excursion limit (EL). The TWA and EL are known as OSHA's permissible exposure limits (PELs). The OSHA standard classifies construction and maintenance activities which could disturb ACM and specifies work practices and precautions which employers must follow when engaging in each class of regulated work.

4.2 Lead-Containing Paint

Lead is regulated by the EPA, New York State Department of Health (NYSDOH), New York State Department of Environmental Conservation (NYSDEC) and OSHA. The EPA and NYSDOH regulate lead use, removal, and disposal, NYSDEC regulates the transportation and manifesting of hazardous wastes and landfills and OSHA regulates lead exposure to workers. The EPA defines lead-based paint (LBP) as paint, varnish, stain, or other applied coating that contains lead equal to or greater than 1.0 milligram per square centimeter (mg/cm2), 5,000 milligrams per kilogram (mg/kg), or 0.5% by dry weight as determined by laboratory analysis. This action level only applies to the US Department of Housing and Urban Development (HUD) Guidelines funded housing or child occupied facilities.

For General Industry construction and demolition, the OSHA lead standard, lead includes metallic lead, all inorganic lead compounds, and organic lead soaps. Lead-containing paint (LCP) is paint with detectable levels of lead (levels above the analytical method's limit of detection). A synopsis of the OSHA regulations (29 CFR 1926.62) and the applicability are as follows:

The OSHA lead standard for construction (29 CFR 1926.62) applies to all construction work where an employee may be occupationally exposed to lead. All work related to construction, alteration, or repair (including painting and decorating) is included. The lead standard applies to any detectable concentration of lead in paint, as even small concentrations of lead can result in unacceptable employee exposures depending upon on the method of removal and other workplace conditions. Under this standard, construction includes, but is not limited to, the following:

- Demolition or salvage of structures where lead or materials containing lead are present.
- Removal of encapsulation of materials containing lead.
- New construction, alteration, repair, or renovation of structures, substrates, or portions containing lead, or materials containing lead.
- Installation of products containing lead.
- Lead contamination/emergency clean-up.

- Transportation, disposal, storage, or containment of lead or materials containing lead on the site or location at which construction activities are performed.
- Maintenance operations associated with construction activities described above.

4.3 Polychlorinated Biphenyls (PCBs)

PCBs are regulated under the Toxic Substance Control Act (TSCA) through EPA. EPA Region 2 regulates the specifics on proper management of PCBs.

4.3.1 PCB-Containing Caulk

EPA indicates that there was potential for widespread use of PCB-containing building materials in schools and other buildings constructed or renovated between 1950 and 1978. PCBs were widely used in caulking and elastic sealant materials because of their properties as a plasticizer. PCB-containing caulk may be present on the exterior of buildings as well as in surrounding surfaces such as windows, doorframes, stairways, building joints, masonry columns and other masonry building materials. PCBs from exterior caulks have the potential to leach into surrounding building materials and soil from precipitation and deterioration of the caulk.

EPA recommends that schools and buildings constructed between 1950 and 1978 be tested for PCBs in caulk and other building materials prior to removal. Tested building materials indicating the presence of PCBs at regulated levels must be disposed of or decontaminated in accordance with the PCB regulations at 40 CFR Part 761, Subpart D. Disposal and cleanup requirements for PCB-contaminated building material depend on whether the material is classified as bulk product waste or remediation waste. Bulk product waste is derived from products manufactured to contain PCBs in a non-liquid state such as caulk, paint and sealants. Remediation waste is derived from waste containing PCBs as a result of a spill or release such as PCB-contaminated soil, sediments or concrete. EPA reinterpreted this rule in 2012 to allow PCB-impacted building materials adjacent to PCB bulk product waste to be managed as PCB bulk product waste. PCB bulk product waste can be disposed of in one of two ways: at a permitted solid waste landfill or a risk-based disposal approval process.

Depending on the chosen disposal method for contaminated wastes and cleanup debris, documentation and approval may be required from the EPA prior to starting removal or abatement projects.

4.3.2 PCB-Containing Equipment

If the generator determines that the ballasts do not contain hazardous constituents and do not contain PCBs then they can be disposed of as solid waste. If they are hazardous and will be disposed, they must be managed as a hazardous waste and cannot be disposed of in a solid waste dumpster or landfill. EPA and state recommendations for management of non-ballasts is

recycling. Ballasts that are leaking and are determined or assumed to contain PCBs must be disposed properly at an EPA approved facility.

5.0 FINDINGS AND RECOMMENDATIONS

5.1 Asbestos-Containing Materials

With respect to this project specific pre-renovation asbestos survey, the following materials were identified as a result of sampling and laboratory analysis to contain greater than 1% asbestos or have been historically known to contain asbestos (>1%) at the facility:

2nd Floor Renovation Spaces				
HA No.	**ACM Description**	**Material Locations**	**% and Type Asbestos**	**Estimated Quantity***
97	Tan 12”x12” Floor Tile with Brown Specks	Rooms 217A and 217C	3.7% Chrysotile	~ 200 Total Square Feet (SF)
121	9”x9” Black Floor Tile	Rooms 233A and 233B	6.3% Chrysotile	~ 6 Total SF
122	Mastic under 9”x9” Black Floor Tile (HA 121 above)	Rooms 233A and 233B	2.1% Chrysotile	~ 6 Total SF
-	Transite Cement Board Radiator Panels	Located behind radiators below windows in Rooms 201, 201A, 201C, 203, 204, 205A, 205B, 207, 208B, 208C, 209, 210, 210A, 210B, 211, 213, 214A, 215, 217A, 217B, 217C, 217D, 217E, 221A, 222, 223, 224, 225,226, 227, 227B 227A, 228, 229, 230, 231, 232, 232A, 232B, 234, 235, and 235B	Not Sampled by Terracon (identified positive in prior report)**	~ 1,176 Total SF

1st Floor Renovation Spaces				
HA No.	**ACM Description**	**Material Locations**	**% and Type Asbestos**	**Estimated Quantity***
-	White 12”x12” Floor Tile and Mastic	Throughout 1st floor renovation space, under non-ACM vinyl flooring materials, carpets, etc.	Not Sampled by Terracon (identified positive in prior report)**	~ 9,631 Total SF

Ground Floor Renovation Spaces				
HA No.	**ACM Description**	**Material Locations**	**% and Type Asbestos**	**Estimated Quantity***
3	Black 9"x 9" Floor Tile	Room 19C	3.4% Chrysotile	~ 90 Total SF
4	Mastic of Black 9"x 9" Floor Tile	Room 19C	4.6% Chrysotile	~ 90 Total SF

Exterior Renovation Areas				
HA No.	**ACM Description**	**Material Locations**	**% and Type Asbestos**	**Estimated Quantity***
9	Exterior Gray Window Caulk	North Stairwell, Exterior Window	1.5% Chrysotile	~ 8 Total Linear Feet (LF)
10	Exterior Black Window Caulk	North Stairwell, Exterior Window (Header)	2.2% Chrysotile	~ 8 Total LF

* **Estimated quantities** are based on a cursory field evaluation, and actual quantities may vary significantly, especially if ACMs are present in hidden and/or inaccessible areas not evaluated as part of this survey. This is not a bidding document and contractors would be responsible for drawing their own conclusions on quantities present.

****** These materials were identified to contain asbestos in the Egan Environmental Consulting Inc. "Asbestos Field Resurvey and Assessment" report dated 2017 (copy included in Appendix G) and were therefore not re-sampled by Terracon.

The above-listed ACMs are included in Appendix A along with individual rooms listed with quantities, material conditions, and the EPA NESHAP material categories. Photos showing examples of identified ACM are included in Appendix D.

If the identified materials containing >1% asbestos will be impacted by the renovation project, the owner and operator (contractor) are responsible for federal, state, and local asbestos regulatory compliance, including applicable notifications prior to abatement activities and renovations. A qualified, state-licensed asbestos abatement contractor should be retained for proper removal, handling, and disposal of ACMs prior to renovation in accordance with applicable federal, state, and local asbestos regulations, as well as in accordance with VA abatement project specifications developed by a state-licensed asbestos project designer.

Additionally, please be aware that the following materials were sampled within the renovation project areas and were identified by laboratory analysis to contain less than 1% asbestos via TEM. Materials containing 1% or less asbestos are not regulated by federal and state EPA NESHAP regulations. However, these materials are regulated by OSHA asbestos provisions found in 29 CFR 1926.1101. It is recommended, however, that if to be impacted by the renovation project that they also be included in the project design for removal by a state-licensed asbestos abatement contractor given the nature of the facility and occupancy.

2nd Floor Renovation Spaces			
HA #	**Material Description Containing <1% Asbestos**	**Material Locations**	**Estimated Quantity***
8	Mastic under Non-Asbestos-Containing 12"x12" Green Floor Tile	Rooms 232 and 232A	~1,515 Total SF
14	Mastic under Non-Asbestos-Containing 12"x12" Brown Floor Tile	Rooms 214, 214A, 220, 228, 229, 229A 232B, 232C, and 233	~1,869 Total SF
26	Mastic of 12"x12' Beige/Tan Floor Tile*	Corridors 235Z, 245Z, 249Z (2nd Floor Main Corridors)	~1,200 Total SF
46	Mastic under Non-Asbestos-Containing 12"x12" Brown Floor Tile	Room 228	~1,320 Total SF
98	Mastic under Asbestos-Containing 12"x12" Tan Floor Tile with Brown Specks	Rooms 217A and 217C	~200 Total SF
124	Mastic under 12"x12" Floor Tile	Room 210 (Day Room)	~1,320 Total SF

*It should be noted that HA #26 (Mastic of 12"x12" Beige/Tan Floor Tile) was not present during laboratory analysis. However, the mastic listed as HA #26 is identical to the mastic listed for HA #14.
HA #26 exists under the 12"x12" Beige/Tan Floor Tile in the locations listed above for HA #26.

1st Floor Renovation Spaces			
HA #	**Material Description Containing <1% Asbestos**	**Material Locations**	**Estimated Quantity***
13	Pipe Fitting Insulation	Room 130	~3 Total LF
17	Pipe Insulation	Room 128A	~120 Total LF

It should be noted that suspect materials, other than those identified during this survey, may exist within the surveyed renovation spaces. Should suspect materials other than those which were identified during this survey be uncovered prior to or during abatement or renovation activities, those materials should be assumed asbestos-containing until sampling and analysis can confirm or deny their asbestos-content. It should be noted that ceiling tiles and associated ACM glue previously recorded in historical surveys were not observed in Room 8 (electrotherapy) on the ground floor and, therefore, not sampled.

5.2 Lead-Containing Paint

A summary of the paint chip analysis results is presented in the following table. Data highlighted in bold indicate LCP. A copy of the laboratory's lead analytical report for the paint chip samples is attached in Appendix C.

Summary of Paint Chip Lead Analysis

Sample ID	Color	Substrate	Component	Location	Analytical Results (% lead by weight {wt.})
Bldg14 – 01	**Blue**	**Plaster**	**Wall**	**2nd floor, Room 232**	**0.21 % wt.**

Bldg14 – 02	White	Plaster	Wall	2nd floor, Day Room	<0.0080 % wt.
Bldg14 – 03	Tan	Drywall	Wall	1st floor, Room 128	<0.0080 % wt.
Bldg14 – 04	**White**	**Drywall**	**Wall**	**1st floor, Room 128**	**0.14 % wt.**

Summary of Lead Paint Chip Analysis

Bldg14 – 05	**Light Tan**	**Drywall**	**Wall**	**1st floor Room 127**	**<0.0080 % wt.**
Bldg14 – 06	**Beige**	**Drywall**	**Wall**	**1st floor, Room 108**	**0.057 % wt.**
Bldg14 – 07	**Light Green**	**CMU Block**	**Wall**	**Ground floor, Storage Room 4**	**0.029 % wt.**
Bldg14 – 08	White	Drywall	Wall	Ground floor, Kitchen	<0.0080 % wt.
Bldg14 – 09	**Green and Blue**	**Drywall**	**Wall**	**Ground floor, Room 17**	**0.14% wt.**
Bldg14 – 10	**Light Green**	**CMU Block**	**Wall**	**Ground floor, Storage Room 4**	**0.40% wt.**
Bldg14 - 11	**Red/Grey**	**Concrete**	**Floor**	**Ground floor, Room 17a**	**0.2556 % wt.**

Note: < indicates lead was not detected at or above the reporting limit.

As summarized above, lead was detected in seven (7) of 11 paint samples collected. All similar painted components which were identified to contain lead within the renovation spaces should also be treated as containing lead.

The LCP sampling was limited to accessible dominant paint-coated surfaces described herein. Any untested paints, if encountered within the renovation spaces, should be assumed to contain lead.

OSHA construction rules do not specify acceptable levels of lead within paints or other surface coatings for the purposes of occupational exposures. Construction work involving the disturbance of LCP must be completed in accordance with OSHA regulations, not limited to the lead in construction standard, 29 CFR 1926.62. Contractors completing work in areas found to contain lead, or where it is reasonable to assume lead may be present, should be notified of the presence (and potential presence) of lead and proper work protocols should be used. Any LCP disturbing work should be completed in accordance with OSHA 29 CFR 1926.62 and VAMC project specifications.

5.3 PCB-Containing Bulk Sampling

Terracon collected three (3) samples of caulk and one (1) sample of mortar from the homogenous areas within the renovation project areas to determine PCB-content. A summary of the PCB caulk and mortar analysis results is presented in the following table. A copy of the laboratory analytical report for PCBs in caulk samples is attached in Appendix C.

Sample ID	Color	Material	Sample Location	PCB Aroclor - Analytical Parameter	Result (milligram/kilogram {mg/kg} PCBs)
21-PCB	Grey	Interior Window caulking	2nd floor, east corridor	Aroclor-1016	None Detected (ND)
				Aroclor-1221	ND
				Aroclor-1232	ND
				Aroclor-1242	ND
				Aroclor-1248	ND
				Aroclor-1254	ND
				Aroclor-1260	ND
				Aroclor-1262	ND
				Aroclor-1268	ND
M-PCB	Grey	Mortar	North exterior stairwell, under window	Aroclor-1016	ND
				Aroclor-1221	ND
				Aroclor-1232	ND
				Aroclor-1242	ND
				Aroclor-1248	ND
				Aroclor-1254	ND
				Aroclor-1260	ND
				Aroclor-1262	ND
				Aroclor-1268	ND
NS-PCB	Grey	Exterior Window caulking	North exterior stairwell, window	Aroclor-1016	ND
				Aroclor-1221	ND
				Aroclor-1232	ND
				Aroclor-1242	ND
				Aroclor-1248	ND
				Aroclor-1254	ND
				Aroclor-1260	ND
				Aroclor-1262	ND
				Aroclor-1268	ND
NS2-PCB	Black	Exterior Window caulking	North exterior stairwell, window header	Aroclor-1016	ND
				Aroclor-1221	ND
				Aroclor-1232	ND
				Aroclor-1242	ND
				Aroclor-1248	ND
				Aroclor-1254	ND
				Aroclor-1260	ND
				Aroclor-1262	ND
				Aroclor-1268	ND

Note: ND - indicates the analyte was not detected at or above the reporting limit

As summarized above, PCBs were not detected in the samples collected from the three (3) caulk samples and one (1) mortar sample.

5.4 PCB Wipe Sampling

Terracon collected eight (8) surface wipe samples for the purpose of determining potential PCBs on surfaces adjacent to electrical equipment in room 8Z and service basement 13C as requested by the client. A summary of the PCB wipe sample analytical results is presented in the following table. A copy of the laboratory PCB wipe sample analytical report is attached in Appendix C.

Sample ID	Location	PCB Aroclor - Analytical Parameter	Result (milligram/kilogram {mg/kg} PCBs)
PCB-W1	Room 8Z, west side, south end, floor	Aroclor-1016	ND
		Aroclor-1221	ND
		Aroclor-1232	ND
		Aroclor-1242	ND
		Aroclor-1248	ND
		Aroclor-1254	ND
		Aroclor-1260	ND
		Aroclor-1262	ND
		Aroclor-1268	ND
PCB-W2	Room 8Z, west side, south end, floor	Aroclor-1016	ND
		Aroclor-1221	ND
		Aroclor-1232	ND
		Aroclor-1242	ND
		Aroclor-1248	ND
		Aroclor-1254	ND
		Aroclor-1260	ND
		Aroclor-1262	ND
		Aroclor-1268	ND
PCB-W3	Room 8Z, large electrical unit, north side, floor	Aroclor-1016	ND
		Aroclor-1221	ND
		Aroclor-1232	ND
		Aroclor-1242	ND
		Aroclor-1248	ND
		Aroclor-1254	ND
		Aroclor-1260	ND
		Aroclor-1262	ND
		Aroclor-1268	ND
PCB-W4	Room 8Z, large electrical unit, north side, on electrical unit	Aroclor-1016	ND
		Aroclor-1221	ND
		Aroclor-1232	ND
		Aroclor-1242	ND
		Aroclor-1248	ND
		Aroclor-1254	ND
		Aroclor-1260	ND
		Aroclor-1262	ND
		Aroclor-1268	ND
PCB-W5	Service Basement 13C, electric box south of stairs, floor	Aroclor-1016	ND
		Aroclor-1221	ND
		Aroclor-1232	ND

		Aroclor-1242	ND
		Aroclor-1248	ND
		Aroclor-1254	ND
		Aroclor-1260	ND
		Aroclor-1262	ND
		Aroclor-1268	ND
PCB-W6	Service Basement 13C, electric box south of stairs, wall	Aroclor-1016	ND
		Aroclor-1221	ND
		Aroclor-1232	ND
		Aroclor-1242	ND
		Aroclor-1248	ND
		Aroclor-1254	ND
		Aroclor-1260	ND
		Aroclor-1262	ND
		Aroclor-1268	ND
PCB-W7	Service Basement 13C, electric motor at south wall, floor	Aroclor-1016	ND
		Aroclor-1221	ND
		Aroclor-1232	ND
		Aroclor-1242	ND
		Aroclor-1248	ND
		Aroclor-1254	ND
		Aroclor-1260	ND
		Aroclor-1262	ND
		Aroclor-1268	ND
PCB-W8	Service Basement 13C, electrical motor at south wall, platform	Aroclor-1016	ND
		Aroclor-1221	ND
		Aroclor-1232	ND
		Aroclor-1242	ND
		Aroclor-1248	ND
		Aroclor-1254	ND
		Aroclor-1260	ND
		Aroclor-1262	ND
		Aroclor-1268	ND

Note: ND - indicates the analyte was not detected at or above the reporting limit

As summarized above, PCBs were not detected in the surface wipe samples collected adjacent to electrical equipment in room 8Z and service basement 13C.

5.5 PCB-Containing Equipment

Terracon visually assessed ballasts inside random fluorescent light fixtures within the renovation areas. Of the ballasts observed, the majority did not have a “No PCBs” label. Therefore, all ballast encountered during renovation should be assumed to contain PCBs. The light ballasts must be diverted from the construction and demolition debris waste stream. For light fixtures to be discarded, light ballasts should be properly collected, packaged, and transported to an appropriately accredited facility which can recycle light ballasts. A waste manifest should be utilized to track the waste ballasts, and a receipt copy should be retained from the recycling facility and provided to the VAMC within 30 calendar days.

6.0 LIMITATIONS/GENERAL COMMENTS

In addition to any limitations discussed in other sections of this report, Terracon did not perform sampling requiring demolition or destructive activities such as knocking holes in walls, dismantling of equipment or removal of protective coverings. At the request of the client and evaluation of the roof was not performed during this survey. Reasonable efforts to access suspect materials within known areas of restricted access (e.g., crawl spaces) were made; however, confined spaces or areas which may pose a health or safety risk to Terracon personnel were not sampled. Sampling did not include suspect materials which could not be safely reached with available ladders/man-lifts. Electrical systems in the building were assumed energized at the time of the survey, and therefore, were not sampled. The vinyl coating, internal paper, and fibrous insulation surrounding the wires are considered non-friable suspect materials and must be assumed to be ACM unless sampling determines otherwise. Terracon did not sample suspect materials that may be present in movable equipment such as freezers, kitchen equipment and hoods. Gaskets which may be present and concealed within piping flanges and mechanical equipment was not included in the survey; if encountered, gaskets must be assumed as ACM and treated accordingly per federal, state, and local asbestos regulations for proper removal and disposal. Terracon typically investigated for flooring beneath carpeting by lifting small corner sections of carpet. If tiles were seen, they have been identified in the report. If tiles were not seen at corners under the carpet, it does not imply that there are no tiles beneath the carpeted floor. Terracon did not conduct destructive investigation of doors in the building to determine if the doors were insulated for fire-rating purposes.

The asbestos survey was conducted in a manner consistent with the level of care and skill ordinarily exercised by members of the profession currently practicing under similar conditions in the same locale. The results, findings, conclusions and recommendations expressed in this report are based on conditions observed during our survey of the building. The information contained in this report is relevant to the date on which this survey was performed, and should not be relied upon to represent conditions at a later date. This report has been prepared on behalf of and exclusively for use by the Triple C – The A&E Group for specific application to their project as discussed. **This report is not a bidding document. Contractors or consultants reviewing this report must draw their own conclusions regarding quantities and any further investigation or remediation deemed necessary.** Terracon does not warrant the work of regulatory agencies or other third-parties supplying information which may have been used in the preparation of this Report. No warranty, express or implied is made.

APPENDIX A

ASBESTOS-CONTAINING MATERIALS BY HOMOGENEOUS AREA

APPENDIX A
VA Project: Building 14 Renovations
VA Medical Center – Montrose, New York
Terracon Project No. J2217018

IDENTIFIED ASBESTOS-CONTAINING MATERIALS (>1% ASBESTOS) BY HOMOGENEOUS AREA (HA)

2nd Floor Renovation Spaces

HA No.	ACM Description	Material Location	% and Type Asbestos**	NESHAP Classification	Condition	Estimated Quantity*
97	Tan 12”x12” Floor Tile with Brown Specks	217A	3.7% Chrysotile	Category I Non-friable	Good	50 SF
		217C				150 SF
					Total Estimated Amount	**~ 200 Square Feet**
121	9”x9” Black Floor Tile	Room 233A	6.3% Chrysotile	Category I Non-friable	Good	3 SF
		Room 233B				3 SF
					Total Estimated Amount	**~ 6 Square Feet**
122	Mastic Under 9”x9” Black Floor Tile (HA 121 above)	Room 233A	2.1% Chrysotile	Category I Non-friable	Good	3 SF
		Room 233B				3 SF
					Total Estimated Amount	**~ 6 Square Feet**
-	Transite Cement Board Radiator Panels (behind radiators)	201	Not Sampled by Terracon (historically known to contain asbestos)	Category II Non-friable	Good	36 SF
		201A				24 SF
		201C				24 SF
		203			Good	12 SF
		204			Good	12 SF
		205A			Good	12 SF

2nd Floor Renovation Spaces

HA No.	ACM Description	Material Location	% and Type Asbestos**	NESHAP Classification	Condition	Estimated Quantity*
		205B			Good	12 SF
		207			Good	144 SF
		208B			Good	24 SF
		208C			Good	36 SF
		209			Good	24 SF
		210			Good	60 SF
		210A			Good	48 SF
		210B			Good	12 SF
		211			Good	24 SF
		213			Good	12 SF
		214A			Good	12 SF
		215			Good	36 SF
		217A			Good	12 SF
		217B			Good	12 SF
		217C			Good	60 SF
		217D			Good	12 SF
		217E			Good	12 SF
		221A			Good	12 SF
		222			Good	12 SF
		223			Good	12 SF
		224			Good	12 SF
		225			Good	12 SF
		226			Good	12 SF
		227			Good	12 SF
		227B			Good	12 SF
		228			Good	72 SF
		228A			Good	48 SF
		229			Good	48 SF
		230			Good	36 SF
		231			Good	24 SF
		232			Good	108 SF
		232A			Good	12 SF

2nd Floor Renovation Spaces

HA No.	ACM Description	Material Location	% and Type Asbestos**	NESHAP Classification	Condition	Estimated Quantity*
		232B			Good	12 SF
		234			Good	12 SF
		235			Good	24 SF
		235B			Good	12 SF
					Total Estimated Amount	**1,176 Total SF**

1st Floor Renovation Spaces

HA No.	ACM Description	Material Location	% and Type Asbestos**	NESHAP Classification	Condition	Estimated Quantity*
-	White 12”x12” Floor Tile and Mastic	100A	Not Sampled by Terracon (identified positive at 3.9% Chrysotile in prior report – see App. G)	Category I Non-friable	Good	154 SF
		101			Good	167 SF
		101A			Good	304 SF
		102			Good	204 SF
		103			Good	120 SF
		104			Good	124 SF
		106			Good	125 SF
		107			Good	108 SF
		108			Good	1177 SF
		109A			Good	21 SF
		114			Good	841 SF
		114A			Good	15 SF
		114C			Good	10 SF
		114D			Good	12 SF
		115			Good	212 SF
		116			Good	48 SF
		121			Good	49 SF
		122			Good	213 SF
		125			Good	116 SF
		126			Good	252 SF

1st Floor Renovation Spaces

HA No.	ACM Description	Material Location	% and Type Asbestos**	NESHAP Classification	Condition	Estimated Quantity*
		126B			Good	192 SF
		127			Good	108 SF
		128			Good	932 SF
		131			Good	34 SF
		132			Good	51 SF
		134			Good	244 SF
		135			Good	118 SF
		145			Good	222 SF
		146			Good	114 SF
		148			Good	64 SF
		179			Good	15 SF
		150			Good	95 SF
		151			Good	209 SF
		152			Good	221 SF
		153			Good	224 SF
		154			Good	214 SF
		155			Good	103 SF
		156			Good	114 SF
		166			Good	147 SF
		167			Good	124 SF
		168			Good	285 SF
		170Z			Good	258 SF
		173Z			Good	278 SF
		174Z			Good	402 SF
		177Z			Good	437 SF
					Total Estimated Amount	**9,631 Total SF**

Ground Floor Renovation Spaces

HA No.	ACM Description	Material Location	% and Type Asbestos**	NESHAP Classification	Condition	Estimated Quantity*
3	Black 9”x 9” Floor Tile	Room 19C	3.4% Chrysotile	Category I Non-friable	Good	~ 90 SF
4	Mastic Under Black 9”x 9” Floor Tile (HA 3 above)	Room 19C	4.6% Chrysotile	Category I Non-friable	Good	~90 SF

Exterior Renovation Areas

HA No.	ACM Description	Material Location	% and Type Asbestos**	NESHAP Classification	Condition	Estimated Quantity*
9	Exterior Gray Window Caulk	North Stairwells, Exterior Window	1.5% Chrysotile	Category I Non-friable	Good	~ 8 Total LF
10	Exterior Black Window Caulk	North Stairwells, Exterior Window (Header)	2.2% Chrysotile	Category I Non-friable	Good	~ 8 Total LF

***Estimated quantities** are based on a cursory field evaluation, and actual quantities may vary significantly, especially if asbestos-containing materials are present in hidden and/or inaccessible areas not evaluated as part of this survey.

****% & Type Asbestos** = this column contains both the analytical result of the sample with the highest concentration of asbestos detected in the samples that make up the HA and the types of asbestos identified.

The materials listed in the table above have been sampled and determined to contain asbestos in concentrations greater than 1%. When disturbed, various federal, state and local regulations apply. Until removed, these materials should be monitored for damage over time and repaired as necessary by appropriately trained personnel. Removal may be necessary before renovations and in most cases before a demolition. See Appendix B for a summary of samples collected. See Appendix C for detailed analytical results.

A copy of the prior asbestos survey report is included in Appendix G.

MATERIALS CONTAINING 1% OR LESS ASBESTOS BY HA
(Not Regulated by EPA, Regulated by OSHA)

2nd Floor Renovation Spaces

HA #	Material Description Containing <1% Asbestos	Material Location	Estimated Quantity*
8	Mastic of 12”x12” Green Floor Tile	Rooms 232 Room 232A	1,515 SF
14	Mastic of 12”x12” Brown Floor Tile	Rooms 214 214A, 220, 228, 229, 229A 232B, 232C, and 233	1,755 SF
26	Mastic of 12”x12” Beige Floor Tile	Corridors 235Z, 245Z, 249Z	1,200 SF
46	Mastic of 12”x12” Brown Floor Tile	Room 228	1,320 SF
98	Mastic of 12”x12” Tan Floor Tile with Brown Specks	Rooms 217A and 217C	200 SF
124	Mastic of 12”x12” Bottom Floor Tile	Room 210 (Day Room)	660 SF

1st Floor Renovation Spaces

HA #	Material Description Containing <1% Asbestos	Material Location	Estimated Quantity*
13	Pipe Fitting Insulation	Room 130	3 LF
17	Pipe Insulation	Room 128A	120 LF

***Estimated quantities** are based on a cursory field evaluation, and actual quantities may vary significantly, especially if asbestos-containing materials are present in hidden and/or inaccessible areas not evaluated as part of this survey.

Materials containing less than 1% asbestos are not regulated by federal and state EPA NESHAP; however, the OSHA personal exposure limits (0.1 f/cc of air as an eight-hour time weighted average or 1.0 f/cc of air over 30 minutes) for asbestos apply when materials containing 1% asbestos or less are disturbed during renovations or demolitions.

APPENDIX B

ASBESTOS SURVEY SAMPLE LOCATION SUMMARY

APPENDIX B
Project: Building 14 Renovations
VA Medical Center - Montrose
Montrose, New York
Terracon Project No. J2217018

ASBESTOS SURVEY SAMPLE LOCATION SUMMARY

2nd Floor Sample Summary

2nd Floor				
HA No.	**Sample ID**	**Suspect Material Description**	**Sample Location**	**Lab Results (% and Type Asbestos)**
01	1A 042112580-0001	Plaster Skim Coat	Room 232	None Detected
	1B 042112580-0003	Plaster Skim Coat	Room 232	None Detected
	1C 042112580-0005	Plaster Skim Coat	Room 228	None Detected
	1D 042112580-0007	Plaster Skim Coat	Room 227	None Detected
	1E 042112580-0009	Plaster Skim Coat	Hallway, outside Room 220	None Detected
	1F 042112580-0011	Plaster Skim Coat	Room 214	None Detected
	1G 042112580-0013	Plaster Skim Coat	Room 210	None Detected
	1H 042112580-0015	Plaster Skim Coat	Room 210	None Detected
	1I 042112580-0017	Plaster Skim Coat	Room 209	None Detected

2nd Floor				
HA No.	**Sample ID**	**Suspect Material Description**	**Sample Location**	**Lab Results (% and Type Asbestos)**
02	2A 042112580-0002	Brown Plaster Scratch Coat	Room 232	None Detected
	2B 042112580-0004	Brown Plaster Scratch Coat	Room 232	None Detected
	2C 042112580-0006	Brown Plaster Scratch Coat	Room 228	None Detected
	2D 042112580-0008	Brown Plaster Scratch Coat	Room 227	None Detected
	2E 042112580-0010	Brown Plaster Scratch Coat	Hallway, outside Room 220	None Detected
	2F 042112580-0012	Brown Plaster Scratch Coat	Room 214	None Detected
	2G 042112580-0014	Brown Plaster Scratch Coat	Room 210	None Detected
	2H 042112580-0016	Brown Plaster Scratch Coat	Room 210	None Detected
	2I 042112580-0018	Brown Plaster Scratch Coat	Room 209	None Detected
03	3A 042112580-0019	Sheetrock	Room 207	None Detected
	3B 042112580-0020	Sheetrock	Room 207A	None Detected
	3C 042112580-0021	Sheetrock	Room 214	None Detected
	3D 042112580-0022	Sheetrock	Room 217C	None Detected
	3E 042112580-0023	Sheetrock	Room 203	None Detected
	3F 042112580-0024	Sheetrock	Room 219	None Detected

2nd Floor				
HA No.	**Sample ID**	**Suspect Material Description**	**Sample Location**	**Lab Results (% and Type Asbestos)**
	3G 042112580-0025	Sheetrock	Room 214	None Detected
	3H 042112580-0026	Sheetrock	Room 203	None Detected
	3I 042112580-0027	Sheetrock	Room 219	None Detected
04	4A 042112580-0028	Joint Compound	Room 207	None Detected
	4B 042112580-0029	Joint Compound	Room 207A	None Detected
	4C 042112580-0030	Joint Compound	Room 214	None Detected
	4D 042112580-0031	Joint Compound	Room 217C	None Detected
	4E 042112580-0032	Joint Compound	Room 203	None Detected
	4F 042112580-0033	Joint Compound	Room 219	None Detected
	4G 042112580-0034	Joint Compound	Room 214	None Detected
	4H 042112580-0035	Joint Compound	Room 203	None Detected
	4I 042112580-0036	Joint Compound	Room 219	None Detected
05	5A 042112580-0037	1'x1' Grid Ceiling Tile	Room 210	None Detected
	5B 042112580-0038	1'x1' Grid Ceiling Tile	Room 208	None Detected
	5C 042112580-0039	1'x1' Grid Ceiling Tile	Room 235B	None Detected

2nd Floor				
HA No.	**Sample ID**	**Suspect Material Description**	**Sample Location**	**Lab Results (% and Type Asbestos)**
06	6A 042112580-0040	2'x2' Grid Ceiling Tile	West end corridor, outside Room 206	None Detected
	6B 042112580-0041	2'x2' Grid Ceiling Tile	Room 217C	None Detected
	6C 042112580-0042	2'x2' Grid Ceiling Tile	East end corridor, outside Room 230	None Detected
07	7A 042112580-0043	12"x12" Green Floor Tile	Room 232	None Detected
	7B 042112580-0044	12"x12" Green Floor Tile	Room 232	None Detected
	7C 042112580-0045	12"x12" Green Floor Tile	Room 232	None Detected
08	8A 042112580-0046	12"x12" Green Floor Tile Mastic	Room 232	**< 1% Chrysotile**
	8B 042112580-0047	12"x12" Green Floor Tile Mastic	Room 232	**< 1% Chrysotile**
	8C 042112580-0048	12"x12" Green Floor Tile Mastic	Room 232	**< 1% Chrysotile**
09	9A 042112580-0049	Cove Base	Room 202	None Detected
	9B 042112580-0050	Cove Base	Room 210A	None Detected
	9C 042112580-0051	Cove Base	Room 232C	None Detected
10	10A 042112580-0052	Cove Base Mastic	Room 202	None Detected
	10B 042112580-0053	Cove Base Mastic	Room 210A	None Detected
	10C 042112580-0054	Cove Base Mastic	Room 232C	None Detected

2nd Floor				
HA No.	**Sample ID**	**Suspect Material Description**	**Sample Location**	**Lab Results (% and Type Asbestos)**
11	11A 042112580-0055	Terrazzo Floor	Room 229	None Detected
	11B 042112580-0056	Terrazzo Floor	Room 227	None Detected
	11C 042112580-0057	Terrazzo Floor	Room 204	None Detected
12	12A 042112580-0058	Terrazzo Floor Mastic	Room 229	None Detected
	12B 042112580-0059	Terrazzo Floor Mastic	Room 227	None Detected
	12C 042112580-0060	Terrazzo Floor Mastic	Room 204	None Detected
13	13A 042112580-0061	12”x12” Brown Floor Tile	Room 232C	None Detected
	13B 042112580-0062	12”x12” Brown Floor Tile	Room 229	None Detected
	13C 042112580-0063	12”x12” Brown Floor Tile	Room 233	None Detected
14	14A 042112580-0064	12”x12” Brown Floor Tile Mastic	Room 232C	**< 1% Chrysotile**
	14B 042112580-0065	12”x12” Brown Floor Tile Mastic	Room 229	**< 1% Chrysotile**
	14C 042112580-0066	12”x12” Brown Floor Tile Mastic	Room 233	**< 1% Chrysotile**
15	15A 042112580-0067	Yellow Ceramic Tile	Room 208	None Detected
	15B 042112580-0068	Yellow Ceramic Tile	Room 208	None Detected
	15C 042112580-0069	Yellow Ceramic Tile	Room 208	None Detected

2nd Floor				
HA No.	**Sample ID**	**Suspect Material Description**	**Sample Location**	**Lab Results (% and Type Asbestos)**
16	16A 042112580-0070	Mastic of Yellow Ceramic Tile	Room 208	None Detected
	16B 042112580-0071	Mastic of Yellow Ceramic Tile	Room 208	None Detected
	16C 042112580-0072	Mastic of Yellow Ceramic Tile	Room 208	None Detected
17	17A 042112580-0073	Grout of Yellow Ceramic Tile	Room 208	None Detected
	17B 042112580-0074	Grout of Yellow Ceramic Tile	Room 208	None Detected
	17C 042112580-0075	Grout of Yellow Ceramic Tile	Room 208	None Detected
18	18A 042112580-0076	1'x1' waterproof ceiling tile	Room 208	None Detected
	18B 042112580-0077	1'x1' waterproof ceiling tile	Room 208	None Detected
	18C 042112580-0078	1'x1' waterproof ceiling tile	Room 208	None Detected
19	19A 042112580-0079	Epoxy Floor	Room 208	None Detected
	19B 042112580-0080	Epoxy Floor	Room 208	None Detected
	19C 042112580-0081	Epoxy Floor	Room 208	None Detected
20	20A 042112580-0082	Residual Sink Caulk	Room 231	None Detected
	20B 042112580-0083	Residual Sink Caulk	Room 231	None Detected
	20C 042112580-0084	Residual Sink Caulk	Room 231	None Detected

2nd Floor				
HA No.	**Sample ID**	**Suspect Material Description**	**Sample Location**	**Lab Results (% and Type Asbestos)**
21	21A 042112580-0085	Firestop Caulk	Room 230	None Detected
	21B 042112580-0086	Firestop Caulk	Room 230A	None Detected
	21C 042112580-0087	Firestop Caulk	Room 233A	None Detected
22	22A 042112580-0088	Peach Ceramic Tile	Room 211	None Detected
	22B 042112580-0089	Peach Ceramic Tile	Room 209	None Detected
	22C 042112580-0090	Peach Ceramic Tile	Room 209	None Detected
23	23A 042112580-0091	Mastic of Peach Ceramic Tile	Room 211	None Detected
	23B 042112580-0092	Mastic of Peach Ceramic Tile	Room 209	None Detected
	23C 042112580-0093	Mastic of Peach Ceramic Tile	Room 209	None Detected
24	24A 042112580-0094	Grout of Peach Ceramic Tile	Room 211	None Detected
	24B 042112580-0095	Grout of Peach Ceramic Tile	Room 209	None Detected
	24C 042112580-0096	Grout of Peach Ceramic Tile	Room 209	None Detected
25	25A 042112580-0097	12”x12’ Beige/Tan Floor Tile	West Wing Corridor	None Detected
	25B 042112580-0098	12”x12’ Beige/Tan Floor Tile	Center Wing Corridor	None Detected
	25C 042112580-0099	12”x12’ Beige/Tan Floor Tile	East Wing Corridor	None Detected

2nd Floor				
HA No.	**Sample ID**	**Suspect Material Description**	**Sample Location**	**Lab Results (% and Type Asbestos)**
26	26A 042112580-0100	Mastic of 12”x12’ Beige/Tan Floor Tile	West Wing Corridor	**Layer Not Present in Laboratory Analysis (However, Mastic Exists Under 12”x12” Beige/Tan Floor Tile And Same As HA 14 (<1% Chrysotile)**
	26B 042112580-0101	Mastic of 12”x12’ Beige/Tan Floor Tile	Center Corridor	**Layer Not Present in Laboratory Analysis (However, Mastic Exists Under 12”x12” Beige/Tan Floor Tile And Same As HA 14 (<1% Chrysotile)**
	26C 042112580-0102	Mastic of 12”x12’ Beige/Tan Floor Tile	East Wing Corridor	**Layer Not Present in Laboratory Analysis (However, Mastic Exists Under 12”x12” Beige/Tan Floor Tile And Same As HA 14 (<1% Chrysotile)**
27	27A 042112580-0103	Red Ceramic Floor Tile	Room 230	None Detected
	27B 042112580-0104	Red Ceramic Floor Tile	Room 230	None Detected
	27C 042112580-0105	Red Ceramic Floor Tile	Room 230	None Detected
28	28A 042112580-0106	Mastic of Red Ceramic Floor Tile	Room 230	None Detected
	28B 042112580-0107	Mastic of Red Ceramic Floor Tile	Room 230	None Detected
	28C 042112580-0108	Mastic of Red Ceramic Floor Tile	Room 230	None Detected

2nd Floor				
HA No.	**Sample ID**	**Suspect Material Description**	**Sample Location**	**Lab Results (% and Type Asbestos)**
29	29A 042112580-0109	Grout of Red Ceramic Floor Tile	Room 230	None Detected
	29B 042112580-0110	Grout of Red Ceramic Floor Tile	Room 230	None Detected
	29C 042112580-0111	Grout of Red Ceramic Floor Tile	Room 230	None Detected
30	30A 042112580-0112	Blue Ceramic Wall Tile	Room 230	None Detected
	30B 042112580-0113	Blue Ceramic Wall Tile	Room 230	None Detected
	30C 042112580-0114	Blue Ceramic Wall Tile	Room 230	None Detected
31	31A 042112580-0115	Mastic of Blue Ceramic Wall Tile	Room 230	None Detected
	31B 042112580-0116	Mastic of Blue Ceramic Wall Tile	Room 230	None Detected
	31C 042112580-0117	Mastic of Blue Ceramic Wall Tile	Room 230	None Detected
32	32A 042112580-0118	Grout of Blue Ceramic Wall Tile	Room 230	None Detected
	32B 042112580-0119	Grout of Blue Ceramic Wall Tile	Room 230	None Detected
	32C 042112580-0120	Grout of Blue Ceramic Wall Tile	Room 230	None Detected
33	33A 042112580-0121	White Ceramic Wall Tile	Room 230	None Detected
	33B 042112580-0122	White Ceramic Wall Tile	Room 230	None Detected
	33C 042112580-0123	White Ceramic Wall Tile	Room 230	None Detected

2nd Floor				
HA No.	**Sample ID**	**Suspect Material Description**	**Sample Location**	**Lab Results (% and Type Asbestos)**
34	34A 042112580-0124	Glue of White Ceramic Wall Tile	Room 230	None Detected
	34B 042112580-0125	Glue of White Ceramic Wall Tile	Room 230	None Detected
	34C 042112580-0126	Glue of White Ceramic Wall Tile	Room 230	None Detected
35	35A 042112580-0127	Grout of White Ceramic Wall Tile	Room 230	None Detected
	35B 042112580-0128	Grout of White Ceramic Wall Tile	Room 230	None Detected
	35C 042112580-0129	Grout of White Ceramic Wall Tile	Room 230	None Detected
36	36A 042112580-0130	Multicolor Ceramic Floor Tile	Room 225 (Laundry Room)	None Detected
	36B 042112580-0131	Multicolor Ceramic Floor Tile	Room 225 (Laundry Room)	None Detected
	36C 042112580-0132	Multicolor Ceramic Floor Tile	Room 225 (Laundry Room)	None Detected
37	37A 042112580-0133	Mastic of Multicolor Ceramic Floor Tile	Room 225 (Laundry Room)	None Detected
	37B 042112580-0134	Mastic of Multicolor Ceramic Floor Tile	Room 225 (Laundry Room)	None Detected
	37C 042112580-0135	Mastic of Multicolor Ceramic Floor Tile	Room 225 (Laundry Room)	None Detected
38	38A 042112580-0136	Grout of Multicolor Ceramic Floor Tile	Room 225 (Laundry Room)	None Detected
	38B 042112580-0137	Grout of Multicolor Ceramic Floor Tile	Room 225 (Laundry Room)	None Detected
	38C 042112580-0138	Grout of Multicolor Ceramic Floor Tile	Room 225 (Laundry Room)	None Detected

2nd Floor				
HA No.	**Sample ID**	**Suspect Material Description**	**Sample Location**	**Lab Results (% and Type Asbestos)**
39	39A 042112580-0139	Red Ceramic Wall Tile	Room 230	None Detected
	39B 042112580-0140	Red Ceramic Wall Tile	Room 230	None Detected
	39C 042112580-0141	Red Ceramic Wall Tile	Room 230	None Detected
40	40A 042112580-0142	Mastic of Red Ceramic Wall Tile	Room 230	None Detected
	40B 042112580-0143	Mastic of Red Ceramic Wall Tile	Room 230	None Detected
	40C 042112580-0144	Mastic of Red Ceramic Wall Tile	Room 230	None Detected
41	41A 042112580-0145	Grout of Red Ceramic Wall Tile	Room 230	None Detected
	41B 042112580-0146	Grout of Red Ceramic Wall Tile	Room 230	None Detected
	41C 042112580-0147	Grout of Red Ceramic Wall Tile	Room 230	None Detected
42	42A 042112580-0148	Black Door Protector Block	Room 235, Bottom of Door	None Detected
	42B 042112580-0149	Black Door Protector Block	Room 235, Bottom of Door	None Detected
	42C 042112580-0150	Black Door Protector Block	Room 235, Bottom of Door	None Detected
43	43A 042112580-0151	12”x12” Light Brown Floor Replacement Tile	Room 227	None Detected
	43B 042112580-0152	12”x12” Light Brown Floor Replacement Tile	Room 227	None Detected
	43C 042112580-0153	12”x12” Light Brown Floor Replacement Tile	Room 227	None Detected

2nd Floor				
HA No.	**Sample ID**	**Suspect Material Description**	**Sample Location**	**Lab Results (% and Type Asbestos)**
45	45A 042112580-0154	Brown Floor Tile with Dark Specs	Room 228	None Detected
	45B 042112580-0155	Brown Floor Tile with Dark Specs	Room 228	None Detected
	45C 042112580-0156	Brown Floor Tile with Dark Specs	Room 228	None Detected
46	46A 042112580-0157	Mastic of Brown Floor Tile with Dark Specs	Room 228	< 1% Chrysotile
	46B 042112580-0158	Mastic of Brown Floor Tile with Dark Specs	Room 228	< 1% Chrysotile
	46C 042112580-0159	Mastic of Brown Floor Tile with Dark Specs	Room 228	< 1% Chrysotile
47	47A 042112580-0160	Yellow CMU Block	Room 225 (Laundry Room)	None Detected
	47B 042112580-0161	Yellow CMU Block	Room 225 (Laundry Room)	None Detected
	47C 042112580-0162	Yellow CMU Block	Room 225 (Laundry Room)	None Detected
48	48A 042112580-0163	Mortar of Yellow CMU Block	Room 225 (Laundry Room)	None Detected
	48B 042112580-0164	Mortar of Yellow CMU Block	Room 225 (Laundry Room)	None Detected
	48C 042112580-0165	Mortar of Yellow CMU Block	Room 225 (Laundry Room)	None Detected
49	49A 042112580-0166	Countertop Adhesive	Room 224	None Detected
	49B 042112580-0167	Countertop Adhesive	Room 224	None Detected
	49C 042112580-0168	Countertop Adhesive	Room 224	None Detected

2nd Floor				
HA No.	**Sample ID**	**Suspect Material Description**	**Sample Location**	**Lab Results (% and Type Asbestos)**
50	50A 042112580-0169	Cove Base	Room 223	None Detected
	50B 042112580-0170	Cove Base	Room 223	None Detected
	50C 042112580-0171	Cove Base	Room 223	None Detected
51	51A 042112580-0172	Mastic of Cove Base	Room 223	None Detected
	51B 042112580-0173	Mastic of Cove Base	Room 223	None Detected
	51C 042112580-0174	Mastic of Cove Base	Room 223	None Detected
52	52A 042112580-0175	Yellow Carpet Glue	Room 203	None Detected
	52B 042112580-0176	Yellow Carpet Glue	Room 203	None Detected
	52C 042112580-0177	Yellow Carpet Glue	Room 203	None Detected
53	53A 042112580-0178	1'x1' Pinhole Ceiling Tile	Room 235	None Detected
	53B 042112580-0179	1'x1' Pinhole Ceiling Tile	Room 214	None Detected
	53C 042112580-0180	1'x1' Pinhole Ceiling Tile	Room 214	None Detected
54	54A 042112580-0181	Ceramic Border Tiles	Room 208B	None Detected
	54B 042112580-0182	Ceramic Border Tiles	Room 208B	None Detected
	54C 042112580-0183	Ceramic Border Tiles	Room 208B	None Detected

2nd Floor				
HA No.	**Sample ID**	**Suspect Material Description**	**Sample Location**	**Lab Results (% and Type Asbestos)**
55	55A 042112580-0184	Mortar of Ceramic Border Tiles	Room 208B	None Detected
	55B 042112580-0185	Mortar of Ceramic Border Tiles	Room 208B	None Detected
	55C 042112580-0186	Mortar of Ceramic Border Tiles	Room 208B	None Detected
56	56A 042112580-0187	1”x1” Textured Ceiling Tile	Room 235	None Detected
	56B 042112580-0188	1”x1” Textured Ceiling Tile	Room 234	None Detected
	56C 042112580-0189	1”x1” Textured Ceiling Tile	Room 232	None Detected
60	60A 042112580-0190	Black Ceramic Wall Tile	Room 221	None Detected
	60B 042112580-0191	Black Ceramic Wall Tile	Room 221	None Detected
	60C 042112580-0192	Black Ceramic Wall Tile	Room 221	None Detected
61	61A 042112580-0193	Mastic of Black Ceramic Wall Tile	Room 221	None Detected
	61B 042112580-0194	Mastic of Black Ceramic Wall Tile	Room 221	None Detected
	61C 042112580-0195	Mastic of Black Ceramic Wall Tile	Room 221	None Detected
62	62A 042112580-0196	Grout of Black Ceramic Wall Tile	Room 221	None Detected
	62B 042112580-0197	Grout of Black Ceramic Wall Tile	Room 221	None Detected
	62C 042112580-0198	Grout of Black Ceramic Wall Tile	Room 221	None Detected

2nd Floor				
HA No.	**Sample ID**	**Suspect Material Description**	**Sample Location**	**Lab Results (% and Type Asbestos)**
63	63A 042112580-0199	Peach Ceramic Wall Tile	Room 201	None Detected
	63B 042112580-0200	Peach Ceramic Wall Tile	Room 201	None Detected
	63C 042112580-0201	Peach Ceramic Wall Tile	Room 201	None Detected
64	64A 042112580-0202	Mastic of Peach Ceramic Wall Tile	Room 201	None Detected
	64B 042112580-0203	Mastic of Peach Ceramic Wall Tile	Room 201	None Detected
	64C 042112580-0204	Mastic of Peach Ceramic Wall Tile	Room 201	None Detected
65	65A 042112580-0205	Grout of Peach Ceramic Wall Tile	Room 201	None Detected
	65B 042112580-0206	Grout of Peach Ceramic Wall Tile	Room 201	None Detected
	65C 042112580-0207	Grout of Peach Ceramic Wall Tile	Room 201	None Detected
69	69A-Ceramic Tile 042112580-0208	Black Ceramic Floor Tile	Room 201	None Detected
	69A-Grout 042112580-0208A	Grout	Room 201	
	69B 042112580-0209	Black Ceramic Floor Tile	Room 201	None Detected
	69C-Ceramic Tile 042112580-0210	Black Ceramic Floor Tile	Room 201	None Detected
	69C-Grout 042112580-0210A	Grout	Room 201	
70	70A 042112580-0211	Mastic of Black Ceramic Floor Tile	Room 201	None Detected

2nd Floor				
HA No.	**Sample ID**	**Suspect Material Description**	**Sample Location**	**Lab Results (% and Type Asbestos)**
	70B 042112580-0212	Mastic of Black Ceramic Floor Tile	Room 201	None Detected
	70C 042112580-0213	Mastic of Black Ceramic Floor Tile	Room 201	None Detected
71	71A 042112580-0214	Grout of Black Ceramic Floor Tile	Room 201	None Detected
	71B 042112580-0215	Grout of Black Ceramic Floor Tile	Room 201	None Detected
	71C 042112580-0216	Grout of Black Ceramic Floor Tile	Room 201	None Detected
72	72A 042112580-0217	Pink Ceramic Wall Tile	Room 205B	None Detected
	72B 042112580-0218	Pink Ceramic Wall Tile	Room 205B	None Detected
	72C 042112580-0219	Pink Ceramic Wall Tile	Room 205B	None Detected
73	73A 042112580-0220	Mastic of Pink Ceramic Wall Tile	Room 205B	None Detected
	73B 042112580-0221	Mastic of Pink Ceramic Wall Tile	Room 205B	None Detected
	73C 042112580-0222	Mastic of Pink Ceramic Wall Tile	Room 205B	None Detected
74	74A 042112580-0223	Grout of Pink Ceramic Wall Tile	Room 205B	None Detected
	74B 042112580-0224	Grout of Pink Ceramic Wall Tile	Room 205B	None Detected
	74C 042112580-0225	Grout of Pink Ceramic Wall Tile	Room 205B	None Detected
75	75A 042112580-0226	Green Ceramic Wall Tile	Room 219	None Detected

2nd Floor				
HA No.	**Sample ID**	**Suspect Material Description**	**Sample Location**	**Lab Results (% and Type Asbestos)**
	75B 042112580-0227	Green Ceramic Wall Tile	Room 219	None Detected
	75C 042112580-0228	Green Ceramic Wall Tile	Room 219	None Detected
76	76A 042112580-0229	Mastic of Green Ceramic Wall Tile	Room 219	None Detected
	76B 042112580-0230	Mastic of Green Ceramic Wall Tile	Room 219	None Detected
	76C 042112580-0231	Mastic of Green Ceramic Wall Tile	Room 219	None Detected
77	77A 042112580-0232	Grout of Green Ceramic Wall Tile	Room 219	None Detected
	77B 042112580-0233	Grout of Green Ceramic Wall Tile	Room 219	None Detected
	77C 042112580-0234	Grout of Green Ceramic Wall Tile	Room 219	None Detected
81	81A 042112580-0235	Red/Brown 12”x12” Floor Tile	Room 217D	None Detected
	81B 042112580-0236	Red/Brown 12”x12” Floor Tile	Room 217D	None Detected
	81C 042112580-0237	Red/Brown 12”x12” Floor Tile	Room 217E	None Detected
82	82A 042112580-0238	Mastic of Red/Brown 12”x12” Floor Tile	Room 217D	None Detected
	82B 042112580-0239	Mastic of Red/Brown 12”x12” Floor Tile	Room 217D	None Detected
	82C 042112580-0240	Mastic of Red/Brown 12”x12” Floor Tile	Room 217E	None Detected
83	83A 042112580-0241	Blue 1”x1” Ceramic Floor Tile	Room 209A	None Detected

2nd Floor				
HA No.	**Sample ID**	**Suspect Material Description**	**Sample Location**	**Lab Results (% and Type Asbestos)**
	83B 042112580-0242	Blue 1”x1” Ceramic Floor Tile	Room 209A	None Detected
	83C 042112580-0243	Blue 1”x1” Ceramic Floor Tile	Room 211A	None Detected
84	84A 042112580-0244	Mastic of Blue 1”x1” Ceramic Floor Tile	Room 209A	None Detected
	84B 042112580-0245	Mastic of Blue 1”x1” Ceramic Floor Tile	Room 209A	None Detected
	84C 042112580-0246	Mastic of Blue 1”x1” Ceramic Floor Tile	Room 211A	None Detected
85	85A 042112580-0247	Grout of Blue 1”x1” Ceramic Floor Tile	Room 209A	None Detected
	85B 042112580-0248	Grout of Blue 1”x1” Ceramic Floor Tile	Room 211A	None Detected
	85C 042112580-0249	Grout of Blue 1”x1” Ceramic Floor Tile	Room 211A	None Detected
86	86A 042112580-0250	Tan with Brown Spots Ceramic Wall Tile	Room 216	None Detected
	86B 042112580-0251	Tan with Brown Spots Ceramic Wall Tile	Room 216	None Detected
	86C 042112580-0252	Tan with Brown Spots Ceramic Wall Tile	Room 215	None Detected
87	87A 042112580-0253	Mastic of Tan with Brown Spots Ceramic Wall Tile	Room 209	None Detected
	87B 042112580-0254	Mastic of Tan with Brown Spots Ceramic Wall Tile	Room 209	None Detected
	87C 042112580-0255	Mastic of Tan with Brown Spots Ceramic Wall Tile	Room 209	None Detected
88	88A 042112580-0256	Grout of Tan with Brown Spots Ceramic Wall Tile	Room 209	None Detected

2nd Floor				
HA No.	**Sample ID**	**Suspect Material Description**	**Sample Location**	**Lab Results (% and Type Asbestos)**
	88B 042112580-0257	Grout of Tan with Brown Spots Ceramic Wall Tile	Room 209	None Detected
	88C 042112580-0258	Grout of Tan with Brown Spots Ceramic Wall Tile	Room 209	None Detected
89	89A 042112580-0259	1'x1' Rough Ceiling Tile	Room 215	None Detected
	89B 042112580-0260	1'x1' Rough Ceiling Tile	Room 215	None Detected
	89C 042112580-0261	1'x1' Rough Ceiling Tile	Room 215	None Detected
91	91A 042112580-0262	Shower Caulk	Room 215	None Detected
	91B 042112580-0263	Shower Caulk	Room 215	None Detected
	91C 042112580-0264	Shower Caulk	Room 215	None Detected
93	93A 042112580-0265	Blue Ceramic Wall Tile	Room 216	None Detected
	93B 042112580-0266	Blue Ceramic Wall Tile	Room 216	None Detected
	93C 042112580-0267	Blue Ceramic Wall Tile	Room 216	None Detected
94	94A 042112580-0268	Mastic of Blue Ceramic Wall Tile	Room 216	None Detected
	94B 042112580-0269	Mastic of Blue Ceramic Wall Tile	Room 216	None Detected
	94C 042112580-0270	Mastic of Blue Ceramic Wall Tile	Room 216	None Detected
95	95A 042112580-0271	Grout of Blue Ceramic Wall Tile	Room 216	None Detected

2nd Floor				
HA No.	**Sample ID**	**Suspect Material Description**	**Sample Location**	**Lab Results (% and Type Asbestos)**
	95B 042112580-0272	Grout of Blue Ceramic Wall Tile	Room 216	None Detected
	95C 042112580-0273	Grout of Blue Ceramic Wall Tile	Room 216	None Detected
96	96A 042112580-0274	Yellow Carpet Glue	Room 204	None Detected
	96B 042112580-0275	Yellow Carpet Glue	Room 204	None Detected
	96C 042112580-0276	Yellow Carpet Glue	Room 204	None Detected
97	97A 042112580-0277	Tan 12”x12” Floor Tile with Brown Specs	Corridor 217A	**3.7% Chrysotile**
	97B 042112580-0278	Tan 12”x12” Floor Tile with Brown Specs	Corridor 217C	**3.7% Chrysotile**
	97C 042112580-0279	Tan 12”x12” Floor Tile with Brown Specs	Corridor 217C	**3.6% Chrysotile**
98	98A 042112580-0280	Mastic of Tan 12”x12” Floor Tile with Brown Specs	Corridor 217	**< 1% Chrysotile**
	98B 042112580-0281	Mastic of Tan 12”x12” Floor Tile with Brown Specs	Corridor 217	**< 1% Chrysotile**
	98C 042112580-0282	Mastic of Tan 12”x12” Floor Tile with Brown Specs	Corridor 217	**< 1% Chrysotile**
99	99A 042112580-0283	Gray Cove Base	Room 223	None Detected
	99B 042112580-0284	Gray Cove Base	Room 223	None Detected
	99C 042112580-0285	Gray Cove Base	Room 204	None Detected
100	100A 042112580-0286	Mastic of Gray Cove Base	Room 223	None Detected

2nd Floor				
HA No.	**Sample ID**	**Suspect Material Description**	**Sample Location**	**Lab Results (% and Type Asbestos)**
	100B 042112580-0287	Mastic of Gray Cove Base	Room 223	None Detected
	100C 042112580-0288	Mastic of Gray Cove Base	Room 204	None Detected
101	101A 042112580-0289	White Countertop Adhesive	Room 214	None Detected
	101B 042112580-0290	White Countertop Adhesive	Room 214	None Detected
	101C 042112580-0291	White Countertop Adhesive	Room 214	None Detected
105	105A 042112580-0292	Blue/White Ceramic Wall Tile	Room 205	None Detected
	105B 042112580-0293	Blue/White Ceramic Wall Tile	Room 205	None Detected
	105C 042112580-0294	Blue/White Ceramic Wall Tile	Room 205	None Detected
106	106A 042112580-0295	Mastic of Blue/White Ceramic Wall Tile	Room 205	None Detected
	106B 042112580-0296	Mastic of Blue/White Ceramic Wall Tile	Room 205	None Detected
	106C 042112580-0297	Mastic of Blue/White Ceramic Wall Tile	Room 205	None Detected
107	107A 042112580-0298	Grout of Blue/White Ceramic Wall Tile	Room 205	None Detected
	107B 042112580-0299	Grout of Blue/White Ceramic Wall Tile	Room 205	None Detected
	107C 042112580-0300	Grout of Blue/White Ceramic Wall Tile	Room 205	None Detected
108	108A 042112580-0301	Archway Bumper Caulk	Room 228	None Detected

2nd Floor				
HA No.	**Sample ID**	**Suspect Material Description**	**Sample Location**	**Lab Results (% and Type Asbestos)**
	108B 042112580-0302	Archway Bumper Caulk	Room 228	None Detected
	108C 042112580-0303	Archway Bumper Caulk	Room 228	None Detected
109	109A 042112580-0304	Gray Countertop Adhesive	Room 215	None Detected
	109B 042112580-0305	Gray Countertop Adhesive	Room 215	None Detected
	109C 042112580-0306	Gray Countertop Adhesive	Room 215	None Detected
110	110A 042112580-0307	White Countertop Adhesive	Room 213	None Detected
	110B 042112580-0308	White Countertop Adhesive	Room 213	None Detected
	110C 042112580-0309	White Countertop Adhesive	Room 213	None Detected
111	111A 042112580-0310	Dark Blue Ceramic Floor Tile	Room 209	None Detected
	111B 042112580-0311	Dark Blue Ceramic Floor Tile	Room 209	None Detected
	111C 042112580-0312	Dark Blue Ceramic Floor Tile	Room 211	None Detected
112	112A 042112580-0313	Mastic Dark Blue Ceramic Floor Tile	Room 211	None Detected
	112B 042112580-0314	Mastic Dark Blue Ceramic Floor Tile	Room 209	None Detected
	112C 042112580-0315	Mastic Dark Blue Ceramic Floor Tile	Room 209	None Detected
113	113A 042112580-0316	Grout Dark Blue Ceramic Floor Tile	Room 209	None Detected

2nd Floor				
HA No.	**Sample ID**	**Suspect Material Description**	**Sample Location**	**Lab Results (% and Type Asbestos)**
	113B 042112580-0317	Grout Dark Blue Ceramic Floor Tile	Room 211	None Detected
	113C 042112580-0318	Grout Dark Blue Ceramic Floor Tile	Room 211	None Detected
114	114A 042112580-0319	Black Cove Base	Room 210	None Detected
	114B 042112580-0320	Black Cove Base	Room 210	None Detected
	114C 042112580-0321	Black Cove Base	Room 210	None Detected
115	115A 042112580-0322	Mastic of Black Cove Base	Room 210	None Detected
	115B 042112580-0323	Mastic of Black Cove Base	Room 210	None Detected
	115C 042112580-0324	Mastic of Black Cove Base	Room 210	None Detected
116	116A 042112580-0325	Countertop Adhesive	Room 206	None Detected
	116B 042112580-0326	Countertop Adhesive	Room 206	None Detected
	116C 042112580-0327	Countertop Adhesive	Room 206	None Detected
117	117A 042112580-0328	12”x12” Black Border Tile	Room 210	None Detected
	117B 042112580-0329	12”x12” Black Border Tile	Room 210	None Detected
	117C 042112580-0330	12”x12” Black Border Tile	Room 210	None Detected
118	118A 042112580-0331	12”x12” Light Red Border Tile	Room 210	None Detected

2nd Floor				
HA No.	**Sample ID**	**Suspect Material Description**	**Sample Location**	**Lab Results (% and Type Asbestos)**
	118B 042112580-0332	12”x12” Light Red Border Tile	Room 210	None Detected
	118C 042112580-0333	12”x12” Light Red Border Tile	Room 210	None Detected
119	119A 042112580-0334	12”x12” Gray Floor Tile	Room 210	None Detected
	119B 042112580-0335	12”x12” Gray Floor Tile	Room 210	None Detected
	119C 042112580-0336	12”x12” Gray Floor Tile	Room 210	None Detected
120	120A 042112580-0337	Mastic under HA#117-119	Room 210	None Detected
	120B 042112580-0338	Mastic under HA#117-119	Room 210	None Detected
	120C 042112580-0339	Mastic under HA#117-119	Room 210	None Detected
121	121A 042112580-0340	9”x9” Black Floor Tile	Room 233A	**5.0% Chrysotile**
	121B 042112580-0341	9”x9” Black Floor Tile	Room 233A	**5.6% Chrysotile**
	121C 042112580-0342	9”x9” Black Floor Tile	Room 233A	**6.3% Chrysotile**
122	122A 042112580-0343	Mastic of 9”x9” Black Floor Tile	Room 233A	**2.1% Chrysotile**
	122B 042112580-0344	Mastic of 9”x9” Black Floor Tile	Room 233A	**1.6% Chrysotile**
	122C 042112580-0345	Mastic of 9”x9” Black Floor Tile	Room 233A	**1.9% Chrysotile**
123	123A 042112580-0346	12”x12’ Bottom Floor Tile Layer	Room 210	None Detected

2nd Floor				
HA No.	**Sample ID**	**Suspect Material Description**	**Sample Location**	**Lab Results (% and Type Asbestos)**
	123B 042112580-0347	12”x12’ Bottom Floor Tile Layer	Room 210	None Detected
	123C 042112580-0348	12”x12’ Bottom Floor Tile Layer	Room 210	None Detected
124	124A 042112580-0349	Mastic of 12”x12’ Bottom Floor Tile Layer	Room 210	**< 1% Chrysotile**
	124B 042112580-0350	Mastic of 12”x12’ Bottom Floor Tile Layer	Room 210	**< 1% Chrysotile**
	124C 042112580-0351	Mastic of 12”x12’ Bottom Floor Tile Layer	Room 210	**< 1% Chrysotile**

1st Floor Sample Summary

1st Floor				
HA No.	**Sample Number**	**Suspect Material Description**	**Sample Location**	**Lab Results (% and Type Asbestos)**
01	1A 042112626-0001	Carpet Glue	Room 128	None Detected
	1B 042112626-0002	Carpet Glue	East Corridor	None Detected
	1C 042112626-0003	Carpet Glue	West Corridor	None Detected
02	2A 042112626-0004	2’x2’ Ceiling Tile	Room 128	None Detected
	2B 042112626-0005	2’x2’ Ceiling Tile	Corridor 174z	None Detected
	2C 042112626-0006	2’x2’ Ceiling Tile	Room 134	None Detected

1st Floor				
HA No.	**Sample Number**	**Suspect Material Description**	**Sample Location**	**Lab Results (% and Type Asbestos)**
03	3A 042112626-0007	Brown Cove Base	Room 128	None Detected
	3B 042112626-0008	Brown Cove Base	West Corridor	None Detected
	3C 042112626-0009	Brown Cove Base	East Corridor	None Detected
04	4A 042112626-0010	Mastic of Brown Cove Base	Room 128	None Detected
	4B 042112626-0011	Mastic of Brown Cove Base	West Corridor	None Detected
	4C 042112626-0012	Mastic of Brown Cove Base	East Corridor	None Detected
05	5A 042112626-0013	Grey Cove Base	Room 114	None Detected
	5B 042112626-0014	Grey Cove Base	Room 114E	None Detected
	5C 042112626-0015	Grey Cove Base	Room 114E	None Detected
06	6A 042112626-0016	Mastic of Grey Cove Base	Room 114	None Detected
	6B 042112626-0017	Mastic of Grey Cove Base	Room 114E	None Detected
	6C 042112626-0018	Mastic of Grey Cove Base	Room 114E	None Detected
07	7A 042112626-0019	White Ceramic Tile	Room 106A	None Detected
	7B 042112626-0020	White Ceramic Tile	Room 106A	None Detected
	7C 042112626-0021	White Ceramic Tile	Room 129	None Detected

1st Floor				
HA No.	**Sample Number**	**Suspect Material Description**	**Sample Location**	**Lab Results (% and Type Asbestos)**
08	8A 042112626-0022	Glue of White Ceramic Tile	Room 106A	None Detected
	8B 042112626-0023	Glue of White Ceramic Tile	Room 106A	None Detected
	8C 042112626-0024	Glue of White Ceramic Tile	Room 129	None Detected
09	9A 042112626-0025	Grout of White Ceramic Tile	Room 106A	None Detected
	9B 042112626-0026	Grout of White Ceramic Tile	Room 106A	None Detected
	9C 042112626-0027	Grout of White Ceramic Tile	Room 129	None Detected
10	10A 042112626-0028	Beige Ceramic Tile	Room 106A	None Detected
	10B 042112626-0029	Beige Ceramic Tile	West Corridor, Water Fountain	None Detected
	10C 042112626-0030	Beige Ceramic Tile	West Corridor, Water Fountain	None Detected
11	11A 042112626-0031	Glue of Beige Ceramic Tile	Room 106A	None Detected
	11B 042112626-0032	Glue of Beige Ceramic Tile	West Corridor, Water Fountain	None Detected
	11C 042112626-0033	Glue of Beige Ceramic Tile	West Corridor, Water Fountain	None Detected
12	12A 042112626-0034	Grout of Beige Ceramic Tile	Room 106A	None Detected
	12B 042112626-0035	Grout of Beige Ceramic Tile	West Corridor, Water Fountain	None Detected
	12C 042112626-0036	Grout of Beige Ceramic Tile	West Corridor, Water Fountain	None Detected

1st Floor				
HA No.	**Sample Number**	**Suspect Material Description**	**Sample Location**	**Lab Results (% and Type Asbestos)**
13	13A 042112626-0037	Pipe Fitting Insulation	Room 130	**< 1% Chrysotile**
	13B 042112626-0038	Pipe Fitting Insulation	Room 130	**< 1% Chrysotile**
	13C 042112626-0039	Pipe Fitting Insulation	Room 130	**< 1% Chrysotile**
14	14A 042112626-0040	12”x12” Beige Ceramic Floor Tile	Room 106A	None Detected
	14B 042112626-0041	12”x12” Beige Ceramic Floor Tile	Room 129	None Detected
	14C 042112626-0042	12”x12” Beige Ceramic Floor Tile	Room 129	None Detected
15	15A 042112626-0043	Glue of 12”x12” Beige Ceramic Floor Tile	Room 106A	None Detected
	15B 042112626-0044	Glue of 12”x12” Beige Ceramic Floor Tile	Room 129	None Detected
	15C 042112626-0045	Glue of 12”x12” Beige Ceramic Floor Tile	Room 129	None Detected
16	16A 042112626-0046	Grout of 12”x12” Beige Ceramic Floor Tile	Room 106A	None Detected
	16B 042112626-0047	Grout of 12”x12” Beige Ceramic Floor Tile	Room 129	None Detected
	16C 042112626-0048	Grout of 12”x12” Beige Ceramic Floor Tile	Room 129	None Detected
17	17A 042112626-0049	Pipe Insulation	Room 128A	None Detected
	17B 042112626-0050	Pipe Insulation	Room 128A	< 1 % Chrysotile
	17C 042112626-0051	Pipe Insulation	Room 128A	None Detected

1st Floor				
HA No.	**Sample Number**	**Suspect Material Description**	**Sample Location**	**Lab Results (% and Type Asbestos)**
18	18A 042112626-0052	Plaster (Base Coat)	Room 134	None Detected
	18B 042112626-0053	Plaster (Base Coat)	Corridor Outside Room 134	None Detected
	18C 042112626-0054	Plaster (Base Coat)	Room 101A	None Detected
	18D 042112626-0055	Plaster (Base Coat)	Room 168	None Detected
	18E 042112626-0056	Plaster (Base Coat)	Corridor Outside Room 137	None Detected
19	19A 042112626-0057	Plaster (Skim Coat)	Room 134	None Detected
	19B 042112626-0058	Plaster (Skim Coat)	Corridor Outside Room 134	None Detected
	19C 042112626-0059	Plaster (Skim Coat)	Room 101A	None Detected
	19D 042112626-0060	Plaster (Skim Coat)	Room 168	None Detected
	19E 042112626-0061	Plaster (Skim Coat)	Corridor Outside Room 137	None Detected
20	20A 042112626-0062	Sheetrock	Room 108	None Detected
	20B 042112626-0063	Sheetrock	Room 124	None Detected
	20C 042112626-0064	Sheetrock	Room 126	None Detected
	20D 042112626-0065	Sheetrock	Room 132	None Detected
	20E 042112626-0066	Sheetrock	Room 168	None Detected

1st Floor				
HA No.	**Sample Number**	**Suspect Material Description**	**Sample Location**	**Lab Results (% and Type Asbestos)**
21	21A 042112626-0067	Joint Compound	Room 108	None Detected
	21B 042112626-0068	Joint Compound	Roo 124	None Detected
	21C 042112626-0069	Joint Compound	Room 126	None Detected
	21D 042112626-0070	Joint Compound	Room 132	None Detected
	21E 042112626-0071	Joint Compound	Room 168	None Detected

Ground Floor Sample Summary

Ground Floor				
HA No.	**Sample Number**	**Suspect Material Description**	**Sample Location**	**Lab Results (% and Type Asbestos)**
01	1A 042112632-0001	Carpet Mastic	Room 8, above Terrazzo Flooring	None Detected
	1B 042112632-0002	Carpet Mastic	Room 8H, above Terrazzo Flooring	None Detected
	1C 042112632-0003	Carpet Mastic	Room 8F, above Terrazzo Flooring	None Detected
02	2A 042112632-0004	Mastic of Laminate Floor	Room 6	None Detected
	2B 042112632-0005	Mastic of Laminate Floor	Room 6	None Detected
	2C 042112632-0006	Mastic of Laminate Floor	Room 6	None Detected

Ground Floor				
HA No.	**Sample Number**	**Suspect Material Description**	**Sample Location**	**Lab Results (% and Type Asbestos)**
03	3A 042112632-0007	9”x9” Black Floor Tile	Room 19C	**2.5% Chrysotile**
	3B 042112632-0008	9”x9” Black Floor Tile	Room 19C	**3.4% Chrysotile**
	3C 042112632-0009	9”x9” Black Floor Tile	Room 19C	**2.8% Chrysotile**
04	4A 042112632-0010	Mastic of 9”x9” Black Floor Tile	Room 19C	**1.7% Chrysotile**
	4B 042112632-0011	Mastic of 9”x9” Black Floor Tile	Room 19C	**2.2% Chrysotile**
	4C 042112632-0012	Mastic of 9”x9” Black Floor Tile	Room 19C	**4.6% Chrysotile**
05	5A 042112632-0013	12”x12” Grey Floor Tile with Blue/Pink Specks	Room 21	None Detected
	5B 042112632-0014	12”x12” Grey Floor Tile with Blue/Pink Specks	Room 21	None Detected
	5C 042112632-0015	12”x12” Grey Floor Tile with Blue/Pink Specks	Room 21	None Detected
06	6A 042112632-0016	Mastic of 12”x12” Grey Floor Tile with Blue/Pink Specks	Room 21	None Detected
	6B 042112632-0017	Mastic of 12”x12” Grey Floor Tile with Blue/Pink Specks	Room 21	None Detected
	6C 042112632-0018	Mastic of 12”x12” Grey Floor Tile with Blue/Pink Specks	Room 21	None Detected

Basement Sample Summary

Basement				
HA No.	**Sample Number**	**Suspect Material Description**	**Sample Location**	**Lab Results (% and Type Asbestos)**
07	7A 042112632-0019	Glass-like Insulation	Pipe Basement	None Detected
	7B 042112632-0020	Glass-like Insulation	Pipe Basement	None Detected
	7C 042112632-0021	Glass-like Insulation	Pipe Basement	None Detected
08	8A 042112632-0022	Insulation Wrap	Pipe Basement	None Detected
	8B 042112632-0023	Insulation Wrap	Pipe Basement	None Detected
	8C 042112632-0024	Insulation Wrap	Pipe Basement	None Detected

Exterior Sample Summary

Exterior				
HA No.	**Sample Number**	**Suspect Material Description**	**Sample Location**	**Lab Results (% and Type Asbestos)**
09	9A 042112632-0025	Grey Window Caulk	North Stairwell, Exterior Window	**1.5% Chrysotile**
	9B 042112632-0026	Grey Window Caulk	North Stairwell, Exterior Window	**1.3% Chrysotile**
	9C 042112632-0027	Grey Window Caulk	North Stairwell, Exterior Window	**1.1% Chrysotile**
10	10A 042112632-0028	Black Window Caulk	North Stairwells, Exterior Window Header	**2.2% Chrysotile**
	10B 042112632-0029	Black Window Caulk	North Stairwells, Exterior Window Header	**1.3% Chrysotile**
	10C 042112632-0030	Black Window Caulk	North Stairwells, Exterior Window Header	**1.2% Chrysotile**

APPENDIX C

ANALYTICAL LABORATORY DATA

Only results included in Specifications -
Original Data Available upon request

EMSL Analytical, Inc.
200 Route 130 North, Cinnaminson, NJ 08077
Phone: (856) 303-2500 Fax: (856) 858-4571 Email: EnvChemistry2@emsl.com

Attn: **Adam Frey**
Terracon Consultants, Inc.
201 Hammer Mill Road
Rocky Hill, CT 06067
Phone: (860) 721-1900
Fax: (860) 721-1939

6/7/2021

The following analytical report covers the analysis performed on samples submitted to EMSL Analytical, Inc. on 5/27/2021. The results are tabulated on the attached data pages for the following client designated project:

Building 14/J2217018

The reference number for these samples is EMSL Order #012105624. Please use this reference when calling about these samples. If you have any questions, please do not hesitate to contact me at (856) 303-2500.

Approved By:

Phillip Worby, Environmental Chemistry
Laboratory Director

The test results contained within this report meet the requirements of NELAP and/or the specific certification program that is applicable, unless otherwise noted.
NELAP Certifications: NJ 03036, NY 10872, PA 68-00367, CA ELAP 1877

The samples associated with this report were received in good condition unless otherwise noted. This report relates only to those items tested as received by the laboratory. The QC data associated with the sample results meet the recovery and precision requirements established by the NELAP, unless specifically indicated. All results for soil samples are reported on a dry weight basis, unless otherwise noted. This report may not be reproduced except in full and without written approval by EMSL Analytical, Inc.

EMSL Analytical, Inc.
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EMSL Order: 012105624
CustomerID: JAWO78
CustomerPO:
ProjectID:

Attn: **Adam Frey**
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Received: 5/27/2021 09:30 AM

Project: **Building 14/J2217018**

Analytical Results

Client Sample Description PCB-W1 ***Collected:*** 5/25/2021 ***Lab ID:*** *012105624-0001*
Room 8Z, large electrial unit, west side, south end

Method	*Parameter*	*Result*	*RL Units*	*Prep Date & Analyst*		*Analysis Date & Analyst*	
GC-SVOA							
3550C/8082A	Aroclor-1016	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1221	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1232	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1242	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1248	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1254	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1260	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1262	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1268	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL

Client Sample Description PCB-W2 ***Collected:*** 5/25/2021 ***Lab ID:*** *012105624-0002*
Room 8Z, west side, south end

Method	*Parameter*	*Result*	*RL Units*	*Prep Date & Analyst*		*Analysis Date & Analyst*	
GC-SVOA							
3550C/8082A	Aroclor-1016	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1221	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1232	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1242	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1248	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1254	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1260	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1262	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1268	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL

Client Sample Description PCB-W3 ***Collected:*** 5/25/2021 ***Lab ID:*** *012105624-0003*
Room 8Z, large electrical unit, north side

Method	*Parameter*	*Result*	*RL Units*	*Prep Date & Analyst*		*Analysis Date & Analyst*	
GC-SVOA							
3550C/8082A	Aroclor-1016	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1221	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1232	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1242	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1248	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL

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Project: **Building 14/J2217018**

Analytical Results

Client Sample Description PCB-W3 ***Collected:*** 5/25/2021 ***Lab ID:*** *012105624-0003*
Room 8Z, large electrical unit, north side

Method	*Parameter*	*Result*	*RL Units*	*Prep Date & Analyst*		*Analysis Date & Analyst*	
GC-SVOA							
3550C/8082A	Aroclor-1254	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1260	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1262	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1268	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL

Client Sample Description PCB-W4 ***Collected:*** 5/25/2021 ***Lab ID:*** *012105624-0004*
Room 8Z, large electrical unit, west side, north end

Method	*Parameter*	*Result*	*RL Units*	*Prep Date & Analyst*		*Analysis Date & Analyst*	
GC-SVOA							
3550C/8082A	Aroclor-1016	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1221	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1232	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1242	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1248	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1254	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1260	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1262	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1268	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL

Client Sample Description PCB-W5 ***Collected:*** 5/25/2021 ***Lab ID:*** *012105624-0005*
Service Basement 13C, electric box south of stairs, floor

Method	*Parameter*	*Result*	*RL Units*	*Prep Date & Analyst*		*Analysis Date & Analyst*	
GC-SVOA							
3550C/8082A	Aroclor-1016	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1221	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1232	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1242	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1248	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1254	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1260	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1262	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1268	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL

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Project: **Building 14/J2217018**

Analytical Results

Client Sample Description PCB-W6
Service Basement 13C, electric box south of stairs, wall
Collected: 5/25/2021 ***Lab ID:*** *012105624-0006*

Method	Parameter	Result	RL Units	Prep Date & Analyst		Analysis Date & Analyst	
GC-SVOA							
3550C/8082A	Aroclor-1016	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1221	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1232	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1242	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1248	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1254	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1260	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1262	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1268	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL

Client Sample Description PCB-W7
Service Basement 13C, electric motor at south wall, floor
Collected: 5/25/2021 ***Lab ID:*** *012105624-0007*

Method	Parameter	Result	RL Units	Prep Date & Analyst		Analysis Date & Analyst	
GC-SVOA							
3550C/8082A	Aroclor-1016	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1221	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1232	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1242	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1248	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1254	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1260	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1262	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1268	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL

Client Sample Description PCB-W8
Service Basement 13C, electrical motor at south wall, platform
Collected: 5/25/2021 ***Lab ID:*** *012105624-0008*

Method	Parameter	Result	RL Units	Prep Date & Analyst		Analysis Date & Analyst	
GC-SVOA							
3550C/8082A	Aroclor-1016	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1221	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1232	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL

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Received: 5/27/2021 09:30 AM

Project: **Building 14/J2217018**

Analytical Results

Client Sample Description PCB-W8
Service Basement 13C, electrical motor at south wall, platform

Collected: 5/25/2021 ***Lab ID:*** *012105624-0008*

Method	*Parameter*	*Result*	*RL Units*	*Prep Date & Analyst*		*Analysis Date & Analyst*	
GC-SVOA							
3550C/8082A	Aroclor-1242	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1248	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1254	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1260	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1262	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL
3550C/8082A	Aroclor-1268	ND	0.50 µg/wipe	6/1/2021	ER	6/1/2021 00:00	TL

Definitions:

MDL - method detection limit
J - Result was below the reporting limit, but at or above the MDL
ND - indicates that the analyte was not detected at the reporting limit
RL - Reporting Limit (Analytical)
D - Dilution Sample required a dilution which was used to calculate final results

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6/4/2021

The following analytical report covers the analysis performed on samples submitted to EMSL Analytical, Inc. on 5/27/2021. The results are tabulated on the attached data pages for the following client designated project:

Building 14/J2217018

The reference number for these samples is EMSL Order #012105621. Please use this reference when calling about these samples. If you have any questions, please do not hesitate to contact me at (856) 303-2500.

Approved By:

Phillip Worby, Environmental Chemistry
Laboratory Director

The test results contained within this report meet the requirements of NELAP and/or the specific certification program that is applicable, unless otherwise noted.
NELAP Certifications: NJ 03036, NY 10872, PA 68-00367, CA ELAP 1877

The samples associated with this report were received in good condition unless otherwise noted. This report relates only to those items tested as received by the laboratory. The QC data associated with the sample results meet the recovery and precision requirements established by the NELAP, unless specifically indicated. All results for soil samples are reported on a dry weight basis, unless otherwise noted. This report may not be reproduced except in full and without written approval by EMSL Analytical, Inc.

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Project: **Building 14/J2217018**

Analytical Results

Client Sample Description 21-PCB
2nd floor, east corridor
Collected: ***Lab ID:*** *012105621-0001*

Method	*Parameter*	*Result*	*RL Units*	*Prep Date & Analyst*		*Analysis Date & Analyst*	
GC-SVOA							
3540C/8082A	Aroclor-1016	ND D	0.93 mg/Kg	6/1/2021	PG	6/2/2021 00:00	TL
3540C/8082A	Aroclor-1221	ND D	0.93 mg/Kg	6/1/2021	PG	6/2/2021 00:00	TL
3540C/8082A	Aroclor-1232	ND D	0.93 mg/Kg	6/1/2021	PG	6/2/2021 00:00	TL
3540C/8082A	Aroclor-1242	ND D	0.93 mg/Kg	6/1/2021	PG	6/2/2021 00:00	TL
3540C/8082A	Aroclor-1248	ND D	0.93 mg/Kg	6/1/2021	PG	6/2/2021 00:00	TL
3540C/8082A	Aroclor-1254	ND D	0.93 mg/Kg	6/1/2021	PG	6/2/2021 00:00	TL
3540C/8082A	Aroclor-1260	ND D	0.93 mg/Kg	6/1/2021	PG	6/2/2021 00:00	TL
3540C/8082A	Aroclor-1262	ND D	0.93 mg/Kg	6/1/2021	PG	6/2/2021 00:00	TL
3540C/8082A	Aroclor-1268	ND D	0.93 mg/Kg	6/1/2021	PG	6/2/2021 00:00	TL

Client Sample Description M-PCB
North exterior stairwell, under window
Collected: ***Lab ID:*** *012105621-0002*

Method	*Parameter*	*Result*	*RL Units*	*Prep Date & Analyst*		*Analysis Date & Analyst*	
GC-SVOA							
3540C/8082A	Aroclor-1016	ND D	0.98 mg/Kg	6/1/2021	PG	6/2/2021 00:00	TL
3540C/8082A	Aroclor-1221	ND D	0.98 mg/Kg	6/1/2021	PG	6/2/2021 00:00	TL
3540C/8082A	Aroclor-1232	ND D	0.98 mg/Kg	6/1/2021	PG	6/2/2021 00:00	TL
3540C/8082A	Aroclor-1242	ND D	0.98 mg/Kg	6/1/2021	PG	6/2/2021 00:00	TL
3540C/8082A	Aroclor-1248	ND D	0.98 mg/Kg	6/1/2021	PG	6/2/2021 00:00	TL
3540C/8082A	Aroclor-1254	ND D	0.98 mg/Kg	6/1/2021	PG	6/2/2021 00:00	TL
3540C/8082A	Aroclor-1260	ND D	0.98 mg/Kg	6/1/2021	PG	6/2/2021 00:00	TL
3540C/8082A	Aroclor-1262	ND D	0.98 mg/Kg	6/1/2021	PG	6/2/2021 00:00	TL
3540C/8082A	Aroclor-1268	ND D	0.98 mg/Kg	6/1/2021	PG	6/2/2021 00:00	TL

Client Sample Description NS-PCB
North exterior stairwell, window
Collected: ***Lab ID:*** *012105621-0003*

Method	*Parameter*	*Result*	*RL Units*	*Prep Date & Analyst*		*Analysis Date & Analyst*	
GC-SVOA							
3540C/8082A	Aroclor-1016	ND D	0.90 mg/Kg	6/1/2021	PG	6/2/2021 00:00	TL
3540C/8082A	Aroclor-1221	ND D	0.90 mg/Kg	6/1/2021	PG	6/2/2021 00:00	TL
3540C/8082A	Aroclor-1232	ND D	0.90 mg/Kg	6/1/2021	PG	6/2/2021 00:00	TL
3540C/8082A	Aroclor-1242	ND D	0.90 mg/Kg	6/1/2021	PG	6/2/2021 00:00	TL
3540C/8082A	Aroclor-1248	ND D	0.90 mg/Kg	6/1/2021	PG	6/2/2021 00:00	TL

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Project: **Building 14/J2217018**

Analytical Results

Client Sample Description NS-PCB
North exterior stairwell, window
Collected: ***Lab ID:*** *012105621-0003*

Method	*Parameter*	*Result*	*RL Units*	*Prep Date & Analyst*		*Analysis Date & Analyst*	
GC-SVOA							
3540C/8082A	Aroclor-1254	ND D	0.90 mg/Kg	6/1/2021	PG	6/2/2021 00:00	TL
3540C/8082A	Aroclor-1260	ND D	0.90 mg/Kg	6/1/2021	PG	6/2/2021 00:00	TL
3540C/8082A	Aroclor-1262	ND D	0.90 mg/Kg	6/1/2021	PG	6/2/2021 00:00	TL
3540C/8082A	Aroclor-1268	ND D	0.90 mg/Kg	6/1/2021	PG	6/2/2021 00:00	TL

Client Sample Description NS2-PCB
North exterior stairwell, window header
Collected: ***Lab ID:*** *012105621-0004*

Method	*Parameter*	*Result*	*RL Units*	*Prep Date & Analyst*		*Analysis Date & Analyst*	
GC-SVOA							
3540C/8082A	Aroclor-1016	ND D	0.95 mg/Kg	6/1/2021	PG	6/2/2021 00:00	TL
3540C/8082A	Aroclor-1221	ND D	0.95 mg/Kg	6/1/2021	PG	6/2/2021 00:00	TL
3540C/8082A	Aroclor-1232	ND D	0.95 mg/Kg	6/1/2021	PG	6/2/2021 00:00	TL
3540C/8082A	Aroclor-1242	ND D	0.95 mg/Kg	6/1/2021	PG	6/2/2021 00:00	TL
3540C/8082A	Aroclor-1248	ND D	0.95 mg/Kg	6/1/2021	PG	6/2/2021 00:00	TL
3540C/8082A	Aroclor-1254	ND D	0.95 mg/Kg	6/1/2021	PG	6/2/2021 00:00	TL
3540C/8082A	Aroclor-1260	ND D	0.95 mg/Kg	6/1/2021	PG	6/2/2021 00:00	TL
3540C/8082A	Aroclor-1262	ND D	0.95 mg/Kg	6/1/2021	PG	6/2/2021 00:00	TL
3540C/8082A	Aroclor-1268	ND D	0.95 mg/Kg	6/1/2021	PG	6/2/2021 00:00	TL

Definitions:
MDL - method detection limit
J - Result was below the reporting limit, but at or above the MDL
ND - indicates that the analyte was not detected at the reporting limit
RL - Reporting Limit (Analytical)
D - Dilution Sample required a dilution which was used to calculate final results

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EMSL Chain of Custody - One Chain

EMSL Order Number / Lab Use Only

012105621

EMSL Analytical, Inc.
200 Route 130 North
Cinnaminson, NJ 08077

PHONE: (800) 220-3675
EMAIL: CinnAsblab@EMSL.com

If Bill-To is the same as Report-To leave this section blank. Third-party billing requires written authorization.

Customer Information

Customer ID:
Company Name: Terracon Consultants, Inc.
Contact Name: Adam Frey
Street Address: 201 Hammer Mill Road
City, State, Zip: Rocky Hill, CT 06067 Country: USA
Phone: 603 306 2506
Email(s) for Report: adam.frey@terracon.com

Billing Information

Billing ID:
Company Name: Terracon Consultants, Inc.
Billing Contact: Don Pomeroy
Street Address: 201 Hammer Mill Road
City, State, Zip: Rocky Hill CT 06067 Country: USA
Phone: 401 500 3117
Email(s) for Invoice: don.pomeroy@terracon.com

Project Information

Project Name/No: Building 14 / J22170 18
Purchase Order:
EMSL LIMS Project ID: (If applicable, EMSL will provide)
US State where samples collected: NY
State of Connecticut (CT) must select project location: ☐ Commercial (Taxable) ☐ Residential (Non-Taxable)
Sampled By Name: Adam Frey
Sampled By Signature: [signature]
No. of Samples in Shipment

Turn-Around-Time (TAT)

☐ 3 Hour ☐ 6 Hour ☐ 24 Hour ☐ 32 Hour ☐ 48 Hour ☐ 72 Hour ☐ 96 Hour ☒ 1 Week ☐ 2 Week

Please call ahead for large projects and/or turnaround times 6 Hours or Less. *32 Hour TAT available for select tests only; samples must be submitted by 11:30am.

ASBESTOS

PCM Air
- ☐ NIOSH 7400
- ☐ NIOSH 7400 w/ 8hr. TWA

PLM - Bulk (reporting limit)
- ☐ PLM EPA 600/R-93/116 (<1%)
- ☐ PLM EPA NOB (<1%)
- ☐ POINT COUNT
  - ☐ 400 (<0.25%) ☐ 1,000 (<0.1%)
- POINT COUNT w/ GRAVIMETRIC
  - ☐ 400 (<0.25%) ☐ 1,000 (<0.1%)
- ☐ NIOSH 9002 (<1%)
- ☐ NYS 198.1 (Friable - NY)
- ☐ NYS 198.6 NOB (Non-Friable - NY)
- ☐ NYS 198.8 (Vermiculite SM-V)

TEM - Air
- ☐ AHERA 40 CFR, Part 763
- ☐ NIOSH 7402
- ☐ EPA Level II
- ☐ ISO 10312*

TEM - Bulk
- ☐ TEM EPA NOB
- ☐ NYS NOB 198.4 (Non-Friable-NY)
- ☐ TEM EPA 600/R-93/116 w Milling Prep (0.1%)

Other Test (please specify)

*Please call with your project-specific requirements.

TEM - Settled Dust
- ☐ Microvac - ASTM D5755
- ☐ Wipe - ASTM D6480
- ☐ Qualitative via Filtration Prep
- ☐ Qualitative via Drop Mount Prep

Soil - Rock - Vermiculite (reporting limit)*
- ☐ PLM EPA 600/R-93/116 with milling prep (<0.25%)
- ☐ PLM EPA 600/R-93/116 with milling prep (<0.1%)
- ☐ TEM EPA 600/R-93/116 with milling prep (<0.1%)
- ☐ TEM Qualitative via Filtration Prep
- ☐ TEM Qualitative via Drop Mount Prep

☐ **Positive Stop - Clearly Identified Homogeneous Areas (HA)**

Filter Pore Size (Air Samples) ☐ 0.8um ☐ 0.45um

LEAD (PB)

Flame Atomic Absoprtion
- ☐ Chips SW846-7000B or AOAC 974.2
- ☐ Soil SW846-7000B/7420
- ☐ Air NIOSH 7082
- ☐ Wastewater SM3111B or SW846-7000B/7420
- ☐ ASTM Wipe SW846-7000B/7420
- ☐ non-ASTM Wipe SW846-7000B/7420
- ☐ TCLP SW846-1311/ 7420/ SM3111B

ICP
- ☐ TEM EPA 600/R-93/116 w Milling Prep (0.1%)
- ☐ Chatfield SOP

MICROBIOLOGY

Swab and Bulk Samples
- ☐ Mold & Fungi - Direct Examination
- ☐ Mold & Fungi Culture (Genus Only)
- ☐ Mold & Fungi Culture (Genus & Species)
- ☐ Bacterial Count & ID (Up to 3 Types)
- ☐ Bacterial Count & ID (Up to 5 Types)

Sewage Screen
- ☐ Sewage Screen (P/A)
- ☐ Sewage Screen (Membrane Filtration)

Water Samples
- ☐ Total Coliform & E. Coli (P/A, SM 9223B)
- ☐ Heterotrophic Plate Count (PP, SM 9251B)
- ☐ Fecal Coliform (SM 9222D)

Air Samples
- ☐ Mold & Fungi (Spore Trap)
- ☐ Mold & Fungi Culture (Genus Only)
- ☐ Mold & Fungi Culture (Genus & Species)
- ☐ Bacterial Count & ID (Up to 3 Types)
- ☐ Bacterial Count & ID (Up to 5 Types)

DNA & PCR Testing: (See Analytical Guide for Code)
Test Code:

Legionella: (See Analytical Guide for Code)
Test Code:

P/A= Presence/Absence, PP= Pour Plate

MAT-SCI (TAT End of Business Day)
- ☐ Common Particle ID (large particles)
- ☐ Full Particle ID (environmental dust)
- ☐ Basic Mateiral ID (solids)
- ☐ Advanced Material ID
- ☐ Physical Testing (Tensile, Compression)
- ☐ Combustion-By-Products (Soot, Char, Etc.)
- ☐ X-Ray Flourescence (elem. Analysis)
- ☐ X-Ray Diffraction (Crystalline Part.)
- ☐ MMVF's (Fibrous Glass, RCF's)
- ☐ Particle Size (Sieve, Microscopy, Laser)
- ☐ Combustible Dust
- ☐ Petrographic Examination

IAQ (TAT End of Business Day)
- ☐ Nuisance Dust ☐ NIOSH 0500 ☐ NIOSH 0600
- ☐ Airborne Dust ☐ PM10 ☐ TSP
- Silica Analysis: ☐ All Species
- Silica Analysis - Single Species
  - ☐ Alpha Quartz ☐ Cristobalite ☐ Tridymite
- ☐ HVAC Efficiency
- ☐ Carbon Black
- ☐ Airborn Oil Mist
- Radon Testing: Call for Kit and COC

Other Test (please specify) PCB Bulk Sample EPA-SW-846-3540C/8082A

Special Instructions and/or Regulatory Requirements (Sample Specifications, Processing Methods, Limits of Detection, etc.)

email for collection date 5/27 BC

Method of Shipment:
Sample Condition Upon Receipt:

Relinquished by: [signature]	Date/Time: 5/25/21 14:15	Received by: Colleen Palladino	Date/Time 5/27/21 9:30 AM
Relinquished by:	Date/Time:	Received by:	Date/Time

Controlled Document - COC-17 One Chain EMSL R5 2/26/2021

☐ **AGREE TO ELECTRONIC SIGNATURE** (By checking, I consent to signing this Chain of Custody document by electronic signature.)

EMSL Analytical, Inc.'s Laboratory Terms and Conditions are incorporated into this Chain of Custody by reference in their entirety. Submission of samples to EMSL Analytical, Inc. constitutes acceptance and acknowledgment of all terms and conditions by Customer.

18.8°C
rec'd in plastic

EMSL ANALYTICAL, INC.
TESTING LABS • PRODUCTS • TRAINING

EMSL Chain of Custody - One Chain

EMSL Order Number / Lab Use Only

012105621

EMSL Analytical, Inc.
200 Route 130 North
Cinnaminson, NJ 08077

PHONE: (800) 220-3675
EMAIL: CinnAsblab@EMSL.com

Additional Pages of the Chain of Custody are only necessary if needed for additional sample information

Special Instructions and/or Regulatory Requirements (Sample Specifications, Processing Methods, Limits of Detection, etc.)

	Sample Number	Sample Location / Description	Volume, Area or Homogeneous Area	Date / Time Sampled (Air Monitoring Only)
1	21-PCB	2nd floor, east corridor		
2	M-PCB	North Exterior Stairwell, under window		
3	NS-PCB	North exterior stairwell, window		
4	NS2-PCB	North exterior stairwell, window header		

Method of Shipment:		Sample Condition Upon Receipt:	
Relinquished by: [illegible]	Date/Time: 5/25/21 14:45	Received by:	Date/Time
Relinquished by:	Date/Time:	Received by:	Date/Time

Controlled Document - COC-17 One Chain EMSL R5 2/26/2021

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EMSL Analytical, Inc.
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (856) 303-2500 / (856) 786-5974
http://www.EMSL.com cinnaminsonleadlab@emsl.com

EMSL Order:	202104321
CustomerID:	JAWO78
CustomerPO:	J2217018
ProjectID:	

Attn: **Adam Frey**
Terracon Consultants, Inc.
201 Hammer Mill Road
Rocky Hill, CT 06067

Phone:	(860) 721-1900
Fax:	(860) 721-1939
Received:	06/02/21 10:00 AM
Collected:	5/25/2021

Project: **Building 14 / J2217018**

Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)*

Client Sample Description	*Lab ID*	*Collected*	*Analyzed*	*Weight*	*Lead Concentration*
Bldg14-01	*202104321-0001*	5/24/2021	6/4/2021	0.2557 g	0.21 % wt
	Site: 2nd fl - rm 232 - blue paint				
Bldg14-02	*202104321-0002*	5/24/2021	6/4/2021	0.2532 g	<0.0080 % wt
	Site: 2nd fl - day rm - white paint				
Bldg14-03	*202104321-0003*	5/25/2021	6/3/2021	0.2514 g	<0.0080 % wt
	Site: 1st fl - rm 128 - tan paint				
Bldg14-04	*202104321-0004*	5/25/2021	6/3/2021	0.2538 g	0.14 % wt
	Site: 1st fl - rm 128 - white paint				
Bldg14-05	*202104321-0005*	5/25/2021	6/3/2021	0.2510 g	<0.0080 % wt
	Site: 1st fl- rm 127 - lt tan				
Bldg14-06	*202104321-0006*	5/25/2021	6/3/2021	0.2509 g	0.057 % wt
	Site: 1st fl - rm 108 - beige				
Bldg14-07	*202104321-0007*	5/25/2021	6/3/2021	0.2536 g	0.029 % wt
	Site: ground fl - storage rm 4 - lt green				
Bldg14-08	*202104321-0008*	5/25/2021	6/3/2021	0.2549 g	<0.0080 % wt
	Site: ground fl - kitchen - white				
Bldg14-09	*202104321-0009*	5/25/2021	6/3/2021	0.2589 g	0.14 % wt
	Site: ground fl - rm 17 - green & blue				
Bldg14-10	*202104321-0010*	5/25/2021	6/3/2021	0.2524 g	0.40 % wt
	Site: ground fl - storage rm 4 - lt green				
Bldg14-11	*202104321-0011*	5/25/2021	6/3/2021	0.2556 g	0.012 % wt
	Site: ground fl - rm 17a - red / grey				

The RLVS for samples -0001 and -0002 fell outside control limits. All other QC results met criteria.

Phillip Worby, Lead Laboratory Manager
or other approved signatory

EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. Results are generated from the field sampling data (sampling volumes and areas, locations, etc.) provided by the client on the Chain of Custody. Samples are within quality control criteria and met method specifications unless otherwise noted.
Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.008% wt based on the minimum sample weight per our SOP. "<" (less than) result signifies the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. Definitions of modifications are available upon request.
Samples analyzed by EMSL Analytical, Inc. Cinnaminson, NJ NELAP Certifications: NJ 03036, NY 10872, PA 68-00367, AIHA-LAP, LLC ELLAP 100194, A2LA 2845.01

Initial report from 06/04/2021 17:14:24

EMSL ANALYTICAL, INC.
TESTING LABS • PRODUCTS • TRAINING

Lead Chain of Custody

EMSL Order Number / Lab Use Only: 202104321

EMSL Analytical, Inc.
200 Route 130 North
Cinnaminson, NJ 08077

PHONE: (800) 220-3675
EMAIL: CinnaminsonLeadLab@emsl.com

Customer Information		Billing Information	
Customer ID:		Billing ID:	
Company Name:	Terracon Consultants, Inc.	Company Name:	Terracon Consultants, Inc.
Contact Name:	Adam Frey	Billing Contact:	Don Pomeroy
Street Address:	201 Hammer Mill Road	Street Address:	201 Hammer Mill Road
City, State, Zip:	Rocky Hill, CT 06067 — Country: USA	City, State, Zip:	Rocky Hill, CT 06067 — Country: USA
Phone:	(603) 300-2506	Phone:	(401) 500-3117
Email(s) for Report:	adam.frey@terracon.com	Email(s) for Invoice:	don.pomeroy@terracon.com

Project Information

Project Name/No: Building 14 / J2217018
Purchase Order:
EMSL LIMS Project ID: (If applicable, EMSL will provide)
US State where samples collected: NY
State of Connecticut (CT) must select project location: ☐ Commercial (Taxable) ☐ Residential (Non-Taxable)
Sampled By Name: Sammy MARRERO
Sampled By Signature: [signature]
No. of Samples in Shipment:

Turn-Around-Time (TAT)

☐ 3 Hour ☐ 6 Hour ☐ 24 Hour ☐ 32 Hour ☐ 48 Hour ☐ 72 Hour ☐ 96 Hour ☒ 1 Week ☐ 2 Week

Please call ahead for large projects and/or turnaround times 6 Hours or Less. *32 Hour TAT available for select tests only; samples must be submitted by 11:30am.

MATRIX	METHOD	INSTRUMENT	REPORTING LIMIT	SELECTION
CHIPS ☐ % by wt. ☑ ppm (mg/kg) ☑ mg/cm²	SW 846-7000B	Flame Atomic Absorption	0.008% (80ppm)	☒
*Reporting Limit based on a minimum 0.25g sample weight	SW 846-6010D*	ICP-OES	0.0004% (4ppm)	☐
AIR	NIOSH 7082	Flame Atomic Absorption	4µg/filter	☐
	NIOSH 7300M / NIOSH 7303M	ICP-OES	0.5µg/filter	☐
	NIOSH 7300M / NIOSH 7303M	ICP-MS	0.05µg/filter	☐
WIPE ☐ ASTM ☐ NON-ASTM	SW 846-7000B	Flame Atomic Absorption	10µg/wipe	☐
*If no box is checked, non-ASTM Wipe is assumed	SW 846-6010D*	ICP-OES	1.0µg/wipe	☐
TCLP	SW 846-1311 / 7000B / SM 3111B	Flame Atomic Absorption	0.4 mg/L (ppm)	☐
	SW 846-1311 / SW 846-6010D*	ICP-OES	0.1 mg/L (ppm)	☐
SPLP	SW 846-1312 / 7000B / SM 3111B	Flame Atomic Absorption	0.4 mg/L (ppm)	☐
	SW 846-1312 / SW 846-6010D*	ICP-OES	0.1 mg/L (ppm)	☐
TTLC	22 CCR App. II, 7000B	Flame Atomic Absorption	40mg/kg (ppm)	☐
	22 CCR App. II, SW 846-6010D*	ICP-OES	2mg/kg (ppm)	☐
STLC	22 CCR App. II, 7000B	Flame Atomic Absorption	0.4 mg/L (ppm)	☐
	22 CCR App. II, SW 846-6010D*	ICP-OES	0.1 mg/L (ppm)	☐
Soil	SW 846-7000B	Flame Atomic Absorption	40mg/kg (ppm)	☐
	SW 846-6010D*	ICP-OES	2mg/kg (ppm)	☐
Wastewater	SM 3111B / SW 846-7000B	Flame Atomic Absorption	0.4 mg/L (ppm)	☐
Unpreserved ☐ / Preserved with HNO3 ☐ PH<2	EPA 200.7	ICP-OES	0.020 mg/L (ppm)	☐
Drinking Water	EPA 200.5	ICP-OES	0.003 mg/L (ppm)	☐
Unpreserved ☐ / Preserved with HNO3 ☐ PH<2	EPA 200.8	ICP-MS	0.001 mg/L (ppm)	☐
TSP/SPM Filter	40 CFR Part 50	ICP-OES	12 µg/filter	☐
Other:				☐

Sample Number	Sample Location	Volume / Area	Date / Time Sampled
BLDG14-01	2nd Fl. Rm 232 (Blue Paint)	2"x2"	5/24 15:15
BLDG14-02	⊥ DAY RM (white Paint)	⊥ ⊥	5/24 15:19
BLDG14-03	1st Fl. Rm 128 (tan Paint)	2"x2"	5/25 09:20
BLDG14-04	⊥ Rm 128 (white Paint)	⊥	5/25 09:21
	ANALYZE By weight.		

Method of Shipment:
Sample Condition Upon Receipt:

Relinquished by:	Date/Time:	Received by:	Date/Time:
[signature]	5/24/21 1530	[signature]	5/27/21 10:40A

Controlled Document - COC-55 Lead R16 4/19/2021

*6010C Available Upon Request

☐ AGREE TO ELECTRONIC SIGNATURE (By checking, I consent to signing this Chain of Custody document by electronic signature.)

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*missing samples # 1+2; Client notified (up)

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Lead Chain of Custody

EMSL Order Number / Lab Use Only

202104321

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EMAIL: CinnaminsonLeadLab@emsl.com

Additional Pages of the Chain of Custody are only necessary if needed for additional sample information

Special Instructions and/or Regulatory Requirements (Sample Specifications, Processing Methods, Limits of Detection, etc.)

Sample Number	Sample Location	Volume / Area	Date / Time Sampled
BLDG14-05	1st Fl Rm 127 (Lt tan)	2"x2"	5/25 0940
BLDG14-06	Rm 108 (BEIGE) Sm.		0943
BLDG14-07	STORAGE RM 04 Sm (Lt Green)		0949
BLDG14-08	Ground Fl. kitchen (white)	2"x2"	5/25 1120
BLDG14-09	Rm 17 (Green+blue)		1130
BLDG14-10	Storage Rm 4 (Lt Green)		1141
BLDG14-11	Rm 17A Sm (RED brown)		1200

Method of Shipment:		Sample Condition Upon Receipt:	
Relinquished by: Sammy Nam	Date/Time: 5/24/21	Received by:	Date/Time
Relinquished by:	Date/Time:	Received by:	Date/Time

Controlled Document - COC-25 Lead R16 4/19/2021

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200 Route 130 North Cinnaminson, NJ 08077
Tel/Fax: (800) 220-3675 / (856) 786-5974
http://www.EMSL.com / cinnasblab@EMSL.com

EMSL Order: 042112632
Customer ID: JAWO50
Customer PO:
Project ID:

Attention: Adam Frey
Terracon Consultants, Inc.
77 Sundial Avenue
Suite 401-W
Manchester, NH 03103
Project: Building 14 / J2217018

Phone: (603) 647-9700
Fax: (603) 647-4432
Received Date: 05/27/2021 9:30 AM
Analysis Date: 06/02/2021 - 06/03/2021
Collected Date:

Test Report:Asbestos Analysis of Bulk Material

Test	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos
Sample ID 1A		**Description**	Room 8, Above Terrazzo Flooring - Carpet Mastic		
042112632-0001		**Homogeneity**	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	06/03/2021	Yellow		100.00% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	06/03/2021	Yellow		100.00% Other	**None Detected**
Sample ID 1B		**Description**	Room 8H - Carpet Mastic		
042112632-0002		**Homogeneity**	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	06/03/2021	Yellow		100.00% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	06/03/2021	Yellow		100.00% Other	**None Detected**
Sample ID 1C		**Description**	Room 8F - Carpet Mastic		
042112632-0003		**Homogeneity**	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	06/03/2021	Yellow		100.00% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	06/03/2021	Yellow		100.00% Other	**None Detected**
Sample ID 2A		**Description**	Room 6 - Mastic of Laminate Floor		
042112632-0004		**Homogeneity**	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	06/03/2021	Tan		100.00% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	06/03/2021	Tan		100.00% Other	**None Detected**
Sample ID 2B		**Description**	Room 6 - Mastic of Laminate Floor		
042112632-0005		**Homogeneity**	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	06/03/2021	Tan		100.00% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	06/03/2021	Tan		100.00% Other	**None Detected**

Initial report from: 06/04/2021 10:02:35

EMSL Analytical, Inc.
200 Route 130 North Cinnaminson, NJ 08077
Tel/Fax: (800) 220-3675 / (856) 786-5974
http://www.EMSL.com / cinnasblab@EMSL.com

EMSL Order: 042112632
Customer ID: JAWO50
Customer PO:
Project ID:

Test Report:Asbestos Analysis of Bulk Material

Test	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos
Sample ID 2C		**Description**	Room 6 - Mastic of Laminate Floor		
042112632-0006		**Homogeneity**	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	06/03/2021	Tan		100.00% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	06/03/2021	Tan		100.00% Other	**None Detected**
Sample ID 3A		**Description**	Room 19C - 9"x9" Black Floor Tile		
042112632-0007		**Homogeneity**	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	06/03/2021	Black	None	97.50% Other	**2.50% Chrysotile**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 3B		**Description**	Room 19C - 9"x9" Black Floor Tile		
042112632-0008		**Homogeneity**	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	06/03/2021	Black	None	96.60% Other	**3.40% Chrysotile**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 3C		**Description**	Room 19C - 9"x9" Black Floor Tile		
042112632-0009		**Homogeneity**	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	06/03/2021	Black	None	97.20% Other	**2.80% Chrysotile**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 4A		**Description**	Room 19C - 9"x9" Black Floor Tile Mastic		
042112632-0010		**Homogeneity**	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	06/03/2021	Black	None	98.30% Other	**1.70% Chrysotile**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 4B		**Description**	Room 19C - 9"x9" Black Floor Tile Mastic		
042112632-0011		**Homogeneity**	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	06/03/2021	Black	None	97.80% Other	**2.20% Chrysotile**
TEM NYS 198.4 NOB					**Not Analyzed**

Initial report from: 06/04/2021 10:02:35

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http://www.EMSL.com / cinnasblab@EMSL.com

EMSL Order: 042112632
Customer ID: JAWO50
Customer PO:
Project ID:

Test Report:Asbestos Analysis of Bulk Material

Test	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos
Sample ID 4C		**Description**	Room 19C - 9"x9" Black Floor Tile Mastic		
042112632-0012		**Homogeneity**	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	06/03/2021	Black	None	100.00% Other	**Inconclusive : <1% Chrysotile**
TEM NYS 198.4 NOB	06/03/2021	Black	None	95.40% Other	**4.60% Chrysotile**
Sample ID 5A		**Description**	Room 21 - 12"x12" Gray Floor Tile w./ Blue/Pink Specs		
042112632-0013		**Homogeneity**	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	06/03/2021	Gray/ Various		100.00% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	06/03/2021	Gray/ Various		100.00% Other	**None Detected**
Sample ID 5B		**Description**	Room 21 - 12"x12" Gray Floor Tile w./ Blue/Pink Specs		
042112632-0014		**Homogeneity**	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	06/03/2021	Gray/ Various		100.00% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	06/03/2021	Gray/ Various		100.00% Other	**None Detected**
Sample ID 5C		**Description**	Room 21 - 12"x12" Gray Floor Tile w./ Blue/Pink Specs		
042112632-0015		**Homogeneity**	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	06/03/2021	Gray/ Various		100.00% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	06/03/2021	Gray/ Various		100.00% Other	**None Detected**
Sample ID 6A		**Description**	Room 21 - Mastic of 12"x12" Gray Floor Tile		
042112632-0016		**Homogeneity**			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	06/03/2021				**Insufficient Material**
TEM NYS 198.4 NOB	06/03/2021				**Insufficient Material**
Sample ID 6B		**Description**	Room 21 - Mastic of 12"x12" Gray Floor Tile		
042112632-0017		**Homogeneity**	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	06/03/2021	Tan/ Yellow		100.00% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	06/03/2021	Tan/ Yellow		100.00% Other	**None Detected**

Initial report from: 06/04/2021 10:02:35

EMSL Analytical, Inc.
200 Route 130 North Cinnaminson, NJ 08077
Tel/Fax: (800) 220-3675 / (856) 786-5974
http://www.EMSL.com / cinnasblab@EMSL.com

EMSL Order: 042112632
Customer ID: JAWO50
Customer PO:
Project ID:

Test Report:Asbestos Analysis of Bulk Material

Test	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos
Sample ID 6C		**Description**	Room 21 - Mastic of 12"x12" Gray Floor Tile		
042112632-0018		**Homogeneity**	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	06/03/2021	Tan/ Yellow		100.00% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	06/03/2021	Tan/ Yellow		100.00% Other	**None Detected**
Sample ID 7A		**Description**	Basement, Pipe - Glass-Like Insulation		
042112632-0019		**Homogeneity**	Homogeneous		
PLM NYS 198.1 Friable	06/02/2021	Yellow	<1.00% Cellulose 95.00% Min. Wool	5.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 7B		**Description**	Basement, Pipe - Glass-Like Insulation		
042112632-0020		**Homogeneity**	Homogeneous		
PLM NYS 198.1 Friable	06/02/2021	Yellow	<1.00% Cellulose 98.00% Min. Wool	2.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 7C		**Description**	Basement, Pipe - Glass-Like Insulation		
042112632-0021		**Homogeneity**	Homogeneous		
PLM NYS 198.1 Friable	06/02/2021	Yellow	92.00% Min. Wool	8.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 8A		**Description**	Basement, Pipe - Insulation Wrap		
042112632-0022		**Homogeneity**	Heterogeneous		
PLM NYS 198.1 Friable	06/02/2021	White/ Yellow	25.00% Min. Wool	75.00% Non-fibrous (other)	**None Detected**
Sample contains mostly paint layer with fiber insulation. Only fiber insulation analyzed.					
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 8B		**Description**	Basement, Pipe - Insulation Wrap		
042112632-0023		**Homogeneity**	Heterogeneous		
PLM NYS 198.1 Friable	06/02/2021	White/ Silver/ Yellow	60.00% Cellulose 10.00% Glass	20.00% Matrix 10.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**

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EMSL Order: 042112632
Customer ID: JAWO50
Customer PO:
Project ID:

Test Report:Asbestos Analysis of Bulk Material

Test	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos
Sample ID 8C *042112632-0024*		**Description**	Basement, Pipe - Insulation Wrap		
		Homogeneity	Heterogeneous		
PLM NYS 198.1 Friable	06/02/2021	White/ Yellow	40.00% Min. Wool	60.00% Non-fibrous (other)	**None Detected**
Sample contains mostly paint layer with fiber insulation. Only fiber insulation analyzed.					
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 9A *042112632-0025*		**Description**	North Stairwell, Exterior Window - Window Caulk(Gray)		
		Homogeneity	Heterogeneous/Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	06/03/2021	Brown/ Gray/ Tan	None	100.00% Other	**Inconclusive : <1% Chrysotile**
TEM NYS 198.4 NOB	06/03/2021	Brown/ Gray/ Tan	None	98.50% Other	**1.50% Chrysotile**
Sample ID 9B *042112632-0026*		**Description**	North Stairwell, Exterior Window - Window Caulk(Gray)		
		Homogeneity	Heterogeneous/Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	06/03/2021	Brown/ Gray/ Tan	<1.00% Glass	100.00% Other	**Inconclusive : <1% Chrysotile**
TEM NYS 198.4 NOB	06/03/2021	Brown/ Gray/ Tan	None	98.70% Other	**1.30% Chrysotile**
Sample ID 9C *042112632-0027*		**Description**	North Stairwell, Exterior Window - Window Caulk(Gray)		
		Homogeneity	Heterogeneous/Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	06/03/2021	Brown/ Gray/ White		100.00% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	06/03/2021	Brown/ Gray/ White	None	98.90% Other	**1.10% Chrysotile**
Sample ID 10A *042112632-0028*		**Description**	North Stairwell, Exterior Window - Window Caulk (Black)		
		Homogeneity	Heterogeneous/Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	06/03/2021	Red/ Black	None	100.00% Other	**Inconclusive : <1% Chrysotile**
TEM NYS 198.4 NOB	06/03/2021	Red/ Black	None	97.80% Other	**2.20% Chrysotile**
Sample ID 10B *042112632-0029*		**Description**	North Stairwell, Exterior Window - Window Caulk (Black)		
		Homogeneity	Heterogeneous/Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	06/03/2021	Red/ Black	None	100.00% Other	**Inconclusive : <1% Chrysotile**
TEM NYS 198.4 NOB	06/03/2021	Red/ Black	None	98.70% Other	**1.30% Chrysotile**

Initial report from: 06/04/2021 10:02:35

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http://www.EMSL.com / cinnasblab@EMSL.com

EMSL Order: 042112632
Customer ID: JAWO50
Customer PO:
Project ID:

Test Report:Asbestos Analysis of Bulk Material

Test	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Fibrous	Asbestos
Sample ID 10C		**Description**	North Stairwell, Exterior Window - Window Caulk (Black)		
042112632-0030		**Homogeneity**	Heterogeneous/Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	06/03/2021	Red/ Black	None	100.00% Other	**Inconclusive : <1% Chrysotile**
TEM NYS 198.4 NOB	06/03/2021	Red/ Black	None	98.80% Other	**1.20% Chrysotile**

Initial report from: 06/04/2021 10:02:35

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EMSL Order:	042112632
Customer ID:	JAWO50
Customer PO:	
Project ID:	

Test Report:Asbestos Analysis of Bulk Material

The samples in this report were submitted to EMSL for analysis by Asbestos Analysis of Bulk Materials via NYS ELAP Approved Methods . The reference number for these samples is the EMSL Order ID above. Please use this reference number when calling about these samples.

Report Comments:

Sample Receipt Date:	5/27/2021	Sample Receipt Time:	9:30 AM
Analysis Completed Date:	6/2/2021	Analysis Completed Time:	2:42 PM

Analyst(s):

Tomas Montes De Oca PLM NYS 198.1 Friable (6)

Steve Jusczuk PLM NYS 198.6 NOB (23)

Jackson Li TEM NYS 198.4 NOB (18)

Samples reviewed and approved by:

Samantha Rundstrom, Laboratory Manager
or Other Approved Signatory

EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. Results are generated from the field sampling data (sampling volumes and areas, locations, etc.) provided by the client on the Chain of Custody. Samples are within quality control criteria and met method specifications unless otherwise noted. Estimation of uncertainty available upon request. This report is a summary of multiple methods of analysis, fully compliant reports are available upon request. All samples examined for the presence of vermiculite when analyzed via NYS 198.1. A combination of PLM and TEM analysis may be necessary to ensure consistently reliable detection of asbestos . Polarized-light microscopy is not consistently reliable in detecting asbestos in floor coverings and similar non-friable organically bound materials. This report must not be used to claim product endorsement by NVLAP of any agency or the U.S. Government . Quantitative transmission electron microscopy is currently the only method that can be used to determine if this material can be considered or treated as non-asbestos containing. NOB= Non friable organically bound; N/A= Not applicable VCM= Vermiculite containing material.

Samples analyzed by EMSL Analytical, Inc. Carle Place, NY NYS ELAP 11469, NVLAP Lab Code 101048-10

Initial report from: 06/04/2021 10:02:35

OrderID: 042112632

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Asbestos Bulk Building Materials - Chain of Custody

EMSL Order Number / Lab Use Only: 042112632

EMSL Analytical, Inc.
200 Route 130 North
Cinnaminson, NJ 08077

PHONE: (800) 220-3675
EMAIL: CinnAsblab@EMSL.com

Customer Information		Billing Information	
Customer ID:		Billing ID:	
Company Name:	Terracon Consultants, Inc.	Company Name:	Terracon Consultants, Inc.
Contact Name:	Adam Frey	Billing Contact:	Don Pomeroy
Street Address:	201 Hammer Mill Road	Street Address:	201 Hammer Mill Road
City, State, Zip:	Rocky Hill, CT 06067 — Country: USA	City, State, Zip:	Rocky Hill, CT 06067 — Country: USA
Phone:	603 300 2506	Phone:	(401) 500-3117
Email(s) for Report:	adam.frey@terracon.com	Email(s) for Invoice:	don.pomeroy@terracon.com

Project Information

Project Name/No: Building 14 / J2217018

Purchase Order:

EMSL LIMS Project ID: (If applicable, EMSL will provide)

US State where samples collected: NY

State of Connecticut (CT) must select project location: ☐ Commercial (Taxable) ☐ Residential (Non-Taxable)

Sampled By Name: J. Rivera

Sampled By Signature:

No. of Samples in Shipment:

Turn-Around-Time (TAT)

☐ 3 Hour ☐ 6 Hour ☐ 24 Hour ☐ 32 Hour ☐ 48 Hour ☐ 72 Hour ☐ 96 Hour ☒ 1 Week ☐ 2 Week

Please call ahead for large projects and/or turnaround times 6 Hours or Less. *32 Hour TAT available for select tests only; samples must be submitted by 11:30am.

RECEIVED EMSL CINNAMINSON, NJ 21 MAY 27 AM 10: 24

Test Selection

PLM - Bulk (reporting limit)

- ☒ PLM EPA 600/R-93/116 (<1%)
- ☐ PLM EPA NOB (<1%)
- ☐ POINT COUNT
  - ☐ 400 (<0.25%) ☐ 1,000 (<0.1%)
- POINT COUNT w/ GRAVIMETRIC
  - ☐ 400 (<0.25%) ☐ 1,000 (<0.1%)
- ☐ NIOSH 9002 (<1%)
- ☒ NYS 198.1 (Friable - NY)
- ☒ NYS 198.6 NOB (Non-Friable - NY)
- ☐ NYS 198.8 (Vermiculite SM-V)

TEM - Bulk

- ☐ TEM - Bulk
- ☐ TEM EPA NOB
- ☒ NYS NOB 198.4 (Non-Friable-NY)
- ☐ TEM EPA 600/R-93/116 w Milling Prep (0.1%)

Other Tests (please specify)

☐ Positive Stop - Clearly Identified Homogeneous Areas (HA)

Sample Number	HA Number	Sample Location	Material Description
1A		Room 8, above Terrazo flooring	Carpet mastic
1B		Room 8H	↓
1C		Room 8F ↓	↓
2A		Room 6	mastic of laminate floor
2B		↓	↓
2C		↓	↓
3A		Room 19c	9x9" Black Floor Tile
3B		↓	↓
3C		↓	↓
4A		Room 19c	9x9" Black Floor Tile (MASTIC)

Special Instructions and/or Regulatory Requirements (Sample Specifications, Processing Methods, Limits of Detection, etc.)

Method of Shipment:

Sample Condition Upon Receipt:

Relinquished by: J. Rivera	Date/Time: 5/25/21 0700	Received by:	Date/Time: 5/27/21
Relinquished by:	Date/Time:	Received by:	Date/Time

Controlled Document - Asbestos Bulk R5 03/18/2021

☐ **AGREE TO ELECTRONIC SIGNATURE** (By checking, I consent to signing this Chain of Custody document by electronic signature.)

EMSL Analytical, Inc.'s Laboratory Terms and Conditions are incorporated into this Chain of Custody by reference in their entirety. Submission of samples to EMSL Analytical, Inc. constitutes acceptance and acknowledgment of all terms and conditions by Customer.

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Asbestos Bulk Building Materials - Chain of Custody

EMSL Order Number / Lab Use Only: 042112632

EMSL Analytical, Inc.
200 Route 130 North
Cinnaminson, NJ 08077

PHONE: (800) 220-3675
EMAIL: CinnAsblab@EMSL.com

Additional Pages of the Chain of Custody are only necessary if needed for additional sample information

Special Instructions and/or Regulatory Requirements (Sample Specifications, Processing Methods, Limits of Detection, etc.)

Sample Number	HA Number	Sample Location	Material Description
4B		Room 19C	Mastic of Black 9x9 Floor Tile
4C		↓	↓
5A		Room 21	12x12 Gray Floor Tile w Blue/pink specs
5B			↓
5C			
6A			Mastic of 12x12 Gray Floor Tile
6B			↓
6C			
7A		Pipe basement	Glass-like insulation
7B			↓
7C			
8A			Insulation wrap
8B			↓
8C			
9A		North stairwell, exterior window	window caulk (grey)
9B		↓	↓
9C			
10A		North stairwell exterior window (header)	window caulk (black)
10B		↓	↓
10C			

RECEIVED EMSL CINNAMINSON, NJ 21 MAY 27 AM 10:24

Method of Shipment:		Sample Condition Upon Receipt:	
Relinquished by: J. Rivera	Date/Time: 5/25/21 0700	Received by:	Date/Time
Relinquished by:	Date/Time:	Received by:	Date/Time

Controlled Document - Asbestos Bulk R5 03/18/2021

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EMSL Analytical, Inc.
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (800) 220-3675 / (856) 786-5974
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EMSL Order:	042112626
CustomerID:	JAWO50
CustomerPO:	
ProjectID:	

Attn: **Adam Frey**
Terracon Consultants, Inc.
77 Sundial Avenue
Suite 401-W
Manchester, NH 03103

Phone:	(603) 647-9700
Fax:	(603) 647-4432
Received:	05/27/21 9:30 AM
Analysis Date:	6/4/2021
Collected:	

Project: **Building 14 / J2217018**

Test Report:Asbestos Analysis of Bulk Material

Test	Analyzed Date	Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 1A *042112626-0001*		**Description** Room 128 - Carpet Glue **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/4/2021	Yellow		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/4/2021	Yellow		100% Other	**None Detected**
Sample ID 1B *042112626-0002*		**Description** East Corridor - Carpet Glue **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/4/2021	Yellow		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/4/2021	Yellow		100% Other	**None Detected**
Sample ID 1C *042112626-0003*		**Description** West Corridor - Carpet Glue **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/4/2021	Yellow		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/4/2021	Yellow		100% Other	**None Detected**
Sample ID 2A *042112626-0004*		**Description** Room 128 - 2'x2' Ceiling Tile **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/4/2021	Tan/White	57% Min. Wool	43% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/4/2021	Tan/White		100% Other	**None Detected**
Sample ID 2B *042112626-0005*		**Description** Corridor 1742 - 2'x2' Ceiling Tile **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/4/2021	Tan/White	60% Min. Wool	40% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/4/2021	Tan/White		100% Other	**None Detected**

Initial Report From 06/04/2021 16:32:17

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EMSL Order:	042112626
CustomerID:	JAWO50
CustomerPO:	
ProjectID:	

Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 2C *042112626-0006*		**Description** Room 134 - 2'x2' Ceiling Tile **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/4/2021	Tan/White	67% Min. Wool	33% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/4/2021	Tan/White		100% Other	**None Detected**
Sample ID 3A *042112626-0007*		**Description** Room 128 - Cove Base (Brown) **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/4/2021	Brown		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/4/2021	Brown		100% Other	**None Detected**
Sample ID 3B *042112626-0008*		**Description** West Corridor - Cove Base (Brown) **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/4/2021	Brown		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/4/2021	Brown		100% Other	**None Detected**
Sample ID 3C *042112626-0009*		**Description** East Corridor - Cove Base (Brown) **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/4/2021	Brown		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/4/2021	Brown		100% Other	**None Detected**
Sample ID 4A *042112626-0010*		**Description** Room 128 - Cove Base Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/4/2021	Yellow		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/4/2021	Yellow		100% Other	**None Detected**
Sample ID 4B *042112626-0011*		**Description** West Corridor - Cove Base Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/4/2021	Yellow		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/4/2021	Yellow		100% Other	**None Detected**

Initial Report From 06/04/2021 16:32:17

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EMSL Order:	042112626
CustomerID:	JAWO50
CustomerPO:	
ProjectID:	

Test Report:Asbestos Analysis of Bulk Material

Test		Color	Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 4C *042112626-0012*		**Description**	East Corridor - Cove Base Mastic		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/4/2021	Yellow		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/4/2021	Yellow		100% Other	**None Detected**
Sample ID 5A *042112626-0013*		**Description**	Room 114 - Cove Base (Gray)		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/4/2021	Gray		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/4/2021	Gray		100% Other	**None Detected**
Sample ID 5B *042112626-0014*		**Description**	Room 114E - Cove Base (Gray)		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/4/2021	Gray		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/4/2021	Gray		100% Other	**None Detected**
Sample ID 5C *042112626-0015*		**Description**	Room 114E - Cove Base (Gray)		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/4/2021	Gray		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/4/2021	Gray		100% Other	**None Detected**
Sample ID 6A *042112626-0016*		**Description**	Room 114 - Cove Base Mastic		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/4/2021	Tan		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/4/2021	Tan		100% Other	**None Detected**
Sample ID 6B *042112626-0017*		**Description**	Room 114E - Cove Base Mastic		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/4/2021	Tan		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/4/2021	Tan		100% Other	**None Detected**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 6C *042112626-0018*		**Description** Room 114E - Cove Base Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/4/2021	Tan		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/4/2021	Tan		100% Other	**None Detected**
Sample ID 7A *042112626-0019*		**Description** Room 106A - White Ceramic Tile **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/2/2021	White		5.00% Quartz 25.00% Ca Carbonate 70.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 7B *042112626-0020*		**Description** Room 106A - White Ceramic Tile **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/2/2021	White		5.00% Quartz 10.00% Ca Carbonate 85.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 7C *042112626-0021*		**Description** Room 129 - White Ceramic Tile **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/2/2021	White		5.00% Quartz 30.00% Ca Carbonate 65.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 8A *042112626-0022*		**Description** Room 106A - White Ceramic Tile Glue **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/4/2021	White		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/4/2021	White		100% Other	**None Detected**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 8B *042112626-0023*		**Description** **Homogeneity**	Room 129 - White Ceramic Tile Glue Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/4/2021	White		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/4/2021	White		100% Other	**None Detected**
Sample ID 8C *042112626-0024*		**Description** **Homogeneity**	Room 129 - White Ceramic Tile Glue Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/4/2021	White		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/4/2021	White		100% Other	**None Detected**
Sample ID 9A *042112626-0025*		**Description** **Homogeneity**	Room 106A - White Ceramic Tile Grout Homogeneous		
PLM NYS 198.1 Friable	6/2/2021	White		4.00% Mica 81.00% Ca Carbonate 15.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 9B *042112626-0026*		**Description** **Homogeneity**	Room 106A - White Ceramic Tile Grout Homogeneous		
PLM NYS 198.1 Friable	6/2/2021	White		8.00% Quartz 22.00% Ca Carbonate 70.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 9C *042112626-0027*		**Description** **Homogeneity**	Room 129 - White Ceramic Tile Grout Homogeneous		
PLM NYS 198.1 Friable	6/2/2021	White		55.00% Ca Carbonate 45.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 10A *042112626-0028*		**Description** **Homogeneity**	Room 106A - Beige Ceramic Tile Homogeneous		
PLM NYS 198.1 Friable	6/2/2021	White		5.00% Quartz 95.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 10B *042112626-0029*		**Description** **Homogeneity**	West Corridor, Water Fountain - Beige Ceramic Tile Homogeneous		
PLM NYS 198.1 Friable	6/2/2021	White		5.00% Quartz 95.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 10C *042112626-0030*		**Description** **Homogeneity**	West Corridor, Water Fountain - Beige Ceramic Tile Homogeneous		
PLM NYS 198.1 Friable	6/2/2021	White		5.00% Quartz 25.00% Ca Carbonate 70.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 11A *042112626-0031*		**Description** **Homogeneity**	Room 106A - Beige Ceramic Tile Glue Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/4/2021	Black		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/4/2021	Black		100% Other	**None Detected**
Sample ID 11B *042112626-0032*		**Description** **Homogeneity**	West Corridor, Water Fountain - Beige Ceramic Tile Glue Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/4/2021	Black		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/4/2021	Black		100% Other	**None Detected**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 11C *042112626-0033*		**Description** West Corridor, Water Fountain - Beige Ceramic Tile Glue **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/4/2021	Black		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/4/2021	Black		100% Other	**None Detected**
Sample ID 12A *042112626-0034*		**Description** Room 106A - Beige Ceramic Tile Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/2/2021	White		4.00% Mica 81.00% Ca Carbonate 15.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 12B *042112626-0035*		**Description** West Corridor, Water Fountain - Beige Ceramic Tile Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/2/2021	White		3.00% Mica 87.00% Ca Carbonate 10.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 12C *042112626-0036*		**Description** West Corridor, Water Fountain - Beige Ceramic Tile Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/2/2021	White		3.00% Mica 77.00% Ca Carbonate 20.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 13A *042112626-0037*		**Description** Room 130 - Pipe Fitting **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable	6/2/2021	Gray/Tan	85.00% Cellulose	14.75% Non-fibrous (other)	**0.25% Chrysotile**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 13B *042112626-0038*		**Description** **Homogeneity**	Room 130 - Pipe Fitting Heterogeneous		
PLM NYS 198.1 Friable	6/2/2021	Gray/Tan	55.00% Cellulose	44.50% Non-fibrous (other)	**0.50% Chrysotile**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 13C *042112626-0039*		**Description** **Homogeneity**	Room 130 - Pipe Fitting Heterogeneous		
PLM NYS 198.1 Friable	6/2/2021	Gray/Tan	70.00% Cellulose	29.75% Non-fibrous (other)	**0.25% Chrysotile**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 14A *042112626-0040*		**Description** **Homogeneity**	Room 106A - 12"x12" Beige Ceramic Floor Tile Heterogeneous		
PLM NYS 198.1 Friable	6/2/2021	Brown/Tan		15.00% Quartz 85.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 14B *042112626-0041*		**Description** **Homogeneity**	Room 129 - 12"x12" Beige Ceramic Floor Tile Heterogeneous		
PLM NYS 198.1 Friable	6/2/2021	Brown/Tan		20.00% Quartz 80.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 14C *042112626-0042*		**Description** **Homogeneity**	Room 129 - 12"x12" Beige Ceramic Floor Tile Heterogeneous		
PLM NYS 198.1 Friable	6/2/2021	Brown/Tan		20.00% Quartz 80.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 15A *042112626-0043*		**Description** **Homogeneity**	Room 106A - Glue of Beige Ceramic Floor Tile Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/4/2021	Black		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/4/2021	Black		100% Other	**None Detected**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 15B *042112626-0044*		**Description**	Room 129 - Glue of Beige Ceramic Floor Tile		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/4/2021	White		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/4/2021	White		100% Other	**None Detected**
Sample ID 15C *042112626-0045*		**Description**	Room 129 - Glue of Beige Ceramic Floor Tile		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/4/2021	White		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/4/2021	White		100% Other	**None Detected**
Sample ID 16A *042112626-0046*		**Description**	Room 106A - Grout of Beige Ceramic Floor Tile		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable	6/2/2021	Gray		55.00% Quartz 20.00% Ca Carbonate 25.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 16B *042112626-0047*		**Description**	Room 129 - Grout of Beige Ceramic Floor Tile		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable	6/2/2021	Brown/Gray		50.00% Quartz 20.00% Ca Carbonate 30.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 16C *042112626-0048*		**Description**	Room 129 - Grout of Beige Ceramic Floor Tile		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable	6/2/2021	Brown/Gray		50.00% Quartz 20.00% Ca Carbonate 30.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 17A *042112626-0049*		**Description** **Homogeneity**	Room 128A - Pipe Insulation Homogeneous		
PLM NYS 198.1 Friable	6/2/2021	Gray/Tan	93.00% Cellulose	7.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 17B *042112626-0050*		**Description** **Homogeneity**	Room 128A - Pipe Insulation Homogeneous		
PLM NYS 198.1 Friable	6/2/2021	Gray/Tan	90.00% Cellulose	9.75% Non-fibrous (other)	**0.25% Chrysotile**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 17C *042112626-0051*		**Description** **Homogeneity**	Room 128A - Pipe Insulation Homogeneous		
PLM NYS 198.1 Friable	6/2/2021	Gray/Tan	95.00% Cellulose	5.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 18A *042112626-0052*		**Description** **Homogeneity**	Room 134 - Plaster (Base Coat) Homogeneous		
PLM NYS 198.1 Friable	6/2/2021	Gray/Tan		65.00% Quartz 20.00% Gypsum 8.00% Ca Carbonate 7.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 18B *042112626-0053*		**Description** **Homogeneity**	Corridor Outside Room 134 - Plaster (Base Coat) Homogeneous		
PLM NYS 198.1 Friable	6/2/2021	Gray/Tan		60.00% Quartz 27.00% Gypsum 5.00% Ca Carbonate 8.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 18C *042112626-0054*		**Description** **Homogeneity**	Room 101A - Plaster (Base Coat) Homogeneous		
PLM NYS 198.1 Friable	6/2/2021	Gray/Tan		60.00% Quartz 28.00% Gypsum 5.00% Ca Carbonate 7.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 18D *042112626-0055*		**Description** **Homogeneity**	Room 108 - Plaster (Base Coat) Homogeneous		
PLM NYS 198.1 Friable	6/2/2021	Gray/Tan		68.00% Quartz 20.00% Gypsum 7.00% Ca Carbonate 5.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 18E *042112626-0056*		**Description** **Homogeneity**	Corridor Outside Room 137 - Plaster (Base Coat) Homogeneous		
PLM NYS 198.1 Friable	6/2/2021	Gray/Tan		65.00% Quartz 25.00% Gypsum 5.00% Ca Carbonate 5.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 19A *042112626-0057*		**Description** **Homogeneity**	Room 134 - Plaster (Skim Coat) Homogeneous		
PLM NYS 198.1 Friable	6/2/2021	White		90.00% Gypsum 5.00% Ca Carbonate 5.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 19B *042112626-0058*		**Description** Corridor Outside Room 134 - Plaster (Skim Coat) **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/2/2021	White		90.00% Gypsum 5.00% Ca Carbonate 5.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 19C *042112626-0059*		**Description** Room 101A - Plaster (Skim Coat) **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/2/2021	White		90.00% Gypsum 5.00% Ca Carbonate 5.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 19D *042112626-0060*		**Description** Room 108 - Plaster (Skim Coat) **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/2/2021	White		90.00% Gypsum 5.00% Ca Carbonate 5.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 19E *042112626-0061*		**Description** Corridor Outside Room 137 - Plaster (Skim Coat) **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/2/2021	White		90.00% Gypsum 5.00% Ca Carbonate 5.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 20A *042112626-0062*		**Description** Room 108 - Sheetrock **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable	6/2/2021	Gray/Tan	<1% Glass 5.00% Cellulose	75.00% Gypsum 15.00% Ca Carbonate 5.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**

Initial Report From 06/04/2021 16:32:17

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200 Route 130 North, Cinnaminson, NJ 08077
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http://www.EMSL.com cinnasblab@EMSL.com

EMSL Order:	042112626
CustomerID:	JAWO50
CustomerPO:	
ProjectID:	

Test Report:Asbestos Analysis of Bulk Material

Test		Color	Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 20B *042112626-0063*		**Description** **Homogeneity**	Room 124 - Sheetrock Heterogeneous		
PLM NYS 198.1 Friable	6/2/2021	Gray/Tan	<1% Glass 12.00% Cellulose	70.00% Gypsum 13.00% Ca Carbonate 5.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 20C *042112626-0064*		**Description** **Homogeneity**	Room 126 - Sheetrock Heterogeneous		
PLM NYS 198.1 Friable	6/2/2021	Gray/Tan	<1% Glass 4.00% Cellulose	70.00% Gypsum 21.00% Ca Carbonate 5.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 20D *042112626-0065*		**Description** **Homogeneity**	Room 132 - Sheetrock Heterogeneous		
PLM NYS 198.1 Friable	6/2/2021	Gray/Tan	<1% Glass 6.00% Cellulose	70.00% Gypsum 19.00% Ca Carbonate 5.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 20E *042112626-0066*		**Description** **Homogeneity**	Room 168 - Sheetrock Heterogeneous		
PLM NYS 198.1 Friable	6/2/2021	Gray/Tan	<1% Glass 4.00% Cellulose	70.00% Gypsum 21.00% Ca Carbonate 5.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 21A *042112626-0067*		**Description** **Homogeneity**	Room 108 - Joint Compound Homogeneous		
PLM NYS 198.1 Friable	6/2/2021	White		6.00% Mica 74.00% Ca Carbonate 20.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**

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EMSL Order:	042112626
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ProjectID:	

Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 21B *042112626-0068*		**Description** Room 124 - Joint Compound **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/2/2021	White		3.00% Mica 87.00% Ca Carbonate 10.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 21C *042112626-0069*		**Description** Room 126 - Joint Compound **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable	6/2/2021	Tan/White	12.00% Cellulose	3.00% Mica 70.00% Ca Carbonate 15.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 21D *042112626-0070*		**Description** Room 132 - Joint Compound **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/2/2021	White		3.00% Mica 82.00% Ca Carbonate 15.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 21E *042112626-0071*		**Description** Room 168 - Joint Compound **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/2/2021	White		4.00% Mica 76.00% Ca Carbonate 20.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**

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EMSL Order:	042112626
CustomerID:	JAWO50
CustomerPO:	
ProjectID:	

Test Report:Asbestos Analysis of Bulk Material

Test	Color	Fibrous	Non-Fibrous	Asbestos
			Non Asbestos	

Analyst(s)

Rosemary Ortega

Steve Jusczuk

Tomas Montes De Oca

Samantha Rundstrom, Laboratory Manager
or other approved signatory

NOB = Non Friable Organically Bound N/A = Not Applicable VCM = Vermiculite Containing Material

-In New York State, TEM is currently the only method that can be used to determine if NOB materials can be considered or treated as non-asbestos containing.
All samples examined for the presence of vermiculite when analyzed via NYS 198.1.
-NYS Guidelines for Vermiculite containing samples are available at http://www.wadsworth.org/labcert/elapcert/forms/VermiculiteInterimGuidance_Rev070913.pdf
EMSL maintains liability limited to cost of analysis. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. Samples were received in good condition unless otherwise noted.
This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government. This report may contain data that is not covered by the NVLAP accreditation.

Samples analyzed by EMSL Analytical, Inc. Carle Place, NY NYS ELAP 11469, NVLAP Lab Code 101048-10

Initial Report From 06/04/2021 16:32:17

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Asbestos Bulk Building Materials - Chain of Custody

EMSL Order Number / Lab Use Only: 042112626

EMSL Analytical, Inc.
200 Route 130 North
Cinnaminson, NJ 08077
PHONE: (800) 220-3675
EMAIL: CinnAsblab@EMSL.com

Customer Information		Billing Information	
Customer ID:		Billing ID:	
Company Name:	Terracon Consultants, Inc.	Company Name:	Terracon Consultants, Inc.
Contact Name:	Adam Frey	Billing Contact:	Don Pomeroy
Street Address:	201 Hammer Mill Road	Street Address:	201 Hammer Mill Road
City, State, Zip:	Rocky Hill, CT 06067 — Country: USA	City, State, Zip:	Rocky Hill, CT 06067 — Country: USA
Phone:	603 300 2506	Phone:	(401) 500-3117
Email(s) for Report:	adam.frey@terracon.com	Email(s) for Invoice:	don.pomeroy@terracon.com

Project Information

Project Name/No: Building 14 / J2217018
Purchase Order:
EMSL LIMS Project ID: (If applicable, EMSL will provide)
US State where samples collected: NY
State of Connecticut (CT) must select project location: ☐ Commercial (Taxable) ☐ Residential (Non-Taxable)
Sampled By Name: J. Rivera
Sampled By Signature:
No. of Samples in Shipment

Turn Around-Time (TAT)

☐ 3 Hour ☐ 6 Hour ☐ 24 Hour ☐ 32 Hour ☐ 48 Hour ☐ 72 Hour ☐ 96 Hour ☒ 1 Week ☐ 2 Week

Please call ahead for large projects and/or turnaround times 6 Hours or Less. *32 Hour TAT available for select tests only; samples must be submitted by 11:30am.

Test Selection

PLM - Bulk (reporting limit)
- ☒ PLM EPA 600/R-93/116 (<1%)
- ☐ PLM EPA NOB (<1%)
- ☐ POINT COUNT
  - ☐ 400 (<0.25%) ☐ 1,000 (<0.1%)
- POINT COUNT w/ GRAVIMETRIC
  - ☐ 400 (<0.25%) ☐ 1,000 (<0.1%)
- ☐ NIOSH 9002 (<1%)
- ☒ NYS 198.1 (Friable - NY)
- ☒ NYS 198.6 NOB (Non-Friable - NY)
- ☐ NYS 198.8 (Vermiculite SM-V)

TEM - Bulk
- ☐ TEM - Bulk
- ☐ TEM EPA NOB
- ☒ NYS NOB 198.4 (Non-Friable-NY)
- ☐ TEM EPA 600/R-93/116 w Milling Prep (0.1%)

Other Tests (please specify)

☐ Positive Stop - Clearly Identified Homogeneous Areas (HA)

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Sample Number	HA Number	Sample Location	Material Description
1A		Room 128	carpet glue
1B		East corridor	↓
1C		West corridor	↓
2A		Room 128	2x2 ceiling tile
2B		Corridor 174z	↓
2C		Room 134	↓
3A		Room 128	covebase (brown)
3B		West corridor	↓
3C		East corridor	↓
4A		Room 128	Covebase mastic

Special Instructions and/or Regulatory Requirements (Sample Specifications, Processing Methods, Limits of Detection, etc.)

Method of Shipment:		Sample Condition Upon Receipt:	
Relinquished by: J. Rivera	Date/Time: 5/25/21 0200	Received by:	Date/Time: 5/27/21
Relinquished by:	Date/Time:	Received by:	Date/Time

Controlled Document - Asbestos Bulk R5 03/18/2021

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Asbestos Bulk Building Materials - Chain of Custody

EMSL Order Number / Lab Use Only

042112626

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PHONE: (800) 220-3675
EMAIL: CinnAsblab@EMSL.com

Additional Pages of the Chain of Custody are only necessary if needed for additional sample information

Special Instructions and/or Regulatory Requirements (Sample Specifications, Processing Methods, Limits of Detection, etc.)

Sample Number	HA Number	Sample Location	Material Description
4B		West corridor	covebase mastic
4C			↓
5A		Room 114	covebase (grey)
5B		Room 114E	↓
5C		↓	↓
6A		Room 114	covebase mastic
6B		Room 114E	↓
6C		↓	↓
7A		Room 106A	white ceramic tile
7B		↓	↓
7C		Room 129	↓
8A		Room 106A	white ceramic tile glue
8B		Room 129	↓
8C		↓	↓
9A		Room 106A	white ceramic tile grout
9B		↓	↓
9C		Room 129	
10A		Room 106a	Beige ceramic tile
10B		west corridor, water fountain	↓
10C		↓	↓
~~B~~ 11A.		Room 106A	Beige ceramic tile glue
11B		west corridor, water fountain	↓
11C		↓	↓
12A		Room 106A	Beige ceramic tile grout
12B		west corridor, water fountain	↓

Method of Shipment:		Sample Condition Upon Receipt:	
Relinquished by: J. Rivera	Date/Time: 5/25/21 0700	Received by:	Date/Time
Relinquished by:	Date/Time:	Received by:	Date/Time

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Special Instructions and/or Regulatory Requirements (Sample Specifications, Processing Methods, Limits of Detection, etc.)

Sample Number	HA Number	Sample Location	Material Description
12C		west corridor, water fountain	Beige ceramic tile grout
13A		Room 130	Pipe filting
13B		↓	↓
13C		↓	↓
14A		Room 166 A	12x12 beige ceramic floor tile
14B		Room 129	↓
14C		↓	↓
15A		Room 106A	glue of beige ceramic floor tile
15B		Room 129	↓
15C		↓	↓
16A		Room 106A	grout of beige ceramic floor tile
16B		Room 129	↓
16C		↓	↓
17A		Room 128A	Pipe insulation
17B		↓	↓
17C		↓	↓
18A		Room 134	plaster (base coat)
18B		corridor outside Room 134	↓
18C		Room 101A	↓
18D		Room 168	↓
18E		corridor outside Room 137	↓
19A		Room 134	plaster (skin coat)
19B		corridor outside Room 134	↓
19C		Room 101A	↓
19D		Room 168	↓

Method of Shipment:		Sample Condition Upon Receipt:	
Relinquished by: J. Rivera	Date/Time: 5/25/21 0700	Received by:	Date/Time
Relinquished by:	Date/Time:	Received by:	Date/Time

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Asbestos Bulk Building Materials - Chain of Custody

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Special Instructions and/or Regulatory Requirements (Sample Specifications, Processing Methods, Limits of Detection, etc.)

Sample Number	HA Number	Sample Location	Material Description
19E		corridor outside Room 137	plaster (skim coat)
20A		Room 108	sheetrock
20B		Room 124	
20C		Room 126	
20D		Room 132	
20E		Room 168	
21A		Room 108	joint compound
21B		Room 124	
21C		Room 126	
21D		Room 132	
21E		Room 168	

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CINNAMINSON, NJ
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Method of Shipment:			Sample Condition Upon Receipt:	
Relinquished by: J. Rivera	Date/Time: 5/25/21 0700		Received by:	Date/Time
Relinquished by:	Date/Time:		Received by:	Date/Time

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EMSL Order:	042112580
CustomerID:	JAWO50
CustomerPO:	J2217018
ProjectID:	

Attn: **Adam Frey**
Terracon Consultants, Inc.
77 Sundial Avenue
Suite 401-W
Manchester, NH 03103

Phone:	(603) 647-9700
Fax:	(603) 647-4432
Received:	5/27/2021 09:30 AM
Analysis Date:	6/10/2021
Collected:	5/24/2021

Project: **Building 14 - J2217018**

Test Report:Asbestos Analysis of Bulk Material

Test	Analyzed Date	Color	Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 1A *042112580-0001*		**Description** 232 - Corner of Dorm - Skim Coat **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/10/2021	White		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 2A *042112580-0002*		**Description** 232 - Corner of Dorm - Brown Coat **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/10/2021	Gray		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 1B *042112580-0003*		**Description** 232 - Front of Dorm - Skim Coat **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/10/2021	White		10.00% Ca Carbonate 90.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 2B *042112580-0004*		**Description** 232 - Front of Dorm - Brown Coat **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/10/2021	Gray		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 1C *042112580-0005*		**Description** 228 - Corner - Skim Coat **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/10/2021	White		10.00% Ca Carbonate 90.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**

Initial Report From 06/11/2021 15:16:36

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EMSL Order:	042112580
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ProjectID:	

Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 2C *042112580-0006*		**Description** **Homogeneity**	228 - Corner - Brown Coat Homogeneous		
PLM NYS 198.1 Friable	6/10/2021	Gray		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 1D *042112580-0007*		**Description** **Homogeneity**	227 - Damaged Wall - Skim Coat Homogeneous		
PLM NYS 198.1 Friable	6/10/2021	White		20.00% Ca Carbonate 80.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 2D *042112580-0008*		**Description** **Homogeneity**	227 - Damaged Wall - Brown Coat Homogeneous		
PLM NYS 198.1 Friable	6/10/2021	Gray		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 1E *042112580-0009*		**Description** **Homogeneity**	Hallway by 220 - Skim Coat Homogeneous		
PLM NYS 198.1 Friable	6/10/2021	White		15.00% Ca Carbonate 85.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 2E *042112580-0010*		**Description** **Homogeneity**	Hallway by 220 - Brown Coat Homogeneous		
PLM NYS 198.1 Friable	6/10/2021	Gray		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 1F *042112580-0011*		**Description** **Homogeneity**	214 - Rear Wall - Skim Coat Homogeneous		
PLM NYS 198.1 Friable	6/10/2021	White		15.00% Ca Carbonate 85.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**

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EMSL Order:	042112580
CustomerID:	JAWO50
CustomerPO:	J2217018
ProjectID:	

Test Report:Asbestos Analysis of Bulk Material

Test		Color	Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 2F *042112580-0012*		**Description** **Homogeneity**	214 - Rear Wall - Brown Coat Homogeneous		
PLM NYS 198.1 Friable	6/10/2021	Gray		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 1G *042112580-0013*		**Description** **Homogeneity**	210 - Rear Corner - Skim Coat Homogeneous		
PLM NYS 198.1 Friable	6/10/2021	White		10.00% Ca Carbonate 90.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 2G *042112580-0014*		**Description** **Homogeneity**	210 - Rear Corner - Brown Coat Homogeneous		
PLM NYS 198.1 Friable	6/10/2021	Gray		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 1H *042112580-0015*		**Description** **Homogeneity**	207 - Column - Skim Coat Homogeneous		
PLM NYS 198.1 Friable	6/10/2021	White		15.00% Ca Carbonate 85.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 2H *042112580-0016*		**Description** **Homogeneity**	207 - Column - Brown Coat Homogeneous		
PLM NYS 198.1 Friable	6/10/2021	Gray		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 1I *042112580-0017*		**Description** **Homogeneity**	209 - Side by Day Room - Skim Coat Homogeneous		
PLM NYS 198.1 Friable	6/10/2021	White		15.00% Ca Carbonate 85.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 2I *042112580-0018*		**Description** **Homogeneity**	209 - Side by Day Room - Brown Coat Homogeneous		
PLM NYS 198.1 Friable	6/10/2021	Gray		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 3A *042112580-0019*		**Description** **Homogeneity**	207 - Partition Wall - Sheetrock Heterogeneous		
PLM NYS 198.1 Friable	6/10/2021	Brown/Beige	10.00% Cellulose 2.00% Glass	85.00% Gypsum 3.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 3B *042112580-0020*		**Description** **Homogeneity**	207A - Partition Wall - Sheetrock Heterogeneous		
PLM NYS 198.1 Friable	6/10/2021	Brown/Beige	10.00% Cellulose 2.00% Glass	85.00% Gypsum 3.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 3C *042112580-0021*		**Description** **Homogeneity**	214 - Partition Wall - Sheetrock Heterogeneous		
PLM NYS 198.1 Friable	6/10/2021	Brown/Beige	10.00% Cellulose 2.00% Glass	85.00% Gypsum 3.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 3D *042112580-0022*		**Description** **Homogeneity**	217C - Partition Wall - Sheetrock Heterogeneous		
PLM NYS 198.1 Friable	6/10/2021	Brown/Beige	10.00% Cellulose 2.00% Glass	85.00% Gypsum 3.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 3E *042112580-0023*		**Description** **Homogeneity**	203 - Partition Wall - Sheetrock Heterogeneous		
PLM NYS 198.1 Friable	6/10/2021	Brown/Beige	10.00% Cellulose 2.00% Glass	85.00% Gypsum 3.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 3F *042112580-0024*		**Description** 219 - Partition Wall - Sheetrock **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable	6/10/2021	Brown/Beige	10.00% Cellulose 2.00% Glass	85.00% Gypsum 3.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 3G *042112580-0025*		**Description** 214 - Partition Wall - Sheetrock **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable	6/10/2021	Brown/Beige	10.00% Cellulose 2.00% Glass	85.00% Gypsum 3.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 3H *042112580-0026*		**Description** 203 - Partition Wall - Sheetrock **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable	6/10/2021	Brown/Beige	10.00% Cellulose 2.00% Glass	85.00% Gypsum 3.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 3I *042112580-0027*		**Description** 219 - Partition Wall - Sheetrock **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable	6/10/2021	Brown/Beige	10.00% Cellulose 2.00% Glass	85.00% Gypsum 3.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 4A *042112580-0028*		**Description** 207 - Partition Wall - Joint Compound **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/10/2021	White		20.00% Ca Carbonate 80.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 4B *042112580-0029*		**Description** 207A - Partition Wall - Joint Compound **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/10/2021	White		20.00% Ca Carbonate 80.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 4C *042112580-0030*		**Description** 214 - Partition Wall - Joint Compound **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/10/2021	White		20.00% Ca Carbonate 80.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 4D *042112580-0031*		**Description** 217C - Partition Wall - Joint Compound **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/10/2021	White		20.00% Ca Carbonate 80.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 4E *042112580-0032*		**Description** 203 - Partition Wall - Joint Compound **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/10/2021	White		20.00% Ca Carbonate 80.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 4F *042112580-0033*		**Description** 219 - Partition Wall - Joint Compound **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/10/2021	White		20.00% Ca Carbonate 80.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 4G *042112580-0034*		**Description** 214 - Partition Wall - Joint Compound **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/10/2021	White		20.00% Ca Carbonate 80.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 4H *042112580-0035*		**Description** 203 - Partition Wall - Joint Compound **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/10/2021	White		20.00% Ca Carbonate 80.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 4I *042112580-0036*		**Description** 219 - Partition Wall - Joint Compound **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/10/2021	White		20.00% Ca Carbonate 80.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 5A *042112580-0037*		**Description** 210 - Ceilings - 111 Grid Ceiling Tile **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021	Gray/White	53% Min. Wool	39% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Gray/White		100% Other	**None Detected**
Sample ID 5B *042112580-0038*		**Description** 208 - Ceilings - 111 Grid Ceiling Tile **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021	Gray/White	47% Min. Wool	46% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Gray/White		100% Other	**None Detected**
Sample ID 5C *042112580-0039*		**Description** 235B - Ceilings - 111 Grid Ceiling Tile **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021	Gray/White	48% Min. Wool	45% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Gray/White		100% Other	**None Detected**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 6A *042112580-0040*		**Description**	Corridor - Ceilings - 2x2 Grid Ceiling Tile		
		Homogeneity	Heterogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021	Gray/White	56% Min. Wool	35% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Gray/White		100% Other	**None Detected**
Sample ID 6B *042112580-0041*		**Description**	217C - Ceilings - 2x2 Grid Ceiling Tile		
		Homogeneity	Heterogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021	Gray/White	55% Min. Wool	37% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Gray/White		100% Other	**None Detected**
Sample ID 6C *042112580-0042*		**Description**	230 Corridor - Ceilings - 2x2 Grid Ceiling Tile		
		Homogeneity	Heterogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021	Gray/White	53% Min. Wool	47% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Gray/White		100% Other	**None Detected**
Sample ID 7A *042112580-0043*		**Description**	232 - Floors - 12x12 Green Floor Tile		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021	Green		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Green		100% Other	**None Detected**
Sample ID 7B *042112580-0044*		**Description**	232 - Floors - 12x12 Green Floor Tile		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021	Green		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Green		100% Other	**None Detected**
Sample ID 7C *042112580-0045*		**Description**	232 - Floors - 12x12 Green Floor Tile		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021	Green		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Green		100% Other	**None Detected**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 8A *042112580-0046*		**Description**	232 - Floors - 12x12 Green Floor Tile Mastic		
		Homogeneity	Heterogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021	Brown/Black		100% Other	**Inconclusive : <1%Chrysotile**
Sample below method recommended minimum weight; analyzed at client's request.					
TEM NYS 198.4 NOB	6/10/2021	Brown/Black		100% Other	**<1% Chrysotile**
Sample ID 8B *042112580-0047*		**Description**	232 - Floors - 12x12 Green Floor Tile Mastic		
		Homogeneity	Heterogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021	Brown/Black		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Brown/Black		100% Other	**<1% Chrysotile**
Sample ID 8C *042112580-0048*		**Description**	232 - Floors - 12x12 Green Floor Tile Mastic		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021	Black		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Black		100% Other	**<1% Chrysotile**
Sample ID 9A *042112580-0049*		**Description**	202 - Perimeter - Baseboard		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021	Brown		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Brown		100% Other	**None Detected**
Sample ID 9B *042112580-0050*		**Description**	210A - Perimeter - Baseboard		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021	Brown		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Brown		100% Other	**None Detected**
Sample ID 9C *042112580-0051*		**Description**	232C - Perimeter - Baseboard		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021	Brown		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Brown		100% Other	**None Detected**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 10A *042112580-0052*		**Description** 202A - Perimeter - Baseboard Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021	Tan		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Tan	<1% Fibrous (other)	100% Other	**None Detected**
Sample ID 10B *042112580-0053*		**Description** 210A - Perimeter - Baseboard Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021	Tan		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Tan	<1% Fibrous (other)	100% Other	**None Detected**
Sample ID 10C *042112580-0054*		**Description** 231C - Perimeter - Baseboard Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021	Tan		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Tan	<1% Fibrous (other)	100% Other	**None Detected**
Sample ID 11A *042112580-0055*		**Description** 229 - Border and Rooms - Terrazzo Floor **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	Various		20.00% Ca Carbonate 80.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 11B *042112580-0056*		**Description** 227 - Border and Rooms - Terrazzo Floor **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	Various		20.00% Ca Carbonate 80.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 11C *042112580-0057*		**Description** 204 - Border and Rooms - Terrazzo Floor **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	Various		20.00% Ca Carbonate 80.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 12A *042112580-0058*		**Description** 229 - Border and Rooms - Terrazzo Floor Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021	Gray		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Gray		100% Other	**None Detected**
Sample ID 12B *042112580-0059*		**Description** 227 - Border and Rooms - Terrazzo Floor Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021	Gray		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Gray		100% Other	**None Detected**
Sample ID 12C *042112580-0060*		**Description** 204 - Border and Rooms - Terrazzo Floor Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021	Gray		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Gray		100% Other	**None Detected**
Sample ID 13A *042112580-0061*		**Description** 232C - Floor - 12x12 Brown Floor Tile **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021	Brown		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Brown		100% Other	**None Detected**
Sample ID 13B *042112580-0062*		**Description** 229 - Floor - 12x12 Brown Floor Tile **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021	Brown		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Brown		100% Other	**None Detected**
Sample ID 13C *042112580-0063*		**Description** 233 - Floor - 12x12 Brown Floor Tile **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021	Brown		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Brown		100% Other	**None Detected**

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EMSL Order:	042112580
CustomerID:	JAWO50
CustomerPO:	J2217018
ProjectID:	

Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 14A *042112580-0064*		**Description** 232C - Floor - 12x12 Brown Floor Tile Mastic **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021	Various		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Various		100% Other	**<1% Chrysotile**
Sample ID 14B *042112580-0065*		**Description** 229 - Floor - 12x12 Brown Floor Tile Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021	Black		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Black		100% Other	**<1% Chrysotile**
Sample ID 14C *042112580-0066*		**Description** 233 - Floor - 12x12 Brown Floor Tile Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021	Black		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Black		100% Other	**<1% Chrysotile**
Sample ID 15A *042112580-0067*		**Description** 208 - Bathroom Wall - Yellow Ceramic Tile **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	White		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 15B *042112580-0068*		**Description** 208 - Bathroom Wall - Yellow Ceramic Tile **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	White		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 15C *042112580-0069*		**Description** 208 - Bathroom Wall - Yellow Ceramic Tile **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	White		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 16A *042112580-0070*		**Description** 208 - Bathroom Wall - Yellow Ceramic Tile Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021	Yellow		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Yellow		100% Other	**None Detected**
Sample ID 16B *042112580-0071*		**Description** 208 - Bathroom Wall - Yellow Ceramic Tile Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021	Yellow		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Yellow		100% Other	**None Detected**
Sample ID 16C *042112580-0072*		**Description** 208 - Bathroom Wall - Yellow Ceramic Tile Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021	Yellow		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Yellow		100% Other	**None Detected**
Sample ID 17A *042112580-0073*		**Description** 208 - Bathroom Wall - Yellow Ceramic Tile Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	White		15.00% Ca Carbonate 85.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 17B *042112580-0074*		**Description** 208 - Bathroom Wall - Yellow Ceramic Tile Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	White		15.00% Ca Carbonate 85.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 17C *042112580-0075*		**Description** 208 - Bathroom Wall - Yellow Ceramic Tile Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	White		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 18A *042112580-0076*		**Description**	208 - Bathroom Ceiling - 1x1 Waterproof Tile		
		Homogeneity	Heterogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021	Gray/White	48% Min. Wool	45% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Gray/White	1.5% Fibrous (other)	98.5% Other	**None Detected**
Sample ID 18B *042112580-0077*		**Description**	208 - Bathroom Ceiling - 1x1 Waterproof Tile		
		Homogeneity	Heterogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021	Gray/White	50% Min. Wool	42% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Gray/White	1.5% Fibrous (other)	98.5% Other	**None Detected**
Sample ID 18C *042112580-0078*		**Description**	230 - Bathroom Ceiling - 1x1 Waterproof Tile		
		Homogeneity	Heterogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021	Gray/White	43% Min. Wool	50% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Gray/White	1.3% Fibrous (other)	98.7% Other	**None Detected**
Sample ID 19A *042112580-0079*		**Description**	208 - Bathroom and Shower - Epoxy Floor		
		Homogeneity	Heterogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021	Various		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Various		100% Other	**None Detected**
Sample ID 19B *042112580-0080*		**Description**	208 - Bathroom and Shower - Epoxy Floor		
		Homogeneity	Heterogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021	Various		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Various		100% Other	**None Detected**
Sample ID 19C *042112580-0081*		**Description**	208 - Bathroom and Shower - Epoxy Floor		
		Homogeneity	Heterogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021	Various		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Various		100% Other	**None Detected**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 20A *042112580-0082*		**Description**	231 - Bathroom and Shower - Residual Sink Caulk		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021	White		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	White		100% Other	**None Detected**
Sample ID 20B *042112580-0083*		**Description**	231 - Bathroom and Shower - Residual Sink Caulk		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021	White		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	White		100% Other	**None Detected**
Sample ID 20C *042112580-0084*		**Description**	231 - Bathroom and Shower - Residual Sink Caulk		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021	White		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	White		100% Other	**None Detected**
Sample ID 21A *042112580-0085*		**Description**	230 - Bathroom - Firestop Caulk		
		Homogeneity	Heterogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021	Red/Silver	1.2% Glass	98.8% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Red/Silver		100% Other	**None Detected**
Sample ID 21B *042112580-0086*		**Description**	230 - Pipe Chase - Firestop Caulk		
		Homogeneity	Heterogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021	Red/Silver	1.0% Glass	99% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Red/Silver		100% Other	**None Detected**
Sample ID 21C *042112580-0087*		**Description**	233B - Closet - Firestop Caulk		
		Homogeneity	Heterogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021	Red/Silver	1.4% Glass	98.6% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Red/Silver		100% Other	**None Detected**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 22A *042112580-0088*		**Description** Rm 211 - Peach Ceramic Tile on Wall - Peach Ceramic Tile **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	Peach		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 22B *042112580-0089*		**Description** Rm 209 - Peach Ceramic Tile on Wall - Peach Ceramic Tile **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	Peach		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 22C *042112580-0090*		**Description** Rm 209 - Peach Ceramic Tile on Wall - Peach Ceramic Tile **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	Peach		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 23A *042112580-0091*		**Description** Rm 211 - Peach Ceramic Tile on Wall - Peach Ceramic Tile Mastic **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Gray		100% Other	**None Detected**
Sample ID 23B *042112580-0092*		**Description** Rm 209 - Peach Ceramic Tile on Wall - Peach Ceramic Tile Mastic **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Gray		100% Other	**None Detected**
Sample ID 23C *042112580-0093*		**Description** Rm 209 - Peach Ceramic Tile on Wall - Peach Ceramic Tile Mastic **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Gray		100% Other	**None Detected**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 24A *042112580-0094*		**Description** Rm 211 - Peach Ceramic Tile on Wall - Peach Ceramic Tile Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	Gray		5.00% Ca Carbonate 95.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 24B *042112580-0095*		**Description** Rm 209 - Peach Ceramic Tile on Wall - Peach Ceramic Tile Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	Gray		5.00% Ca Carbonate 95.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 24C *042112580-0096*		**Description** Rm 209 - Peach Ceramic Tile on Wall - Peach Ceramic Tile Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	Gray		5.00% Ca Carbonate 95.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 25A *042112580-0097*		**Description** Corridor - Corridor Floor Tile - 12x12 Floor Tile Beige w/Tan **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	White		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	White		100% Other	**None Detected**
Sample ID 25B *042112580-0098*		**Description** Corridor - Corridor Floor Tile - 12x12 Floor Tile Beige w/Tan **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	White		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	White		100% Other	**None Detected**
Sample ID 25C *042112580-0099*		**Description** Corridor - Corridor Floor Tile - 12x12 Floor Tile Beige w/Tan **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	White		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	White		100% Other	**None Detected**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 26A *042112580-0100*		**Description**	Corridor - Corridor Floor Tile - 12x12 Floor Tile Beige w/Tan Mastic		
		Homogeneity			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021			% Other	**Layer Not Present**
TEM NYS 198.4 NOB	6/8/2021			% Other	**Layer Not Present**
Sample ID 26B *042112580-0101*		**Description**	Corridor - Corridor Floor Tile - 12x12 Floor Tile Beige w/Tan Mastic		
		Homogeneity			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021			% Other	**Insufficient Material**
TEM NYS 198.4 NOB	6/8/2021			% Other	**Insufficient Material**
Sample ID 26C *042112580-0102*		**Description**	Corridor - Corridor Floor Tile - 12x12 Floor Tile Beige w/Tan Mastic		
		Homogeneity			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/8/2021			% Other	**Layer Not Present**
TEM NYS 198.4 NOB	6/8/2021			% Other	**Layer Not Present**
Sample ID 27A *042112580-0103*		**Description**	230 - Bathroom - Red Ceramic Floor Tile		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable	6/11/2021	Red		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 27B *042112580-0104*		**Description**	230 - Bathroom - Red Ceramic Floor Tile		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable	6/11/2021	Red		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 27C *042112580-0105*		**Description**	230 - Bathroom - Red Ceramic Floor Tile		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable	6/11/2021	Red		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 28A *042112580-0106*		**Description** 230 - Bathroom - Red Ceramic Floor Tile Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray		100% Other	**Inconclusive: None Detected**
Material appears to be mortar.					
TEM NYS 198.4 NOB	6/10/2021	Gray		100% Other	**None Detected**
Sample ID 28B *042112580-0107*		**Description** 230 - Bathroom - Red Ceramic Floor Tile Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray		100% Other	**Inconclusive: None Detected**
Material appears to be mortar					
TEM NYS 198.4 NOB	6/10/2021	Gray		100% Other	**None Detected**
Sample ID 28C *042112580-0108*		**Description** 230 - Bathroom - Red Ceramic Floor Tile Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray		100% Other	**Inconclusive: None Detected**
Material appears to be mortar					
TEM NYS 198.4 NOB	6/10/2021	Gray		100% Other	**None Detected**
Sample ID 29A *042112580-0109*		**Description** 230 - Red Tiles - Red Ceramic Floor Tile Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	Gray/White		10.00% Ca Carbonate 5.00% Perlite 85.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 29B *042112580-0110*		**Description** 230 - Red Tiles - Red Ceramic Floor Tile Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	Gray		10.00% Ca Carbonate 90.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**

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EMSL Order:	042112580
CustomerID:	JAWO50
CustomerPO:	J2217018
ProjectID:	

Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 29C *042112580-0111*		**Description** 230 - Red Tiles - Red Ceramic Floor Tile Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	Gray		10.00% Ca Carbonate 90.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 30A *042112580-0112*		**Description** 230 - Wall Tile - Blue Ceramic Wall Tile **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable	6/11/2021	White/Blue		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 30B *042112580-0113*		**Description** 230 - Wall Tile - Blue Ceramic Wall Tile **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable	6/11/2021	White/Blue		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 30C *042112580-0114*		**Description** 230 - Wall Tile - Blue Ceramic Wall Tile **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	White/Blue		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 31A *042112580-0115*		**Description** 230 - Wall Tile Mastic - Blue Ceramic Wall Tile Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray		100% Other	**Inconclusive: None Detected**
Material appears to be mortar					
TEM NYS 198.4 NOB	6/10/2021	Gray		100% Other	**None Detected**
Sample ID 31B *042112580-0116*		**Description** 230 - Wall Tile Mastic - Blue Ceramic Wall Tile Mastic **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray/Tan		100% Other	**Inconclusive: None Detected**
Material appears to be mortar					
TEM NYS 198.4 NOB	6/10/2021	Gray/Tan		100% Other	**None Detected**

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EMSL Order:	042112580
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ProjectID:	

Test Report:Asbestos Analysis of Bulk Material

Test		Color	Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 31C *042112580-0117*		**Description** 230 - Wall Tile Mastic - Blue Ceramic Wall Tile Mastic **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray/Tan		100% Other	**Inconclusive: None Detected**
Material appears to be mortar. Result includes a small amount of inseparable attached material.					
TEM NYS 198.4 NOB	6/10/2021	Gray/Tan		100% Other	**None Detected**
Sample ID 32A *042112580-0118*		**Description** 230 - Wall Tile Grout - Blue Ceramic Wall Tile Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	Gray		15.00% Ca Carbonate 85.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 32B *042112580-0119*		**Description** 230 - Wall Tile Grout - Blue Ceramic Wall Tile Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	Gray		15.00% Ca Carbonate 85.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 32C *042112580-0120*		**Description** 230 - Wall Tile Grout - Blue Ceramic Wall Tile Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	Gray		15.00% Ca Carbonate 85.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 33A *042112580-0121*		**Description** 230 - White Ceramic Wall - White Ceramic Tile **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable	6/11/2021	White		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 33B *042112580-0122*		**Description** 230 - White Ceramic Wall - White Ceramic Tile **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable	6/11/2021	White		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 33C *042112580-0123*		**Description** 230 - White Ceramic Wall - White Ceramic Tile **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable	6/11/2021	White		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 34A *042112580-0124*		**Description** 230 - White Ceramic Wall - White Ceramic Tile Glue **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	White/Yellow		100% Other	**Inconclusive: None Detected**
Result includes a small amount of inseparable attached material.					
TEM NYS 198.4 NOB	6/10/2021	White/Yellow		100% Other	**None Detected**
Sample ID 34B *042112580-0125*		**Description** 230 - White Ceramic Wall - White Ceramic Tile Glue **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Yellow		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Yellow		100% Other	**None Detected**
Sample ID 34C *042112580-0126*		**Description** 230 - White Ceramic Wall - White Ceramic Tile Glue **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Yellow		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Yellow		100% Other	**None Detected**
Sample ID 35A *042112580-0127*		**Description** 230 - White Ceramic Wall - White Ceramic Tile Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	Gray		10.00% Ca Carbonate 90.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 35B *042112580-0128*		**Description** 230 - White Ceramic Wall - White Ceramic Tile Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	Gray		10.00% Ca Carbonate 90.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 35C *042112580-0129*		**Description** 230 - White Ceramic Wall - White Ceramic Tile Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	Gray		10.00% Ca Carbonate 90.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 36A *042112580-0130*		**Description** Laundry Room - Floors - Multicolor Ceramic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	Peach		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 36B *042112580-0131*		**Description** Laundry Room - Floors - Multicolor Ceramic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	Peach		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 36C *042112580-0132*		**Description** Laundry Room - Floors - Multicolor Ceramic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	Peach		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 37A *042112580-0133*		**Description** Laundry Room - Floors - Multicolor Ceramic Floor Mastic **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Brown/Gray		100% Other	**Inconclusive: None Detected**
Material appears to be mortar.			Result includes a small amount of inseparable attached material.		
TEM NYS 198.4 NOB	6/10/2021	Brown/Gray		100% Other	**None Detected**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 37B *042112580-0134*		**Description**	Laundry Room - Floors - Multicolor Ceramic Floor Mastic		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray		100% Other	**Inconclusive: None Detected**
Material appears to be mortar.					
TEM NYS 198.4 NOB	6/10/2021	Gray		100% Other	**None Detected**
Sample ID 37C *042112580-0135*		**Description**	Laundry Room - Floors - Multicolor Ceramic Floor Mastic		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray		100% Other	**Inconclusive: None Detected**
Material appears to be mortar.					
TEM NYS 198.4 NOB	6/10/2021	Gray		100% Other	**None Detected**
Sample ID 38A *042112580-0136*		**Description**	Laundry Room - Floors - Multicolor Ceramic Floor Grout		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable	6/11/2021	Gray		15.00% Ca Carbonate 85.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 38B *042112580-0137*		**Description**	Laundry Room - Floors - Multicolor Ceramic Floor Grout		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable	6/11/2021	Gray		15.00% Ca Carbonate 85.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 38C *042112580-0138*		**Description**	Laundry Room - Floors - Multicolor Ceramic Floor Grout		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable	6/11/2021	Gray		15.00% Ca Carbonate 85.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 39A *042112580-0139*		**Description** 230 - Wall Tile - Red Ceramic Tile Wall **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable	6/11/2021	Brown/White		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 39B *042112580-0140*		**Description** 230 - Wall Tile - Red Ceramic Tile Wall **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable	6/11/2021	Brown/White		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 39C *042112580-0141*		**Description** 230 - Wall Tile - Red Ceramic Tile Wall **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable	6/11/2021	Brown/White		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 40A *042112580-0142*		**Description** 230 - Wall Tile - Red Ceramic Tile Wall Mastic **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Brown/White		100% Other	**Inconclusive: None Detected**
Result includes a small amount of inseparable attached material.					
TEM NYS 198.4 NOB	6/10/2021	Brown/White		100% Other	**None Detected**
Sample ID 40B *042112580-0143*		**Description** 230 - Wall Tile - Red Ceramic Tile Wall Mastic **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Brown/White		100% Other	**Inconclusive: None Detected**
Result includes a small amount of inseparable attached material.					
TEM NYS 198.4 NOB	6/10/2021	Brown/White		100% Other	**None Detected**
Sample ID 40C *042112580-0144*		**Description** 230 - Wall Tile - Red Ceramic Tile Wall Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Brown/White		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Brown/White		100% Other	**None Detected**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 41A *042112580-0145*		**Description** 230 - Wall Tile - Red Ceramic Tile Wall Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	White		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 41B *042112580-0146*		**Description** 230 - Wall Tile - Red Ceramic Tile Wall Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	White		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 41C *042112580-0147*		**Description** 230 - Wall Tile - Red Ceramic Tile Wall Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	White		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 42A *042112580-0148*		**Description** 235 - Bottom of Door - Door Protector Block **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Black		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Black		100% Other	**None Detected**
Sample ID 42B *042112580-0149*		**Description** 235 - Bottom of Door - Door Protector Block **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Black		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Black		100% Other	**None Detected**
Sample ID 42C *042112580-0150*		**Description** 235 - Bottom of Door - Door Protector Block **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Black		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Black		100% Other	**None Detected**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 43A *042112580-0151*		**Description**	227 - Floor Replaced Tiles - 12x12 Light Brown Floor Tile		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Brown/Red		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Brown/Red		100% Other	**None Detected**
Sample ID 43B *042112580-0152*		**Description**	227 - Floor Replaced Tiles - 12x12 Light Brown Floor Tile		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Brown/Red		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Brown/Red		100% Other	**None Detected**
Sample ID 43C *042112580-0153*		**Description**	227 - Floor Replaced Tiles - 12x12 Light Brown Floor Tile		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Brown/Red		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Brown/Red		100% Other	**None Detected**
Sample ID 45A *042112580-0154*		**Description**	Room 228 - Floor - Brown Floor Tile w/Dark Specks		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Brown/Black		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Brown/Black		100% Other	**None Detected**
Sample ID 45B *042112580-0155*		**Description**	Room 228 - Floor - Brown Floor Tile w/Dark Specks		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Brown/Black		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Brown/Black		100% Other	**None Detected**
Sample ID 45C *042112580-0156*		**Description**	Room 228 - Floor - Brown Floor Tile w/Dark Specks		
		Homogeneity	Heterogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Brown/Black		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Brown/Black		100% Other	**None Detected**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 46A *042112580-0157*		**Description**	Room 228 - Floor - Brown Floor Tile w/Dark Specks Mastic		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Black		100% Other	**Inconclusive : <1%Chrysotile**
TEM NYS 198.4 NOB	6/10/2021	Black		100% Other	**<1% Chrysotile**
Sample ID 46B *042112580-0158*		**Description**	Room 228 - Floor - Brown Floor Tile w/Dark Specks Mastic		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Black		100% Other	**Inconclusive : <1%Chrysotile**
TEM NYS 198.4 NOB	6/10/2021	Black		100% Other	**<1% Chrysotile**
Sample ID 46C *042112580-0159*		**Description**	Room 228 - Floor - Brown Floor Tile w/Dark Specks Mastic		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Black		100% Other	**Inconclusive : <1%Chrysotile**
TEM NYS 198.4 NOB	6/10/2021	Black		100% Other	**<1% Chrysotile**
Sample ID 47A *042112580-0160*		**Description**	Room 225 - Block Walls in Laundry - Yellow CMU		
		Homogeneity	Heterogeneous		
PLM NYS 198.1 Friable	6/11/2021	Yellow		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 47B *042112580-0161*		**Description**	Room 225 - Block Walls in Laundry - Yellow CMU		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable	6/11/2021	Yellow		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 47C *042112580-0162*		**Description**	Room 225 - Block Walls in Laundry - Yellow CMU		
		Homogeneity	Heterogeneous		
PLM NYS 198.1 Friable	6/11/2021	Yellow		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**

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EMSL Order:	042112580
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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 48A *042112580-0163*		**Description** Room 225 - Block Walls in Laundry - Yellow CMU Mortar **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	Gray		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 48B *042112580-0164*		**Description** Room 225 - Block Walls in Laundry - Yellow CMU Mortar **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	Gray		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 48C *042112580-0165*		**Description** Room 225 - Block Walls in Laundry - Yellow CMU Mortar **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	Gray		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 49A *042112580-0166*		**Description** By Laundry Room - Wood Vinyl Counter - Counter Top Adhesive **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Brown/White		100% Other	**Inconclusive: None Detected**
Sample below method recommended minimum weight; analyzed at client's request.					
TEM NYS 198.4 NOB	6/10/2021	Brown/White		100% Other	**None Detected**
Sample ID 49B *042112580-0167*		**Description** By Laundry Room - Wood Vinyl Counter - Counter Top Adhesive **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Brown/White		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Brown/White		100% Other	**None Detected**
Sample ID 49C *042112580-0168*		**Description** By Laundry Room - Wood Vinyl Counter - Counter Top Adhesive **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Brown/White		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Brown/White		100% Other	**None Detected**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 50A *042112580-0169*		**Description**	223 - Cove Base Perimeter - Cove Base		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Gray		100% Other	**None Detected**
Sample ID 50B *042112580-0170*		**Description**	223 - Cove Base Perimeter - Cove Base		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Gray		100% Other	**None Detected**
Sample ID 50C *042112580-0171*		**Description**	223 - Cove Base Perimeter - Cove Base		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Gray		100% Other	**None Detected**
Sample ID 51A *042112580-0172*		**Description**	223 - Cove Base Perimeter - Cove Base Mastic		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Yellow		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Yellow		100% Other	**None Detected**
Sample ID 51B *042112580-0173*		**Description**	223 - Cove Base Perimeter - Cove Base Mastic		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Yellow		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Yellow		100% Other	**None Detected**
Sample ID 51C *042112580-0174*		**Description**	223 - Cove Base Perimeter - Cove Base Mastic		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Yellow		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Yellow		100% Other	**None Detected**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 52A *042112580-0175*		**Description** 203 - Yellow Glue - Carpet Glue **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Tan		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Tan		100% Other	**None Detected**
Sample ID 52B *042112580-0176*		**Description** 203 - Yellow Glue - Carpet Glue **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Tan		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Tan		100% Other	**None Detected**
Sample ID 52C *042112580-0177*		**Description** 203 - Yellow Glue - Carpet Glue **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Tan		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Tan		100% Other	**None Detected**
Sample ID 53A *042112580-0178*		**Description** 235 - Grid Ceiling Tile - 1x1 Pinhole Ceiling Tile **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray/White	1.4% Min. Wool	98.6% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Gray/White		100% Other	**None Detected**
Sample ID 53B *042112580-0179*		**Description** 214 - Grid Ceiling Tile - 1x1 Pinhole Ceiling Tile **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray/White	4.8% Min. Wool	95.2% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Gray/White		100% Other	**None Detected**
Sample ID 53C *042112580-0180*		**Description** 214 - Grid Ceiling Tile - 1x1 Pinhole Ceiling Tile **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray/White	50% Min. Wool	50% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Gray/White		100% Other	**None Detected**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 54A *042112580-0181*		**Description** Small Bathrooms Throughout - Border Tiles Ceramic **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable	6/11/2021	Brown/White		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 54B *042112580-0182*		**Description** Small Bathrooms Throughout - Border Tiles Ceramic **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable	6/11/2021	Brown/White		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 54C *042112580-0183*		**Description** Small Bathrooms Throughout - Border Tiles Ceramic **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable	6/11/2021	Brown/White		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 55A *042112580-0184*		**Description** Bathrooms - Border Tile Ceramic Mortar - Mahogany Baseboard Mastic **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray/Tan		100% Other	**Inconclusive: None Detected**
Material appears to be mortar. Result includes a small amount of inseparable attached material.					
TEM NYS 198.4 NOB	6/10/2021	Gray/Tan		100% Other	**None Detected**
Sample ID 55B *042112580-0185*		**Description** Bathrooms - Border Tile Ceramic Mortar - Mahogany Baseboard Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray		100% Other	**Inconclusive: None Detected**
Material appears to be mortar					
TEM NYS 198.4 NOB	6/10/2021	Gray		100% Other	**None Detected**
Sample ID 55C *042112580-0186*		**Description** Bathrooms - Border Tile Ceramic Mortar - Mahogany Baseboard Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray		100% Other	**Inconclusive: None Detected**
Material appears to be mortar					
TEM NYS 198.4 NOB	6/10/2021	Gray		100% Other	**None Detected**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 56A *042112580-0187*		**Description** 235 - Ceiling Tile - 1x1 Textured Ceiling Tile **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray/White	54% Min. Wool	46% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Gray/White		100% Other	**None Detected**
Sample ID 56B *042112580-0188*		**Description** 234 - Ceiling Tile - 1x1 Textured Ceiling Tile **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray/White	54% Min. Wool	46% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Gray/White		100% Other	**None Detected**
Sample ID 56C *042112580-0189*		**Description** 232 - Ceiling Tile - 1x1 Textured Ceiling Tile **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray/White	54% Min. Wool	46% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Gray/White		100% Other	**None Detected**
Sample ID 60A *042112580-0190*		**Description** BMS Closet 221 - Black Ceramic Wall Tile **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable	6/11/2021	Tan/Black		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 60B *042112580-0191*		**Description** BMS Closet 221 - Black Ceramic Wall Tile **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	Tan/Black		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 60C *042112580-0192*		**Description** BMS Closet 221 - Black Ceramic Wall Tile **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable	6/11/2021	Tan/Black		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 61A *042112580-0193*		**Description**	BMS Closet 221 - Black Ceramic Wall Tile Mastic		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Gray		100% Other	**None Detected**
Sample ID 61B *042112580-0194*		**Description**	BMS Closet 221 - Black Ceramic Wall Tile Mastic		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/10/2021	Gray		100% Other	**None Detected**
Sample ID 61C *042112580-0195*		**Description**	BMS Closet 221 - Black Ceramic Wall Tile Mastic		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Gray		100% Other	**None Detected**
Sample ID 62A *042112580-0196*		**Description**	BMS Closet 221 - Black Ceramic Wall Tile Grout		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable	6/11/2021	Gray		10.00% Ca Carbonate 90.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 62B *042112580-0197*		**Description**	BMS Closet 221 - Black Ceramic Wall Tile Grout		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable	6/11/2021	Gray		10.00% Ca Carbonate 90.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 62C *042112580-0198*		**Description**	BMS Closet 221 - Black Ceramic Wall Tile Grout		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable	6/11/2021	Gray		10.00% Ca Carbonate 90.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 63A *042112580-0199*		**Description** 201 - Ceramic Tiles on Wall - Ceramic Tile Peach Wall **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable	6/11/2021	White/Peach		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 63B *042112580-0200*		**Description** 201 - Ceramic Tiles on Wall - Ceramic Tile Peach Wall **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable	6/11/2021	White/Peach		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 63C *042112580-0201*		**Description** 201 - Ceramic Tiles on Wall - Ceramic Tile Peach Wall **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable	6/11/2021	White/Peach		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 64A *042112580-0202*		**Description** 201 - Ceramic Tiles on Wall - Ceramic Tile Peach Wall Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Tan		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Tan		100% Other	**None Detected**
Sample ID 64B *042112580-0203*		**Description** 201 - Ceramic Tiles on Wall - Ceramic Tile Peach Wall Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Tan		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Tan		100% Other	**None Detected**
Sample ID 64C *042112580-0204*		**Description** 201 - Ceramic Tiles on Wall - Ceramic Tile Peach Wall Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Tan		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Tan		100% Other	**None Detected**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 65A *042112580-0205*		**Description** 201 - Ceramic Tiles on Wall - Ceramic Tile Peach Wall Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	White		5.00% Ca Carbonate 95.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 65B *042112580-0206*		**Description** 201 - Ceramic Tiles on Wall - Ceramic Tile Peach Wall Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	White		5.00% Ca Carbonate 95.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 65C *042112580-0207*		**Description** 201 - Ceramic Tiles on Wall - Ceramic Tile Peach Wall Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	White		5.00% Ca Carbonate 95.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 69A-Ceramic Tile *042112580-0208*		**Description** 201 - Floor - Black Ceramic Floor Tile **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	Black		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 69A-Grout *042112580-0208A*		**Description** 201 - Floor - Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	Gray		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 69B *042112580-0209*		**Description** 201 - Floor - Black Ceramic Floor Tile **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	Black		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID	69C-Ceramic Tile *042112580-0210*	**Description** **Homogeneity**	201 - Floor - Black Ceramic Floor Tile Homogeneous		
PLM NYS 198.1 Friable	6/11/2021	Black		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID	69C-Grout *042112580-0210A*	**Description** **Homogeneity**	201 - Floor - Grout Homogeneous		
PLM NYS 198.1 Friable	6/11/2021	Gray		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID	70A *042112580-0211*	**Description** **Homogeneity**	201 - Floor - Black Ceramic Floor Tile Mastic Heterogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray/Black		100% Other	**Inconclusive: None Detected**
Material appears to be leveler.					
TEM NYS 198.4 NOB	6/11/2021	Gray/Black		100% Other	**None Detected**
Sample ID	70B *042112580-0212*	**Description** **Homogeneity**	201 - Floor - Black Ceramic Floor Tile Mastic Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray		100% Other	**Inconclusive: None Detected**
Material appears to be leveler					
TEM NYS 198.4 NOB	6/11/2021	Gray		100% Other	**None Detected**
Sample ID	70C *042112580-0213*	**Description** **Homogeneity**	201 - Floor - Black Ceramic Floor Tile Mastic Heterogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray/Black		100% Other	**Inconclusive: None Detected**
Material appears to be leveler.					
TEM NYS 198.4 NOB	6/11/2021	Gray/Black		100% Other	**None Detected**
Sample ID	71A *042112580-0214*	**Description** **Homogeneity**	201 - Ceramic on Wall - Black Ceramic Floor Tile Grout Homogeneous		
PLM NYS 198.1 Friable	6/11/2021	White		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 71B *042112580-0215*		**Description** 201 - Ceramic on Wall - Black Ceramic Floor Tile Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	White		5.00% Ca Carbonate 95.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 71C *042112580-0216*		**Description** 201 - Ceramic on Wall - Black Ceramic Floor Tile Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	White		10.00% Ca Carbonate 90.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 72A *042112580-0217*		**Description** 205B - Pink Tile - Pink Ceramic Wall Tile **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable	6/11/2021	White/Pink		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 72B *042112580-0218*		**Description** 205B - Pink Tile - Pink Ceramic Wall Tile **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable	6/11/2021	White/Pink		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 72C *042112580-0219*		**Description** 205B - Pink Tile - Pink Ceramic Wall Tile **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable	6/11/2021	White/Pink		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 73A *042112580-0220*		**Description** 205B - Pink Tile - Pink Ceramic Wall Tile Mastic **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Tan/Yellow		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Tan/Yellow		100% Other	**None Detected**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 73B *042112580-0221*		**Description** 205B - Pink Tile - Pink Ceramic Wall Tile Mastic **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Tan/Yellow		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Tan/Yellow		100% Other	**None Detected**
Sample ID 73C *042112580-0222*		**Description** 205B - Pink Tile - Pink Ceramic Wall Tile Mastic **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Tan/Yellow		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Tan/Yellow		100% Other	**None Detected**
Sample ID 74A *042112580-0223*		**Description** 205B - Pink Tile - Pink Ceramic Wall Tile Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	White		20.00% Ca Carbonate 80.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 74B *042112580-0224*		**Description** 205B - Pink Tile - Pink Ceramic Wall Tile Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	White		15.00% Ca Carbonate 85.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 74C *042112580-0225*		**Description** 205B - Pink Tile - Pink Ceramic Wall Tile Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	White		20.00% Ca Carbonate 80.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 75A *042112580-0226*		**Description** 219 - Green Ceramic Wall Tile **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	Green		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 75B *042112580-0227*		**Description** 219 - Green Ceramic Wall Tile **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	Green		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 75C *042112580-0228*		**Description** 219 - Green Ceramic Wall Tile **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	Green		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 76A *042112580-0229*		**Description** 219 - Green Ceramic Wall Tile Mastic **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray/Tan		100% Other	**Inconclusive: None Detected**
Material appears to be mortar.				Result includes a small amount of inseparable attached material	
TEM NYS 198.4 NOB	6/11/2021	Gray/Tan		100% Other	**None Detected**
Sample ID 76B *042112580-0230*		**Description** 219 - Green Ceramic Wall Tile Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray		100% Other	**Inconclusive: None Detected**
Material appears to be mortar					
TEM NYS 198.4 NOB	6/11/2021	Gray		100% Other	**None Detected**
Sample ID 76C *042112580-0231*		**Description** 219 - Green Ceramic Wall Tile Mastic **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray/Tan		100% Other	**Inconclusive: None Detected**
Material appears to be mortar. Result includes a small amount of inseparable attached material.					
TEM NYS 198.4 NOB	6/11/2021	Gray/Tan		100% Other	**None Detected**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 77A *042112580-0232*		**Description** **Homogeneity**	219 - Green Ceramic Wall Tile Grout Homogeneous		
PLM NYS 198.1 Friable	6/11/2021	Gray		10.00% Ca Carbonate 90.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 77B *042112580-0233*		**Description** **Homogeneity**	219 - Green Ceramic Wall Tile Grout Homogeneous		
PLM NYS 198.1 Friable	6/11/2021	Gray		10.00% Ca Carbonate 90.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 77C *042112580-0234*		**Description** **Homogeneity**	219 - Green Ceramic Wall Tile Grout Homogeneous		
PLM NYS 198.1 Friable	6/11/2021	Gray		10.00% Ca Carbonate 90.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 81A *042112580-0235*		**Description** **Homogeneity**	217D - Floor Tile - Red and Brown 12x12 Floor Tile Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Brown/Red		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Brown/Red		100% Other	**None Detected**
Sample ID 81B *042112580-0236*		**Description** **Homogeneity**	217D - Floor Tile - Red and Brown 12x12 Floor Tile Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Brown/Red		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Brown/Red		100% Other	**None Detected**
Sample ID 81C *042112580-0237*		**Description** **Homogeneity**	217E - Floor Tile - Red and Brown 12x12 Floor Tile Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Brown/Red		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Brown/Red		100% Other	**None Detected**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 82A *042112580-0238*		**Description** 217D - Floor Tile - Red and Brown 12x12 Floor Tile Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Brown		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Brown		100% Other	**None Detected**
Sample ID 82B *042112580-0239*		**Description** 217D - Floor Tile - Red and Brown 12x12 Floor Tile Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Brown		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Brown		100% Other	**None Detected**
Sample ID 82C *042112580-0240*		**Description** 217E - Floor Tile - Red and Brown 12x12 Floor Tile Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Brown		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Brown		100% Other	**None Detected**
Sample ID 83A *042112580-0241*		**Description** 209A - Blue Floor - Blue 1x1 Ceramic Tile **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	Blue		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 83B *042112580-0242*		**Description** 209A - Blue Floor - Blue 1x1 Ceramic Tile **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	Blue		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 83C *042112580-0243*		**Description** 211A - Blue Floor - Blue 1x1 Ceramic Tile **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	Blue		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 84A *042112580-0244*		**Description** 209A - Blue Floor - Blue 1x1 Ceramic Tile Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray		100% Other	**Inconclusive: None Detected**
Material appears to be grout.					
TEM NYS 198.4 NOB	6/11/2021	Gray		100% Other	**None Detected**
Sample ID 84B *042112580-0245*		**Description** 209A - Blue Floor - Blue 1x1 Ceramic Tile Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray		100% Other	**Inconclusive: None Detected**
Material appears to be grout.					
TEM NYS 198.4 NOB	6/11/2021	Gray		100% Other	**None Detected**
Sample ID 84C *042112580-0246*		**Description** 211A - Blue Floor - Blue 1x1 Ceramic Tile Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray		100% Other	**Inconclusive: None Detected**
Material appears to be grout					
TEM NYS 198.4 NOB	6/11/2021	Gray		100% Other	**None Detected**
Sample ID 85A *042112580-0247*		**Description** 209A - Blue Floor - Blue 1x1 Ceramic Tile Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	Gray		10.00% Ca Carbonate 90.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 85B *042112580-0248*		**Description** 211A - Blue Floor - Blue 1x1 Ceramic Tile Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	Gray		10.00% Ca Carbonate 90.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 85C *042112580-0249*		**Description** 211A - Blue Floor - Blue 1x1 Ceramic Tile Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	Gray		10.00% Ca Carbonate 90.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 86A *042112580-0250*		**Description** 216 - Tan Ceramic Wall Tile w/Brown Spots **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable	6/11/2021	Tan/White		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 86B *042112580-0251*		**Description** 216 - Tan Ceramic Wall Tile w/Brown Spots **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable	6/11/2021	Tan/White		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 86C *042112580-0252*		**Description** 215 - Tan Ceramic Wall Tile w/Brown Spots **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable	6/11/2021	Tan/White		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 87A *042112580-0253*		**Description** 209 - Tan Ceramic Wall Tile w/Brown Spots Mastic **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Tan/White		100% Other	**Inconclusive: None Detected**
Material appears to be plaster.			Result includes a small amount of inseparable attached material.		
TEM NYS 198.4 NOB	6/11/2021	Tan/White		100% Other	**None Detected**
Sample ID 87B *042112580-0254*		**Description** 209 - Tan Ceramic Wall Tile w/Brown Spots Mastic **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Tan/White		100% Other	**Inconclusive: None Detected**
Material appears to be plaster.			Result includes a small amount of inseparable attached material.		
TEM NYS 198.4 NOB	6/11/2021	Tan/White		100% Other	**None Detected**

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EMSL Order:	042112580
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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 87C *042112580-0255*		**Description** 209 - Tan Ceramic Wall Tile w/Brown Spots Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	White		100% Other	**Inconclusive: None Detected**
Material appears to be plaster.			Result includes a small amount of inseparable attached material.		
TEM NYS 198.4 NOB	6/11/2021	White		100% Other	**None Detected**
Sample ID 88A *042112580-0256*		**Description** 209 - Tan Ceramic Wall Tile w/Brown Spots Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	White		100.00% Non-fibrous (other)	**None Detected**
Material appears to be ceramic tile					
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 88B *042112580-0257*		**Description** 209 - Tan Ceramic Wall Tile w/Brown Spots Grout **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable	6/11/2021	Tan/White		100.00% Non-fibrous (other)	**None Detected**
Material appears to be ceramic tile					
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 88C *042112580-0258*		**Description** 209 - Tan Ceramic Wall Tile w/Brown Spots Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	White		100.00% Non-fibrous (other)	**None Detected**
Material appears to be ceramic tile					
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 89A *042112580-0259*		**Description** 215 - Grid Ceiling Tile - 1x1 Rough Ceiling Tile **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray/White	52% Min. Wool	48% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Gray/White		100% Other	**None Detected**
Sample ID 89B *042112580-0260*		**Description** 215 - Grid Ceiling Tile - 1x1 Rough Ceiling Tile **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray/White	53% Min. Wool	47% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Gray/White		100% Other	**None Detected**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 89C *042112580-0261*		**Description** 215 - Grid Ceiling Tile - 1x1 Rough Ceiling Tile **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray/White	52% Min. Wool	48% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Gray/White		100% Other	**None Detected**
Sample ID 91A *042112580-0262*		**Description** - Shower Caulk **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	White		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	White		100% Other	**None Detected**
Sample ID 91B *042112580-0263*		**Description** - Shower Caulk **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	White		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	White		100% Other	**None Detected**
Sample ID 91C *042112580-0264*		**Description** - Shower Caulk **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	White		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	White		100% Other	**None Detected**
Sample ID 93A *042112580-0265*		**Description** 216 - On Wall - Blue Ceramic Wall Tile **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable	6/11/2021	White/Blue		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 93B *042112580-0266*		**Description** 216 - On Wall - Blue Ceramic Wall Tile **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable	6/11/2021	White/Blue		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 93C *042112580-0267*		**Description** 216 - On Wall - Blue Ceramic Wall Tile **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable	6/11/2021	White/Blue		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 94A *042112580-0268*		**Description** 216 - On Wall - Blue Ceramic Wall Tile Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray		100% Other	**Inconclusive: None Detected**
Material appears to be mortar.					
TEM NYS 198.4 NOB	6/11/2021	Gray		100% Other	**None Detected**
Sample ID 94B *042112580-0269*		**Description** 216 - On Wall - Blue Ceramic Wall Tile Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray		100% Other	**Inconclusive: None Detected**
Material appears to be mortar					
TEM NYS 198.4 NOB	6/11/2021	Gray		100% Other	**None Detected**
Sample ID 94C *042112580-0270*		**Description** 216 - On Wall - Blue Ceramic Wall Tile Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray		100% Other	**Inconclusive: None Detected**
Material appears to be mortar.					
TEM NYS 198.4 NOB	6/11/2021	Gray		100% Other	**None Detected**
Sample ID 95A *042112580-0271*		**Description** 216 - On Wall - Blue Ceramic Wall Tile Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	Gray		10.00% Ca Carbonate 90.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 95B *042112580-0272*		**Description** 216 - On Wall - Blue Ceramic Wall Tile Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	Gray		10.00% Ca Carbonate 90.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 95C *042112580-0273*		**Description** 216 - On Wall - Blue Ceramic Wall Tile Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	Gray		10.00% Ca Carbonate 90.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 96A *042112580-0274*		**Description** 204 - Yellow Carpet Glue - Carpet Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Tan		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Tan		100% Other	**None Detected**
Sample ID 96B *042112580-0275*		**Description** 204 - Yellow Carpet Glue - Carpet Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Tan		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Tan		100% Other	**None Detected**
Sample ID 96C *042112580-0276*		**Description** 204 - Yellow Carpet Glue - Carpet Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Tan		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Tan		100% Other	**None Detected**
Sample ID 97A *042112580-0277*		**Description** 217 - Floor - Tan Floor Tile w/Brown Specks 12x12 **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Tan	1.1% Fibrous (other)	98.9% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Tan		96.3% Other	**3.7% Chrysotile**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 97B *042112580-0278*		**Description** 217 - Floor - Tan Floor Tile w/Brown Specks 12x12 **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Tan		100% Other	**Inconclusive : <1%Chrysotile**
TEM NYS 198.4 NOB	6/11/2021	Tan		96.3% Other	**3.7% Chrysotile**
Sample ID 97C *042112580-0279*		**Description** 217 - Floor - Tan Floor Tile w/Brown Specks 12x12 **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Tan		100% Other	**Inconclusive : <1%Chrysotile**
TEM NYS 198.4 NOB	6/11/2021	Tan		96.4% Other	**3.6% Chrysotile**
Sample ID 98A *042112580-0280*		**Description** 217 - Floor - Tan Floor Tile w/Brown Specks 12x12 Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Tan		100% Other	**Inconclusive: None Detected**
Sample below method recommended minimum weight; analyzed at client's request.					
TEM NYS 198.4 NOB	6/11/2021	Tan		100% Other	**<1% Chrysotile**
Sample ID 98B *042112580-0281*		**Description** 217 - Floor - Tan Floor Tile w/Brown Specks 12x12 Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Tan		100% Other	**Inconclusive: None Detected**
Sample below method recommended minimum weight; analyzed at client's request.					
TEM NYS 198.4 NOB	6/11/2021	Tan		100% Other	**<1% Chrysotile**
Sample ID 98C *042112580-0282*		**Description** 217 - Floor - Tan Floor Tile w/Brown Specks 12x12 Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Tan		100% Other	**Inconclusive: None Detected**
Sample below method recommended minimum weight; analyzed at client's request.					
TEM NYS 198.4 NOB	6/11/2021	Tan		100% Other	**<1% Chrysotile**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 99A *042112580-0283*		**Description** 223 - Room 223 - Gray Cove Base **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Gray		100% Other	**None Detected**
Sample ID 99B *042112580-0284*		**Description** 223 - Room 223 - Gray Cove Base **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Gray		100% Other	**None Detected**
Sample ID 99C *042112580-0285*		**Description** 204 - Gray Cove Base **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Gray		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Gray		100% Other	**None Detected**
Sample ID 100A *042112580-0286*		**Description** 223 - Gray Cove Base Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Yellow		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Yellow		100% Other	**None Detected**
Sample ID 100B *042112580-0287*		**Description** 223 - Gray Cove Base Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Yellow		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Yellow		100% Other	**None Detected**
Sample ID 100C *042112580-0288*		**Description** 204 - Gray Cove Base Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/9/2021	Yellow		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Yellow		100% Other	**None Detected**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 101A *042112580-0289*		**Description** 214 - On Counter - White Countertop Adhesive **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Brown/White		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Brown/White		100% Other	**None Detected**
Sample ID 101B *042112580-0290*		**Description** 214 - On Counter - White Countertop Adhesive **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Brown/White		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Brown/White		100% Other	**None Detected**
Sample ID 101C *042112580-0291*		**Description** 214 - On Counter - White Countertop Adhesive **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Brown/White		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Brown/White		100% Other	**None Detected**
Sample ID 105A *042112580-0292*		**Description** 205 - Wall Tile - Blue and White Ceramic Tile **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable	6/11/2021	White/Blue		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 105B *042112580-0293*		**Description** 205 - Wall Tile - Blue and White Ceramic Tile **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	White		15.00% Ca Carbonate 85.00% Non-fibrous (other)	**None Detected**
Material appears to be joint compound					
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 105C *042112580-0294*		**Description** 205 - Wall Tile - Blue and White Ceramic Tile **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable	6/11/2021	White/Blue		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 106A *042112580-0295*		**Description** 205 - Wall Tile - Blue and White Ceramic Tile Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Tan		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Tan		100% Other	**None Detected**
Sample ID 106B *042112580-0296*		**Description** 205 - Wall Tile - Blue and White Ceramic Tile Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Tan		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Tan		100% Other	**None Detected**
Sample ID 106C *042112580-0297*		**Description** 205 - Wall Tile - Blue and White Ceramic Tile Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Tan		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Tan		100% Other	**None Detected**
Sample ID 107A *042112580-0298*		**Description** 205 - Wall Tile - Blue and White Ceramic Tile Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	White		10.00% Ca Carbonate 90.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 107B *042112580-0299*		**Description** 205 - Wall Tile - Blue and White Ceramic Tile Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	White		10.00% Ca Carbonate 90.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 107C *042112580-0300*		**Description** 205 - Wall Tile - Blue and White Ceramic Tile Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	White		10.00% Ca Carbonate 90.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**

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EMSL Order:	042112580
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ProjectID:	

Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 108A *042112580-0301*		**Description**	228 - Archway Bumper Caulk - Archway Bumper Caulk		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	White		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	White		100% Other	**None Detected**
Sample ID 108B *042112580-0302*		**Description**	228 - Archway Bumper Caulk - Archway Bumper Caulk		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	White		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	White		100% Other	**None Detected**
Sample ID 108C *042112580-0303*		**Description**	228 - Archway Bumper Caulk - Archway Bumper Caulk		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	White		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	White		100% Other	**None Detected**
Sample ID 109A *042112580-0304*		**Description**	215 - Gray Countertop - Gray Countertop Adhesive		
		Homogeneity	Heterogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Brown/Gray		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Brown/Gray		100% Other	**None Detected**
Sample ID 109B *042112580-0305*		**Description**	215 - Gray Countertop - Gray Countertop Adhesive		
		Homogeneity	Heterogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Brown/Gray		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Brown/Gray		100% Other	**None Detected**
Sample ID 109C *042112580-0306*		**Description**	215 - Gray Countertop - Gray Countertop Adhesive		
		Homogeneity	Heterogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Brown/Gray		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Brown/Gray		100% Other	**None Detected**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 110A *042112580-0307*		**Description**	213 - White Countertop - White Countertop Adhesive		
		Homogeneity	Heterogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Brown/White		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Brown/White		100% Other	**None Detected**
Sample ID 110B *042112580-0308*		**Description**	213 - White Countertop - White Countertop Adhesive		
		Homogeneity	Heterogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Brown/White		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Brown/White		100% Other	**None Detected**
Sample ID 110C *042112580-0309*		**Description**	213 - White Countertop - White Countertop Adhesive		
		Homogeneity	Heterogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Brown/White		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Brown/White		100% Other	**None Detected**
Sample ID 111A-Ceramic Tile *042112580-0310*		**Description**	209 - Blue Floor Tile - Dark Blue Ceramic Floor Tile		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable	6/11/2021	Blue		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 111A-Grout *042112580-0310A*		**Description**	209 - Blue Floor Tile - Grout		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable	6/11/2021	Gray		5.00% Ca Carbonate 95.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 111B *042112580-0311*		**Description**	209 - Blue Floor Tile - Dark Blue Ceramic Floor Tile		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable	6/11/2021	Blue		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 111C *042112580-0312*		**Description** 211 - Blue Floor Tile - Dark Blue Ceramic Floor Tile **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	Blue		100.00% Non-fibrous (other)	**None Detected**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 112A *042112580-0313*		**Description** 211 - Blue Floor Tile - Dark Blue Ceramic Floor Tile Mastic **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Brown/White		100% Other	**Inconclusive: None Detected**
Material appears to be plaster. Result includes a small amount of inseparable attached material.					
TEM NYS 198.4 NOB	6/11/2021	Brown/White		100% Other	**None Detected**
Sample ID 112B *042112580-0314*		**Description** 209 - Blue Floor Tile - Dark Blue Ceramic Floor Tile Mastic **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Brown/White		100% Other	**Inconclusive: None Detected**
Material appears to be plaster. Result includes a small amount of inseparable attached material.					
TEM NYS 198.4 NOB	6/11/2021	Brown/White		100% Other	**None Detected**
Sample ID 112C *042112580-0315*		**Description** 209 - Blue Floor Tile - Dark Blue Ceramic Floor Tile Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	White		100% Other	**Inconclusive: None Detected**
Material appears to be plaster. Result includes a small amount of inseparable attached material.					
TEM NYS 198.4 NOB	6/11/2021	White		100% Other	**None Detected**
Sample ID 113A *042112580-0316*		**Description** 211 - Blue Floor Tile - Dark Blue Ceramic Floor Tile Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	White		100.00% Non-fibrous (other)	**None Detected**
Material appears to be ceramic tile					
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 113B *042112580-0317*		**Description** 211 - Blue Floor Tile - Dark Blue Ceramic Floor Tile Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	White		100.00% Non-fibrous (other)	**None Detected**
Material appears to be ceramic tile					
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 113C *042112580-0318*		**Description** Day Room - Perimeter - Dark Blue Ceramic Floor Tile Grout **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable	6/11/2021	White		100.00% Non-fibrous (other)	**None Detected**
Material appears to be ceramic tile					
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB					**Not Analyzed**
TEM NYS 198.4 NOB					**Not Analyzed**
Sample ID 114A *042112580-0319*		**Description** Day Room - Perimeter - Black Cove Base **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Gray		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Gray		100% Other	**None Detected**
Sample ID 114B *042112580-0320*		**Description** Day Room - Perimeter - Black Cove Base **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Gray		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Gray		100% Other	**None Detected**
Sample ID 114C *042112580-0321*		**Description** Day Room - Perimeter - Black Cove Base **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Gray		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Gray		100% Other	**None Detected**
Sample ID 115A *042112580-0322*		**Description** Day Room - Perimeter - Black Cove Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Yellow		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Yellow		100% Other	**None Detected**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 115B *042112580-0323*		**Description**	Day Room - Perimeter - Black Cove Mastic		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Yellow		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Yellow		100% Other	**None Detected**
Sample ID 115C *042112580-0324*		**Description**	Day Room - Perimeter - Black Cove Mastic		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Yellow		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Yellow		100% Other	**None Detected**
Sample ID 116A *042112580-0325*		**Description**	206 - On Counters - Countertop Adhesive		
		Homogeneity	Heterogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Brown/White		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Brown/White		100% Other	**None Detected**
Sample ID 116B *042112580-0326*		**Description**	206 - On Counters - Countertop Adhesive		
		Homogeneity	Heterogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Brown/White		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Brown/White		100% Other	**None Detected**
Sample ID 116C *042112580-0327*		**Description**	206 - On Counters - Countertop Adhesive		
		Homogeneity	Heterogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Brown/White		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Brown/White		100% Other	**None Detected**
Sample ID 117A *042112580-0328*		**Description**	210 - Daytroom Perimeter - 12x12 Black Border Tile		
		Homogeneity	Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Black		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Black		100% Other	**None Detected**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 117B *042112580-0329*		**Description** 210 - Daytroom Perimeter - 12x12 Black Border Tile **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Black		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Black		100% Other	**None Detected**
Sample ID 117C *042112580-0330*		**Description** 210 - Daytroom Perimeter - 12x12 Black Border Tile **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Black		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Black		100% Other	**None Detected**
Sample ID 118A *042112580-0331*		**Description** 210 - Dayroom - 12x12 Light Red Floor Tile Border **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Pink		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Pink		100% Other	**None Detected**
Sample ID 118B *042112580-0332*		**Description** 210 - Dayroom - 12x12 Light Red Floor Tile Border **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Pink		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Pink		100% Other	**None Detected**
Sample ID 118C *042112580-0333*		**Description** 210 - Dayroom - 12x12 Light Red Floor Tile Border **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Pink		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Pink		100% Other	**None Detected**
Sample ID 119A *042112580-0334*		**Description** 210 - Dayroom - 12x12 Gray Floor Tile **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Gray		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Gray		100% Other	**None Detected**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 119B *042112580-0335*		**Description** 210 - Dayroom - 12x12 Gray Floor Tile **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Gray		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Gray		100% Other	**None Detected**
Sample ID 119C *042112580-0336*		**Description** 210 - Dayroom - 12x12 Gray Floor Tile **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Gray		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Gray		100% Other	**None Detected**
Sample ID 120A *042112580-0337*		**Description** 210 - Dayroom - Mastic under 117-119 **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Tan/White		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Tan/White		100% Other	**None Detected**
Sample ID 120B *042112580-0338*		**Description** 210 - Dayroom - Mastic under 117-119 **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Tan/White		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Tan/White		100% Other	**None Detected**
Sample ID 120C *042112580-0339*		**Description** 210 - Dayroom - Mastic under 117-119 **Homogeneity** Heterogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Tan/White		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Tan/White		100% Other	**None Detected**
Sample ID 121A *042112580-0340*		**Description** 233 A - Closet Floor - 9x9 Black Floor Tile **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Black		95.0% Other	**5.0% Chrysotile**
TEM NYS 198.4 NOB	6/10/2021			% Other	**Positive Stop (Not Analyzed)**

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Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 121B *042112580-0341*		**Description** **Homogeneity**	233 B - Closet Floor - 9x9 Black Floor Tile Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Black		94.4% Other	**5.6% Chrysotile**
TEM NYS 198.4 NOB	6/10/2021			% Other	**Positive Stop (Not Analyzed)**
Sample ID 121C *042112580-0342*		**Description** **Homogeneity**	233 B - Closet Floor - 9x9 Black Floor Tile Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Black		93.7% Other	**6.3% Chrysotile**
TEM NYS 198.4 NOB	6/10/2021			% Other	**Positive Stop (Not Analyzed)**
Sample ID 122A *042112580-0343*		**Description** **Homogeneity**	233 A - Closet Floor - 9x9 Black Floor Tile Mastic Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Black		100% Other	**Inconclusive : <1%Chrysotile**
Sample below method recommended minimum weight; analyzed at client's request.					
TEM NYS 198.4 NOB	6/11/2021	Black		97.9% Other	**2.1% Chrysotile**
Sample ID 122B *042112580-0344*		**Description** **Homogeneity**	233 B - Closet Floor - 9x9 Black Floor Tile Mastic Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Black		100% Other	**Inconclusive : <1%Chrysotile**
Sample below method recommended minimum weight; analyzed at client's request.					
TEM NYS 198.4 NOB	6/11/2021	Black		98.4% Other	**1.6% Chrysotile**
Sample ID 122C *042112580-0345*		**Description** **Homogeneity**	233 A - Closet Floor - 9x9 Black Floor Tile Mastic Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Black		100% Other	**Inconclusive : <1%Chrysotile**
Sample below method recommended minimum weight; analyzed at client's request.					
TEM NYS 198.4 NOB	6/11/2021	Black		98.1% Other	**1.9% Chrysotile**

Initial Report From 06/11/2021 15:16:36

EMSL Analytical, Inc.
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (800) 220-3675 / (856) 786-5974
http://www.EMSL.com cinnasblab@EMSL.com

EMSL Order:	042112580
CustomerID:	JAWO50
CustomerPO:	J2217018
ProjectID:	

Test Report:Asbestos Analysis of Bulk Material

Test		Color	Non Asbestos Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID 123A *042112580-0346*		**Description** 210 - Day Room Floor - 12x12 Bottom Floor Tile Layer **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Beige		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Beige		100% Other	**None Detected**
Sample ID 123B *042112580-0347*		**Description** 210 - Day Room Floor - 12x12 Bottom Floor Tile Layer **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Beige		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Beige		100% Other	**None Detected**
Sample ID 123C *042112580-0348*		**Description** 210 - Day Room Floor - 12x12 Bottom Floor Tile Layer **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Beige		100% Other	**Inconclusive: None Detected**
TEM NYS 198.4 NOB	6/11/2021	Beige		100% Other	**None Detected**
Sample ID 124A *042112580-0349*		**Description** 210 - Day Room Floor - 12x12 Bottom Floor Tile Layer Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Black		100% Other	**Inconclusive: None Detected**
Sample below method recommended minimum weight; analyzed at client's request.					
TEM NYS 198.4 NOB	6/11/2021	Black		100% Other	**<1% Chrysotile**
Sample ID 124B *042112580-0350*		**Description** 210 - Day Room Floor - 12x12 Bottom Floor Tile Layer Mastic **Homogeneity** Homogeneous			
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Black		100% Other	**Inconclusive: None Detected**
Sample below method recommended minimum weight; analyzed at client's request.					
TEM NYS 198.4 NOB	6/11/2021	Black		100% Other	**<1% Chrysotile**

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200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (800) 220-3675 / (856) 786-5974
http://www.EMSL.com cinnasblab@EMSL.com

EMSL Order:	042112580
CustomerID:	JAWO50
CustomerPO:	J2217018
ProjectID:	

Test Report:Asbestos Analysis of Bulk Material

Test		Color	Fibrous	Non Asbestos Non-Fibrous	Asbestos
Sample ID	124C *042112580-0351*	**Description** **Homogeneity**	210 - Day Room Floor - 12x12 Bottom Floor Tile Layer Mastic Homogeneous		
PLM NYS 198.1 Friable					**Not Analyzed**
PLM NYS 198.6 VCM					**Not Analyzed**
PLM NYS 198.6 NOB	6/10/2021	Black		100% Other	**Inconclusive: None Detected**
Sample below method recommended minimum weight; analyzed at client's request.					
TEM NYS 198.4 NOB	6/11/2021	Black		100% Other	**<1% Chrysotile**

Analyst(s)

Jessica Schwartz
Melissa Hartwig
Peter Donato

Samantha Rundstrom, Laboratory Manager
or other approved signatory

NOB = Non Friable Organically Bound N/A = Not Applicable VCM = Vermiculite Containing Material

-In New York State, TEM is currently the only method that can be used to determine if NOB materials can be considered or treated as non-asbestos containing.
All samples examined for the presence of vermiculite when analyzed via NYS 198.1.
-NYS Guidelines for Vermiculite containing samples are available at http://www.wadsworth.org/labcert/elapcert/forms/VermiculiteInterimGuidance_Rev070913.pdf
EMSL maintains liability limited to cost of analysis. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. Samples were received in good condition unless otherwise noted.
This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government. This report may contain data that is not covered by the NVLAP accreditation.

Samples analyzed by EMSL Analytical, Inc. Rochester, NY NYS ELAP 12088, NVLAP Lab Code 600183-0

Initial Report From 06/11/2021 15:16:36

APPENDIX D

PHOTO LOG OF CONFIRMED ACM

Photo #1 - HA #97 – Tan 12”x12” Floor Tile with Brown Specks

Photo #2 - HA #121 and #122 – Black 9”x9” floor tile and mastic (2nd floor, Room 233A/B)

Photo #3 – HA #3 and #4 – Black 9”x9” floor tile and mastic (ground floor, Room 19C)

Photo #4 – HA#9 Grey Window Caulking, north exterior stairwells

Photo #5 – HA #10 Black Caulking, north exterior stairwells

Photo #6 – Transite cement board radiator panels, behind radiators on 1st and 2nd floors
*not sampled by Terracon

Photo #7 – White 12”x12” floor tile and mastic throughout 1st floor
*not sampled by Terracon

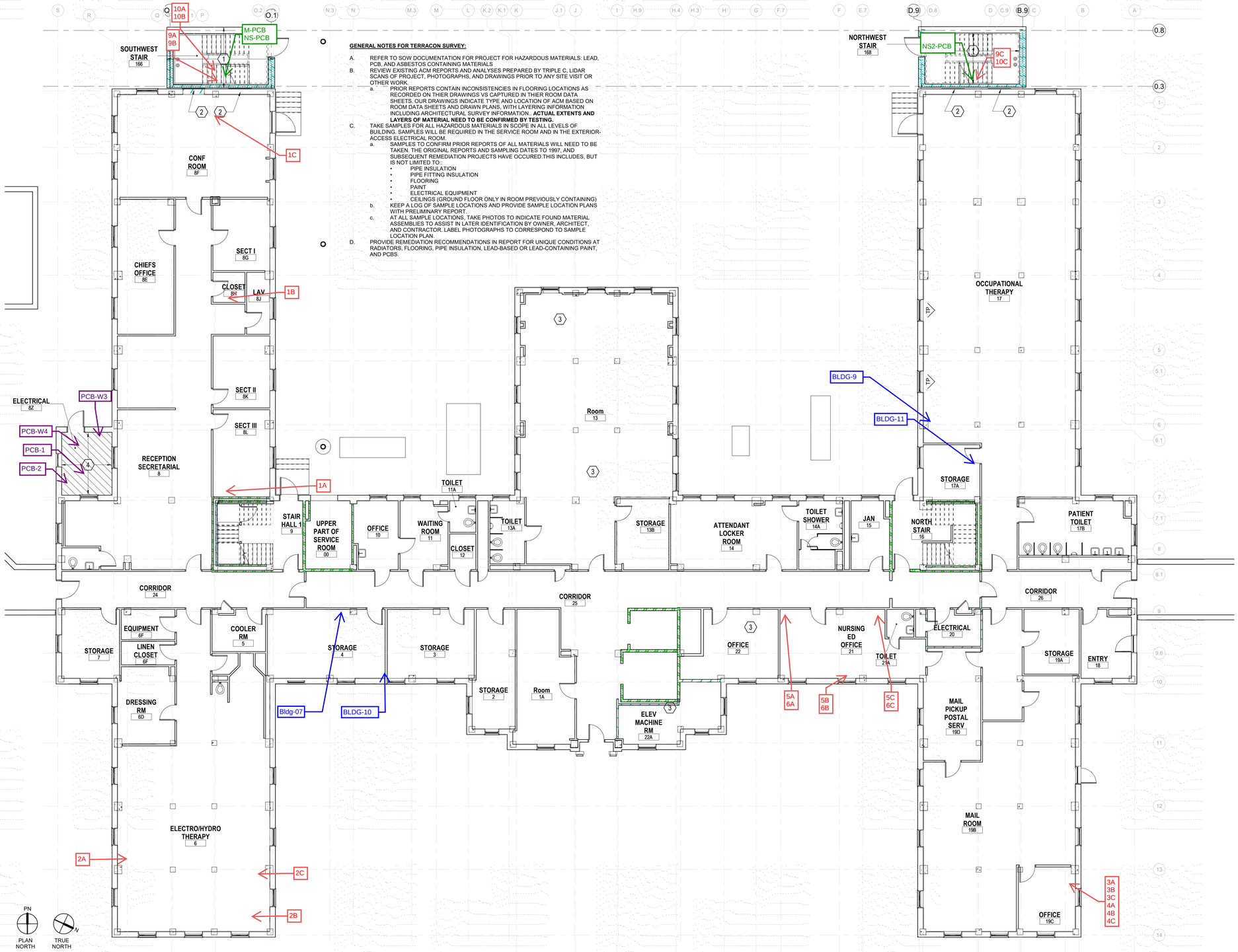
APPENDIX E

LICENSES AND CERTIFICATIONS

Not included in Specifications -
Available upon request

APPENDIX F

SAMPLE LOCATION DIAGRAMS



GENERAL NOTES FOR TERRACON SURVEY:

A. REFER TO SOW DOCUMENTATION FOR PROJECT FOR HAZARDOUS MATERIALS: LEAD, PCB, AND ASBESTOS CONTAINING MATERIALS

B. REVIEW EXISTING ACM REPORTS AND ANALYSES PREPARED BY TRIPLE C, LIDAR SCANS OF PROJECT, PHOTOGRAPHS, AND DRAWINGS PRIOR TO ANY SITE VISIT OR OTHER WORK.
   a. PRIOR REPORTS CONTAIN INCONSISTENCIES IN FLOORING LOCATIONS AS RECORDED ON THIER DRAWINGS VS CAPTURED IN THIER ROOM DATA SHEETS. OUR DRAWINGS INDICATE TYPE AND LOCATION OF ACM BASED ON ROOM DATA SHEETS AND DRAWN PLANS, WITH LAYERING INFORMATION INCLUDING ARCHITECTURAL SURVEY INFORMATION. **ACTUAL EXTENTS AND LAYERS OF MATERIAL NEED TO BE CONFIRMED BY TESTING.**

C. TAKE SAMPLES FOR ALL HAZARDOUS MATERIALS IN SCOPE IN ALL LEVELS OF BUILDING. SAMPLES WILL BE REQUIRED IN THE SERVICE ROOM AND IN THE EXTERIOR-ACCESS ELECTRICAL ROOM.
   a. SAMPLES TO CONFIRM PRIOR REPORTS OF ALL MATERIALS WILL NEED TO BE TAKEN. THE ORIGINAL REPORTS AND SAMPLING DATES TO 1997, AND SUBSEQUENT REMEDIATION PROJECTS HAVE OCCURED.THIS INCLUDES, BUT IS NOT LIMITED TO:-
      - PIPE INSULATION
      - PIPE FITTING INSULATION
      - FLOORING
      - PAINT
      - ELECTRICAL EQUIPMENT
      - CEILINGS (GROUND FLOOR ONLY IN ROOM PREVIOUSLY CONTAINING)
   b. KEEP A LOG OF SAMPLE LOCATIONS AND PROVIDE SAMPLE LOCATION PLANS WITH PRELIMINARY REPORT.
   c. AT ALL SAMPLE LOCATIONS, TAKE PHOTOS TO INDICATE FOUND MATERIAL ASSEMBLIES TO ASSIST IN LATER IDENTIFICATION BY ARCHITECT, AND CONTRACTOR. LABEL PHOTOGRAPHS TO CORRESPOND TO SAMPLE LOCATION PLAN.

D. PROVIDE REMEDIATION RECOMMENDATIONS IN REPORT FOR UNIQUE CONDITIONS AT RADIATORS, FLOORING, PIPE INSULATION, LEAD-BASED OR LEAD-CONTAINING PAINT, AND PCBS.

F1 ASBESTOS ABATEMENT PLAN - GROUND FLOOR

1/8" = 1'-0"

HAZARDOUS MATERIAL ABATEMENT GENERAL NOTES

1. ALL HAZARDOUS MATERIAL REMOVAL SHALL BE PERFORMED IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS AND ALL APPLICABLE FEDERAL, STATE AND LOCAL LAWS, REGULATIONS, ORDERS AND DIRECTIVES INCLUDING WITHOUT LIMITATIONS THOSE OF THE RESPONSIBLE STATE OF NEW YORK AGENCIES, U.S. ENVIRONMENTAL PROTECTION AGENCY, U.S. DEPARTMENT OF LABOR, OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION, NATIONAL INSTITUTE OF OCCUPATIONAL SAFETY AND HEALTH, STATE OF NEW YORK DEPARTMENT OF PUBLIC HEALTH, AND THE STATE OF NEW YORK DEPARTMENT OF ENVIRONMENTAL CONSERVATION
2. CONTRACTOR SHALL COMPLY WITH OSHA REGULATIONS FOR SILICA DUST CONTROL 29 CFR 1926.1153, 29 CFR 1910.134
3. CONTRACTOR SHALL USE EXTREME CARE AND CAUTION DURING ALL ABATEMENT PROCEDURES. CONTRACTOR SHALL CONDUCT REMOVAL OF ALL MATERIALS FROM THE SITE WITH A MINIMUM DISTURBANCE AND PROVIDE REGULAR MAINTENANCE AND PROTECTION OF THE BUILDING PREMISES, STAGING AREA, TRANSPORTATION ROUTES, ETC, THROUGHOUT THE BUILDING. REFER TO THE ICRA PLANS (SHEETS GI201-GI203) FOR GUIDANCE ON PLANNED DEBRIS TRANSPORT PATHS. COORDINATE PHASING OF WORK AND HAZARDOUS MATERIAL CONTAINMENT PLANS WITH THE COR. COORDINATE USAGE OF STAIRS VS USAGE OF CHUTE FOR DISPOSAL OF REMOVED HAZARDOUS MATERIAL ON THE FIRST FLOOR.THE ABATEMENT CONTRACTOR SHALL PREPARE THE WORK AREA FOR REMOVAL IN ACCORDANCE WITH APPLICABLE REGULATIONS. WHERE OVERLAPS OCCUR, THE MOST STRINGENT REQUIREMENTS APPLY.
4. THE DISTURBANCE OF ANY ACM, OR SUSPECT ACM, SHALL BE PERFORMED BY A NYS LICENSED ASBESTOS ABATEMENT CONTRACTOR.
5. THE DISTURBANCE OF ANY LEAD-BASED PAINT, OR SUSPECT LBP, SHALL BE PERFORMED BY A NYS LICENSED LEAD ABATEMENT CONTRACTOR. LEAD CONTAINING PAINT AND CONTAMINATED MATERIALS SHALL BE REMOVED AND DISPOSED OF IN COMPLIANCE WITH EPA AND OSHA REGULATIONS.
6. CONTRACTOR TO MAINTAIN MEANS OF EGRESS PATHWAYS AT ALL TIMES. COORDINATE ALTERNATE PROVISIONS AND OBTAIN APPROVAL FROM OWNER AND AHJ IF EXISTING MEANS OF EGRESS MUST BE COMPROMISED.OF MATERIAL EQUIPMENT, WASTE TRAILERS/DUMPSTERS, AS WELL AS CONTRACTOR PARKING SHALL BE COORDINATED WITH THE REST OF THE CONTRACT DOCUMENTS, THE GENERAL CONTRACTOR, AND THE COR.
7. CONTRACTOR SHALL DEVELOP AND IMPLEMENT WRITTEN STANDARD OPERATING PROCEDURES FOR ABATEMENT WORK TO ENSURE MAXIMUM PROTECTION AND SAFEGUARDS FOR LEAD AND/OR ASBESTOS EXPOSURE TO WORKERS, PATIENTS, EMPLOYEES, GENERAL PUBLIC, AND THE ENVIRONMENT.
8. THE LOCATIONS OF SITE STORAGE SHALL BE COORDINATED WITH THE VA COR.
9. CONTRACTOR SHALL PROVIDE ALL TOOLS, SCAFFOLDING, LADDERS, BARRIERS, AND ASSOCIATED MATERIALS AND EQUIPMENT REQUIRED TO COMPLETE ALL WORK INDICATED IN THE CONTRACT DOCUMENTS. THE OWNER OR THIER REPRESETATIVE SHALL NOT BE RSPONSIBLE FOR LOST, DAMAGED OR STOLEN ITEMS.
10. CONTRACTOR SHALL PROVIDE ALL SIGNS, LABELS, WARNINGS, AND POSTED INSTRUCTIONS THAT ARE NECESSARY TO PROTECT, INFORM, AND WARN OF THE HAZARD FROM ASBESTOS EXPOSURE.
11. CONTRACTOR SHALL POST IN A PROMINENT AND CONVENIENT PLACE FOR LABORERS, A COPY OF THE LATEST APPLICABLE REGULATIONS FROM OSHA, EPA, NIOSH, NYSDPH, AND THE NYSDEC.
12. CONTRACTOR SHALL COMPLETELY PROTECT ALL CONTROLS, CONDUIT, TUBING, ELECTRICAL PANELS, EQUIPMENT, ETC, SCHEDULED TO REMAIN WITHIN THE WORK AREAS.
13. ALL BUILDING FINISHES, CONSTRUCTION EQUIPMENT, OR OTHER COMPONENTS OF THE BUILDING WHICH ARE SCHEDULED TO REMAIN, THAT ARE DAMAGED OR ARE IN ANY WAY DISRUPTED AS A RESULT OF THE EXECUTION OF THIS CONTRACT ARE TO BE REPLACED OR RESTORED TO ORIGINAL CONDITIONS BY THE CONTRACTOR, WITHOUT ADDITIONAL COST TO THE OWNER.
14. THE VA AND THE HAZARDOUS MATERIAL ABATEMENT CONTRACTOR SHALL MUTUALLY AGREE ON THE NUMBER AND LOCATION OF ANY REMOTE DECONTAMINATION UNITS DURING THE PRE-CONSTRUCTION MEETING. TWO RECOMMENDED LOCATIONS HAVE BEEN PROVIDED ON THE DRAWINGS.
15. SUBMIT DRAWINGS INDICATING THE LOCATION AND NUMBER OF HEPA FILTER EQUIPPED NEGATIVE PRESSURE MACHINES, AIRLOCKS, AND DECONTAMINATION CHAMBERS. SUBMIT CALCULATIONS SHOWING THE NUMBER OF AIR CHANGES FOR EACH CONTAMENTS AREA.
16. PHASE WORK AS REQUIRED BY THE GENERAL CONTRACTOR AND VA CONTRACTOR TO COORDINATE DEMOLITION ACTIVITIES WITH COR TO MAINTAIN FULL FUNCTIONALITY OF ADJACENT OCCUPIED SPACES. THE GROUND FLOOR IS INTENDED TO REMAIN OPERATIONAL DURING THIS PROJECT. UTILIZE GLOVEBAG METHODS ON THE GROUND FLOOR TO MINIMIZE IMPACT ON BUILDING OPERATIONS.
17. CONTRACTOR TO PROVIDE FIRE, SMOKE, DIRT, DUST AND NOISE CONTAINMENT BARRIERS BETWEEN WORK AREA AND ADJACENT OCCUPIED SPACES. COORDINATE WITH VA ICRA, ASBESTOS, AND LEAD ABATEMENT REQUIREMENTS, AND THE COR.
18. CONTRACTOR TO COORDINATE ALL UTILITY SYSTEM SHUTDOWN ACTIVITIES IN ADVANCE WITH THE COR. ALL OCCUPIED SPACES ADJACENT TO THE AREA OF WORK ARE TO REMAIN OPERATIONAL.
19. WORK OUTSIDE OF NORMAL HOURS MUST BE APPROVED BY THE COR.
20. THE ASBESTOS ABATEMENT CONTRACTOR AND THE MECHANICAL AND PLUMBING CONTRACTORS SHALL BE RESPONSIBLE FOR DISMANTLING ANY HVAC EQUIPMENT AS NECESSARY TO GAIN ACCESS TO ACM ON HVAC EQUIPMENT FOR PROPER REMOVAL AND DISPOSAL.
21. CONTRACTOR TO REMOVE ALL DEMOLITION AND CONSTRUCTION DEBRIS ON A DAILY BASIS. COORDINATE MEANS, METHODS AND ROUTES WITH VA ASBESTOS AND ICRA REQUIREMENTS, AND THE COR. ALL REMOVED HAZARDOUS MATERIALS AND HAZARDOUS MATERIAL CONTAMINATED WASTE SHALL BE PROPERLY PACKAGED PRIOR TO REMOVAL FROM THE WORK AREAS. WARNING LABELS SHALL BE APPLIED TO ASBESTOS WASTE AS APPROPRIATE. ALL ACM OR LCP REMOVED SHALL BE ACCOMPANIED BY A WASTE SHIPMENT RECORDS. COMPLETED WASTE SHIPMENT RECORDS SHALL BE PROVIDED TO THE OWNER AS A PART OF THE CLOSEOUT DOCUMENTATION, ORIGINAL RECORDS SHALL BE PROVIDED TO THE OWNER WITHIN 35 DAYS OF WASTE LEAVING THE SITE.
22. CONTRACTOR TO ASSUME THAT ALL UNTESTED ORIGINAL BUILDING MATERIALS TO CONTAIN ASBESTOS OR LEAD, UNLESS SAID MATERIAL IS TESTED AND CONFIRMED AS CONTAINING LESS THAN THE REGULATED PERCENTAGE OF ASBESTOS AND/OR LEAD. EXISTING ACM HAS BEEN CONFIRMED IN PIPE INSULATION AND FITTINGS, SPECIFIC ORIGINAL FLOORING MATERIALS, AND IN TRANSITE PANELS AT RADIATORS BELOW WINDOWS. NO ASBESTOS CONTENT HAS BEEN IDENTIFIED IN SAMPLING OF CIELING TILES, DRYWALL, JOINT COMPOUND, SKIM COAT, FIBERBOARD, FIRESTOP, COVE BASE, MASONRY WINDOW CAULK, BATHROOM CAULK, TILE GROUT, TILE GLUE, CERAMIC TILES, OR SPECIFIC FLOORING MATERIALS. LEAD CONTAINING PAINT HAS BEEN IDENTIFIED IN AT LEAST ONE AREA IN THE FACILITY. SHOULD ANY PREVIOUSLY UNIDENTIFIED OR OTHERWISE UNANTICIPATED SUSPECT MATERIAL BE IDENTIFIED DURING CONSTRUCTION, STOP WORK AND NOTIFY OWNER FOR FURTHER DIRECTION. UNDER NO CIRCUMSTANCES SHALL THE CONTRACTOR COLLECT OR ANALYZE BULK SAMPLES OF SUSPECT MATERIALS WITHOUT THE APPROVAL OF THE OWNER.
23. ALL MATERIAL MEASUREMENTS, QUANTITIES, AND LOCATIONS ARE APPROXIMATE AND FOR GENERAL ORIENTATION ONLY. AS HIDDEN CONDITIONS ARE UNCOVERED, ADDITIONAL HAZARDOUS MATERIAL MAY BE UNCOVERED THAT REQUIRE ABATEMENT. REFER TO SPECIFICATIONS FOR ADDITIONAL INFORMATION. REFER TO PHOTOGRAPHS ON HP001 FOR ADDITIONAL INFORMATION REGARDING SPECIFIC KNOWN HAZARDOUS MATERIALS.

KEYNOTES

1. NEW STAIR TOWER, CONSTRUCTED AS PHASE 1, COMPLETED PRIOR TO INTERIOR ASBESTOS ABATEMENT TO PERMIT USAGE OF THE STAIRS FOR ASBESTOS REMOVAL PATHS FROM UPPER FLOORS.
2. WINDOWS SCHEDULED TO BE IMPACTED BY NEW STAIRS. DEMOLITION AND INFILL WILL OCCUR. TRANSITE PANELS AT EQUIPMENT BELOW REMOVED WINDOWS TO BE ABATED. SEALANT AT WINDOW HEADERS CONTAINS ASBESTOS BASED ON HISTORICAL ASBESTOS ASSESSMENTS.
3. ASBESTOS ABATEMENT SCHEDULED ON THIS FLOOR TO INCLUDE CEILING TILE, PIPE AND PIPE FITTING ACM INSULATION ONLY. REFER TO SHEET HC101 FOR MORE INFORMATION.
4. TEST FOR PCBS AT EXISTING ELECTRICAL EQUIPMENT IN ELECTRICAL ROOM.

LEGEND

- REMOVAL PATH — PATH INDICATED IS PROVIDED FOR INTENT ONLY. COORDINATE FINAL REMOVAL PATHWAYS, PHASING, AND METHODS WITH GENERAL CONTRACTOR AND COR.
- # — ASBESTOS SAMPLE LOCATION
- # — PAINT CHIP SAMPLE LOCATION
- # — PCB BULK SAMPLE LOCATION
- # — PCB WIPE SAMPLE LOCATION

NOT FOR CONSTRUCTION

Revisions: | Date:

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STAMP

Office of Construction and Facilities Management

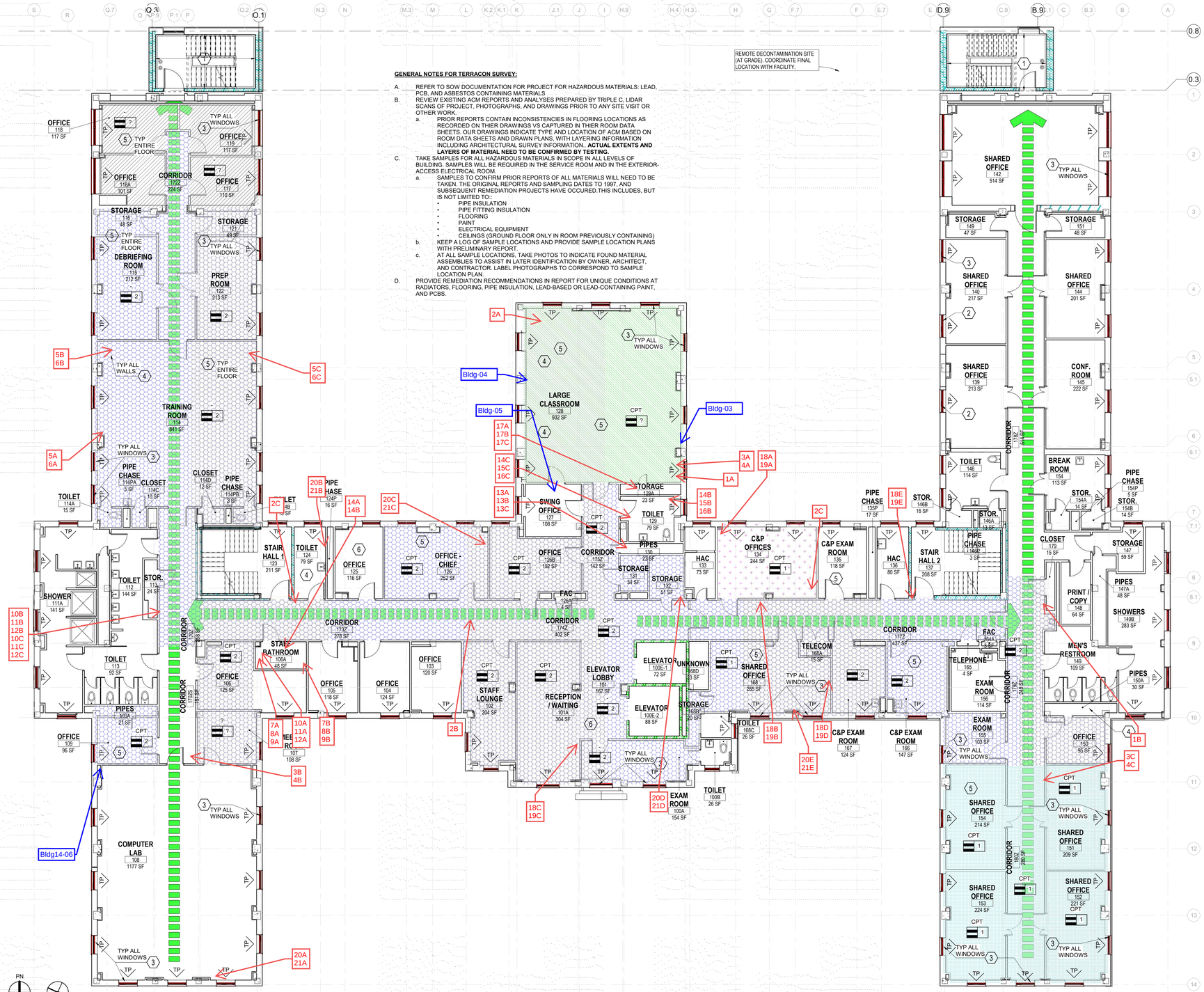
VA U.S. Department of Veterans Affairs

Drawing Title	HAZARDOUS ABATEMENT - GROUND FLOOR
Approved:	
Phase	DESIGN DEVELOPMENT
	FULLY SPRINKLERED
Project Title	RENOVATE B14 ABCD - RESIDENTIAL PROGRAM
Project Number	620-20-105
Building Number	B14ABCD
Location	2094 Albany Post Road, Montrose, NY 10548
Issue Date	05/04/2021
Checked	M. Perkins
Drawn	K. BICKEL
Drawing Number	H-101

VA FORM 08 - 6231

BIM 360://620-20-105 Renovate B14 ABCD 101201208620-20-105.14 ABCD-A.rvt

4/21/2021 10:57:35 AM



01 ASBESTOS ABATEMENT PLAN - FIRST FLOOR

1/8" = 1'-0"

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A. REFER TO SOW DOCUMENTATION FOR PROJECT FOR HAZARDOUS MATERIALS: LEAD, PCB, AND ASBESTOS CONTAINING MATERIALS

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13. ALL BUILDING FINISHES, CONSTRUCTION EQUIPMENT, OR OTHER COMPONENTS OF THE BUILDING WHICH ARE SCHEDULED TO REMAIN, THAT ARE DAMAGED OR ARE IN ANY WAY DISRUPTED AS A RESULT OF THE EXECUTION OF THIS CONTRACT ARE TO BE REPLACED OR RESTORED TO ORIGINAL CONDITIONS BY THE CONTRACTOR, WITHOUT ADDITIONAL COST TO THE OWNER.
14. THE VA AND THE HAZARDOUS MATERIAL ABATEMENT CONTRACTOR SHALL MUTUALLY AGREE ON THE NUMBER AND LOCATION OF ANY REMOTE DECONTAMINATION UNITS DURING THE PRE-CONSTRUCTION MEETING. TWO RECOMMENDED LOCATIONS HAVE BEEN PROVIDED ON THE DRAWINGS.
15. SUBMIT DRAWINGS INDICATING THE LOCATION AND NUMBER OF HEPA FILTER EQUIPPED NEGATIVE PRESSURE MACHINES, AIRLOCKS, AND DECONTAMINATION CHAMBERS. SUBMIT CALCULATIONS SHOWING THE NUMBER OF AIR CHANGES FOR EACH CONTAINMENTS AREA.
16. PHASE WORK AS REQUIRED BY THE GENERAL CONTRACTOR AND VA. CONTRACTOR TO COORDINATE DEMOLITION ACTIVITIES WITH COR TO MAINTAIN FULL FUNCTIONALITY OF ADJACENT OCCUPIED SPACES. THE GROUND FLOOR IS INTENDED TO REMAIN OPERATIONAL DURING THIS PROJECT. UTILIZE GLOVEBAG METHODS ON THE GROUND FLOOR TO MINIMIZE IMPACT ON BUILDING OPERATIONS.
17. CONTRACTOR TO PROVIDE FIRE, SMOKE, DIRT, DUST AND NOISE CONTAINMENT BARRIERS BETWEEN WORK AREA AND ADJACENT OCCUPIED SPACES. COORDINATE WITH VA ICRA, ASBESTOS, AND LEAD ABATEMENT REQUIREMENTS, AND THE COR.
18. CONTRACTOR TO COORDINATE ALL UTILITY SYSTEM SHUTDOWN ACTIVITIES IN ADVANCE WITH THE COR. ALL OCCUPIED SPACES ADJACENT TO THE AREA OF WORK ARE TO REMAIN OPERATIONAL.
19. WORK OUTSIDE OF NORMAL HOURS MUST BE APPROVED BY THE COR.
20. THE ASBESTOS ABATEMENT CONTRACTOR AND THE MECHANICAL AND PLUMBING CONTRACTORS SHALL BE RESPONSIBLE FOR DISMANTLING ANY HVAC EQUIPMENT AS NECESSARY TO GAIN ACCESS TO ACM ON HVAC EQUIPMENT FOR PROPER REMOVAL AND DISPOSAL.
21. CONTRACTOR TO REMOVE ALL DEMOLITION AND CONSTRUCTION DEBRIS ON A DAILY BASIS. COORDINATE MEANS, METHODS AND ROUTES WITH VA ASBESTOS AND ICRA REQUIREMENTS, AND THE COR. ALL REMOVED HAZARDOUS MATERIALS AND HAZARDOUS MATERIAL CONTAMINATED WASTE SHALL BE PROPERLY PACKAGED PRIOR TO REMOVAL FROM THE WORK AREAS. WARNING LABELS SHALL BE APPLIED TO ASBESTOS WASTE AS APPROPRIATE. ALL ACM OR LCP REMOVED SHALL BE ACCOMPANIED BY A WASTE SHIPMENT RECORDS. COMPLETED WASTE SHIPMENT RECORDS SHALL BE PROVIDED TO THE OWNER AS A PART OF THE CLOSEOUT DOCUMENTATION, ORIGINAL RECORDS SHALL BE PROVIDED TO THE OWNER WITHIN 35 DAYS OF WASTE LEAVING THE SITE.
22. CONTRACTOR TO ASSUME THAT ALL UNTESTED ORIGINAL BUILDING MATERIALS TO CONTAIN ASBESTOS OR LEAD, UNLESS SAID MATERIAL IS TESTED AND CONFIRMED AS CONTAINING LESS THAN THE REGULATORY PERCENTAGE OF ASBESTOS AND/OR LEAD. EXISTING ACM HAS BEEN CONFIRMED IN PIPE INSULATION AND FITTINGS, SPECIFIC ORIGINAL FLOORING MATERIALS, AND IN TRANSITE PANELS AT RADIATORS BELOW WINDOWS. NO ASBESTOS CONTENT HAS BEEN IDENTIFIED IN SAMPLING OF CIELING TILES, DRYWALL, JOINT COMPOUND, SKIM COAT, FIBERBOARD, FIRESTOP, COVE BASE, MASONRY WINDOW CAULK, BATHROOM CAULK, TILE GROUT, TILE GLUE, CERAMIC TILES, OR SPECIFIC FLOORING MATERIALS. LEAD CONTAINING PAINT HAS BEEN IDENTIFIED IN AT LEAST ONE AREA IN THE FACILITY. SHOULD ANY PREVIOUSLY UNIDENTIFIED OR OTHERWISE UNANTICIPATED SUSPECT MATERIAL BE IDENTIFIED DURING CONSTRUCTION, STOP WORK AND NOTIFY OWNER FOR FURTHER DIRECTION. UNDER NO CIRCUMSTANCES SHALL THE CONTRACTOR COLLECT OR ANALYZE BULK SAMPLES OF SUSPECT MATERIALS WITHOUT THE APPROVAL OF THE OWNER.
23. ALL MATERIAL MEASUREMENTS, QUANTITIES, AND LOCATIONS ARE APPROXIMATE AND FOR GENERAL ORIENTATION ONLY. AS HIDDEN CONDITIONS ARE UNCOVERED, ADDITIONAL HAZARDOUS MATERIAL MAY BE UNCOVERED THAT REQUIRE ABATEMENT. REFER TO SPECIFICATIONS FOR ADDITIONAL INFORMATION. REFER TO PHOTOGRAPHS ON HP001 FOR ADDITIONAL INFORMATION REGARDING SPECIFIC KNOWN HAZARDOUS MATERIALS.

KEYNOTES

1. NEW STAIR TOWER, CONSTRUCTED AS PHASE 1, COMPLETED PRIOR TO INTERIOR ASBESTOS ABATEMENT TO PERMIT USAGE OF THE STAIRS FOR ASBESTOS REMOVAL PATHS FROM UPPER FLOORS.
2. -
3. ABATE TRANSITE PANELS ON RADIATOR BELOW WINDOW, TYP ALL WINDOWS THIS FLOOR.
4. ADDITIONAL SCHEDULED ABATEMENT ON THIS FLOOR INCLUDES PIPE AND PIPE FITTING INSULATION. SPACES ARE NOTED FOR COORDINATION. REFER TO SHEET HC102 FOR MORE INFORMATION.
5. ABATE FLOOR FINISH WHERE ANY ASBESTOS FLOORING HAS BEEN RECORDED TO OCCUR.

→ ASBESTOS SAMPLE LOCATION

→ PAINT CHIP SAMPLE LOCATION

→ PCB BULK SAMPLE LOCATION

LEGEND

QUANTITIES - ACM MATERIALS

1-112796-02-A	5898 SF	3.9 % CHRYSOTILE FROM HISTORICAL RECORD	INFORMATION FROM 2017 ASBESTOS SURVEY BY THOMAS EGAN
1-112796-03-A	1148 SF	6.2 % CHRYSOTILE FROM HISTORICAL RECORD	INFORMATION FROM 2017 ASBESTOS SURVEY BY THOMAS EGAN
1-112796-04-A	244 SF	2.6 % CHRYSOTILE FROM HISTORICAL RECORD	INFORMATION FROM 2017 ASBESTOS SURVEY BY THOMAS EGAN
1-120296-01-A	932 SF	3.1 % CHRYSOTILE FROM HISTORICAL RECORD	INFORMATION FROM 2017 ASBESTOS SURVEY BY THOMAS EGAN
1-122396-03A	445 SF	ASSUMED ACM, MISSING LAB INFORMATION	INFORMATION FROM 2017 ASBESTOS SURVEY BY THOMAS EGAN
	8668 SF	**TOTAL FLOOR FINISH MATERIAL TO BE ABATED THIS FLOOR**	
TP TRANSITE PANELS	1478 SF ± 112 @ 13SF EA	TRANSITE PANELS (AT WINDOWS) TO BE ABATED THIS FLOOR	

SAMPLE HA ## — SAMPLE LOCATION: NOT ALL SAMPLE LOCATIONS SHOWN FOR CLARITY. ONLY POSITIVE OR POSITIVE STOP SAMPLES ARE LOCATED. SAMPLE NUMBERS ARE BASED ON SURVEY REPORT. REFER TO SURVEY REPORT FOR SPECIFIC SAMPLE INFORMATION.

XXX — LAYER INDICATOR: LAYERS OF FLOORING AS INDICATED IN HISTORICAL RECORDS/NEW SAMPLING. TOP ENCAPSULATING LAYER, WHERE OCCURS, IS INDICATED ABOVE USING ARCHITECTURAL ABBREVIATIONS FOR MATERIALS.

REMOVAL PATH — PATH INDICATED IS PROVIDED FOR INTENT ONLY. COORDINATE FINAL REMOVAL PATHWAYS, PHASING, AND METHODS WITH GENERAL CONTRACTOR AND COR.

NOT FOR CONSTRUCTION

Revisions: Date:

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Office of Construction and Facilities Management
VA U.S. Department of Veterans Affairs

Drawing Title: HAZARDOUS ABATEMENT - FIRST FLOOR

Approved:

Phase: DESIGN DEVELOPMENT

FULLY SPRINKLERED

Project Title: RENOVATE B14 ABCD - RESIDENTIAL PROGRAM

Location: 2094 Albany Post Road, Montrose, NY 10548

Project Number: 620-20-105

Building Number: B14ABCD

Drawing Number: H-102

Issue Date: 05/04/2021 | Checked: M. Perkins | Drawn: K. BICKEL

VA FORM 08 - 6231

BIM 360://620-20-105 Renovate B14 ABCD 101201/620-20-105.14 ABCD-A.rvt

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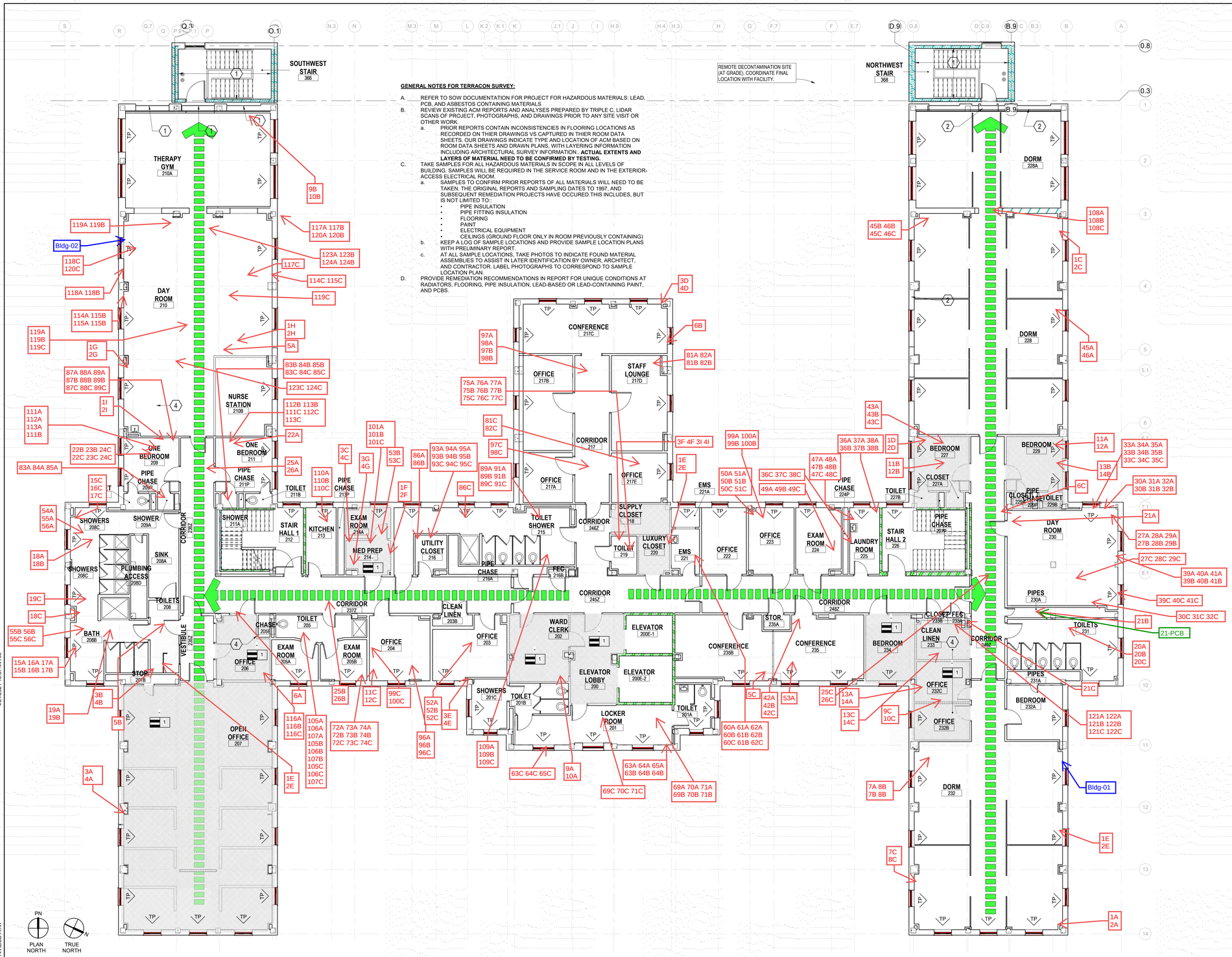

1 ASBESTOS ABATEMENT PLAN - SECOND FLOOR
1/8" = 1'-0"

GENERAL NOTES FOR TERRACON SURVEY:

A. REFER TO SOW DOCUMENTATION FOR PROJECT FOR HAZARDOUS MATERIALS: LEAD, PCB, AND ASBESTOS CONTAINING MATERIALS

B. REVIEW EXISTING ACM REPORTS AND ANALYSES PREPARED BY TRIPLE C, LIDAR SCANS OF PROJECT, PHOTOGRAPHS, AND DRAWINGS PRIOR TO ANY SITE VISIT OR OTHER WORK.
   a. PRIOR REPORTS CONTAIN INCONSISTENCIES IN FLOORING LOCATIONS AS RECORDED ON THIER DRAWINGS VS CAPTURED IN THIER ROOM DATA SHEETS. OUR DRAWINGS INDICATE TYPE AND LOCATION OF ACM BASED ON ROOM DATA SHEETS AND DRAWN PLANS, WITH LAYERING INFORMATION INCLUDING ARCHITECTURAL SURVEY INFORMATION. **ACTUAL EXTENTS AND LAYERS OF MATERIAL NEED TO BE CONFIRMED BY TESTING.**

C. TAKE SAMPLES FOR ALL HAZARDOUS MATERIALS IN SCOPE IN ALL LEVELS OF BUILDING. SAMPLES WILL BE REQUIRED IN THE SERVICE ROOM AND IN THE EXTERIOR-ACCESS ELECTRICAL ROOM.
   a. SAMPLES TO CONFIRM PRIOR REPORTS OF ALL MATERIALS WILL NEED TO BE TAKEN. THE ORIGINAL REPORTS AND SAMPLING DATES TO 1997, AND SUBSEQUENT REMEDIATION PROJECTS HAVE OCCURED.THIS INCLUDES, BUT IS NOT LIMITED TO:-
      - PIPE INSULATION
      - PIPE FITTING INSULATION
      - FLOORING
      - PAINT
      - ELECTRICAL EQUIPMENT
      - CEILINGS (GROUND FLOOR ONLY IN ROOM PREVIOUSLY CONTAINING)
   b. KEEP A LOG OF SAMPLE LOCATIONS AND PROVIDE SAMPLE LOCATION PLANS WITH PRELIMINARY REPORT.
   c. AT ALL SAMPLE LOCATIONS, TAKE PHOTOS TO INDICATE FOUND MATERIAL ASSEMBLIES TO ASSIST IN LATER IDENTIFICATION BY OWNER, ARCHITECT, AND CONTRACTOR. LABEL PHOTOGRAPHS TO CORRESPOND TO SAMPLE LOCATION PLAN.

D. PROVIDE REMEDIATION RECOMMENDATIONS IN REPORT FOR UNIQUE CONDITIONS AT RADIATORS, FLOORING, PIPE INSULATION, LEAD-BASED OR LEAD-CONTAINING PAINT, AND PCBS.

HAZARDOUS MATERIAL ABATEMENT GENERAL NOTES

1. ALL HAZARDOUS MATERIAL REMOVAL SHALL BE PERFORMED IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS AND ALL APPLICABLE FEDERAL, STATE AND LOCAL LAWS, REGULATIONS, ORDERS AND DIRECTIVES INCLUDING WITHOUT LIMITATIONS THOSE OF THE RESPONSIBLE STATE OF NEW YORK AGENCIES, U.S. ENVIRONMENTAL PROTECTION AGENCY, U.S. DEPARTMENT OF LABOR, OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION, NATIONAL INSTITUTE OF OCCUPATIONAL SAFETY AND HEALTH, STATE OF NEW YORK DEPARTMENT OF PUBLIC HEALTH, AND THE STATE OF NEW YORK DEPARTMENT OF ENVIRONMENTAL CONSERVATION
2. CONTRACTOR SHALL COMPLY WITH OSHA REGULATIONS FOR SILICA DUST CONTROL 29 CFR 1926.1153, 29 CFR 1910.134
3. CONTRACTOR SHALL USE EXTREME CARE AND CAUTION DURING ALL ABATEMENT PROCEDURES. CONTRACTOR SHALL CONDUCT REMOVAL OF ALL MATERIALS FROM THE SITE WITH A MINIMUM DISTURBANCE AND PROVIDE REGULAR MAINTENANCE AND PROTECTION OF THE BUILDING PREMISES, STAGING AREA, TRANSPORTATION ROUTES, ETC, THROUGHOUT THE BUILDING. REFER TO THE ICRA PLANS (SHEETS GI201-GI203) FOR GUIDANCE ON PLANNED DEBRIS TRANSPORT PATHS. COORDINATE PHASING OF WORK AND HAZARDOUS MATERIAL CONTAINMENT PLANS WITH THE COR. COORDINATE USAGE OF STAIRS VS USAGE OF CHUTE FOR DISPOSAL OF REMOVED HAZARDOUS MATERIAL ON THE FIRST FLOOR.THE ABATEMENT CONTRACTOR SHALL PREPARE THE WORK AREA FOR REMOVAL IN ACCORDANCE WITH APPLICABLE REGULATIONS. WHERE OVERLAPS OCCUR, THE MOST STRINGENT REQUIREMENTS APPLY.
4. THE DISTURBANCE OF ANY ACM, OR SUSPECT ACM, SHALL BE PERFORMED BY A NYS LICENSED ASBESTOS ABATEMENT CONTRACTOR.
5. THE DISTURBANCE OF ANY LEAD-BASED PAINT, OR SUSPECT LBP, SHALL BE PERFORMED BY A NYS LICENSED LEAD ABATEMENT CONTRACTOR. LEAD CONTAINING PAINT AND CONTAMINATED MATERIALS SHALL BE REMOVED AND DISPOSED OF IN COMPLIANCE WITH EPA AND OSHA REGULATIONS.
6. CONTRACTOR TO MAINTAIN MEANS OF EGRESS PATHWAYS AT ALL TIMES. COORDINATE ALTERNATE PROVISIONS AND OBTAIN APPROVAL FROM OWNER AND AHJ IF EXISTING MEANS OF EGRESS MUST BE COMPROMISED.OF MATERIAL EQUIPMENT, WASTE TRAILERS/DUMPSTERS, AS WELL AS CONTRACTOR PARKING SHALL BE COORDINATED WITH THE REST OF THE CONTRACT DOCUMENTS, THE GENERAL CONTRACTOR, AND THE COR.
7. CONTRACTOR SHALL DEVELOP AND IMPLEMENT WRITTEN STANDARD OPERATING PROCEDURES FOR ABATEMENT WORK TO ENSURE MAXIMUM PROTECTION AND SAFEGUARDS FOR LEAD AND/OR ASBESTOS EXPOSURE TO WORKERS, PATIENTS, EMPLOYEES, GENERAL PUBLIC, AND THE ENVIRONMENT.
8. THE LOCATIONS OF SITE STORAGE SHALL BE COORDINATED WITH THE VA COR.
9. CONTRACTOR SHALL PROVIDE ALL TOOLS, SCAFFOLDING, LADDERS, BARRIERS, AND ASSOCIATED MATERIALS AND EQUIPMENT REQUIRED TO COMPLETE ALL WORK INDICATED IN THE CONTRACT DOCUMENTS. THE OWNER OR THIER REPRESENTATIVE SHALL NOT BE RESPONSIBLE FOR LOST, DAMAGED OR STOLEN ITEMS.
10. CONTRACTOR SHALL PROVIDE ALL SIGNS, LABELS, WARNINGS, AND POSTED INSTRUCTIONS THAT ARE NECESSARY TO PROTECT, INFORM, AND WARN OF THE HAZARD FROM ASBESTOS EXPOSURE.
11. CONTRACTOR SHALL POST IN A PROMINENT AND CONVENIENT PLACE FOR LABORERS, A COPY OF THE LATEST APPLICABLE REGULATIONS FROM OSHA, EPA, NIOSH, NYSDPH, AND THE NYSDEC.
12. CONTRACTOR SHALL COMPLETELY PROTECT ALL CONTROLS, CONDUIT, TUBING, ELECTRICAL PANELS, EQUIPMENT, ETC, SCHEDULED TO REMAIN WITHIN THE WORK AREAS.
13. ALL BUILDING FINISHES, CONSTRUCTION EQUIPMENT, OR OTHER COMPONENTS OF THE BUILDING WHICH ARE SCHEDULED TO REMAIN, THAT ARE DAMAGED OR ARE IN ANY WAY DISRUPTED AS A RESULT OF THE EXECUTION OF THIS CONTRACT ARE TO BE REPLACED OR RESTORED TO ORIGINAL CONDITIONS BY THE CONTRACTOR, WITHOUT ADDITIONAL COST TO THE OWNER.
14. THE VA AND THE HAZARDOUS MATERIAL ABATEMENT CONTRACTOR SHALL MUTUALLY AGREE ON THE NUMBER AND LOCATION OF ANY REMOTE DECONTAMINATION UNITS DURING THE PRE-CONSTRUCTION MEETING. TWO RECOMMENDED LOCATIONS HAVE BEEN PROVIDED ON THE DRAWINGS.
15. SUBMIT DRAWINGS INDICATING THE LOCATION AND NUMBER OF HEPA FILTER EQUIPPED NEGATIVE PRESSURE MACHINES, AIRLOCKS, AND DECONTAMINATION CHAMBERS. SUBMIT CALCULATIONS SHOWING THE NUMBER OF AIR CHANGES FOR EACH CONTAINMENTS AREA.
16. PHASE WORK AS REQUIRED BY THE GENERAL CONTRACTOR AND VA. CONTRACTOR TO COORDINATE DEMOLITION ACTIVITIES WITH COR TO MAINTAIN FULL FUNCTIONALITY OF ADJACENT OCCUPIED SPACES. THE GROUND FLOOR IS INTENDED TO REMAIN OPERATIONAL DURING THIS PROJECT. UTILIZE GLOVEBAG METHODS ON THE GROUND FLOOR TO MINIMIZE IMPACT ON BUILDING OPERATIONS.
17. CONTRACTOR TO PROVIDE FIRE, SMOKE, DIRT, DUST AND NOISE CONTAINMENT BARRIERS BETWEEN WORK AREA AND ADJACENT OCCUPIED SPACES. COORDINATE WITH VA ICRA, ASBESTOS, AND LEAD ABATEMENT REQUIREMENTS, AND THE COR.
18. CONTRACTOR TO COORDINATE ALL UTILITY SYSTEM SHUTDOWN ACTIVITIES IN ADVANCE WITH THE COR. ALL OCCUPIED SPACES ADJACENT TO THE AREA OF WORK ARE TO REMAIN OPERATIONAL.
19. WORK OUTSIDE OF NORMAL HOURS MUST BE APPROVED BY THE COR.
20. THE ASBESTOS ABATEMENT CONTRACTOR AND THE MECHANICAL AND PLUMBING CONTRACTORS SHALL BE RESPONSIBLE FOR DISMANTLING ANY HVAC EQUIPMENT AS NECESSARY TO GAIN ACCESS TO ACM ON HVAC EQUIPMENT FOR PROPER REMOVAL AND DISPOSAL.
21. CONTRACTOR TO REMOVE ALL DEMOLITION AND CONSTRUCTION DEBRIS ON A DAILY BASIS. COORDINATE MEANS, METHODS AND ROUTES WITH VA ASBESTOS AND ICRA REQUIREMENTS, AND THE COR. ALL REMOVED HAZARDOUS MATERIALS AND HAZARDOUS MATERIAL CONTAMINATED WASTE SHALL BE PROPERLY PACKAGED PRIOR TO REMOVAL FROM THE WORK AREAS. WARNING LABELS SHALL BE APPLIED TO ASBESTOS WASTE AS APPROPRIATE. ALL ACM OR LCP REMOVED SHALL BE ACCOMPANIED BY A WASTE SHIPMENT RECORDS. COMPLETED WASTE SHIPMENT RECORDS SHALL BE PROVIDED TO THE OWNER AS A PART OF THE CLOSEOUT DOCUMENTATION, ORIGINAL RECORDS SHALL BE PROVIDED TO THE OWNER WITHIN 35 DAYS OF WASTE LEAVING THE SITE.
22. CONTRACTOR TO ASSUME THAT ALL UNTESTED ORIGINAL BUILDING MATERIALS TO CONTAIN ASBESTOS OR LEAD, UNLESS SAID MATERIAL IS TESTED AND CONFIRMED AS CONTAINING LESS THAN THE REGULATED PERCENTAGE OF ASBESTOS AND/OR LEAD. EXISTING ACM HAS BEEN CONFIRMED IN PIPE INSULATION AND FITTINGS, SPECIFIC ORIGINAL FLOORING MATERIALS, AND IN TRANSITE PANELS AT RADIATORS BELOW WINDOWS. NO ASBESTOS CONTENT HAS BEEN IDENTIFIED IN SAMPLING OF CEILING TILES, DRYWALL, JOINT COMPOUND, SKIM COAT, FIBERBOARD, FIRESTOP, COVE BASE, MASONRY WINDOW CAULK, BATHROOM CAULK, TILE GROUT, TILE GLUE, CERAMIC TILES, OR SPECIFIC FLOORING MATERIALS. LEAD CONTAINING PAINT HAS BEEN IDENTIFIED IN AT LEAST ONE AREA IN THE FACILITY. SHOULD ANY PREVIOUSLY UNIDENTIFIED OR OTHERWISE UNANTICIPATED SUSPECT MATERIAL BE IDENTIFIED DURING CONSTRUCTION, STOP WORK AND NOTIFY OWNER FOR FURTHER DIRECTION. UNDER NO CIRCUMSTANCES SHALL THE CONTRACTOR COLLECT OR ANALYZE BULK SAMPLES OF SUSPECT MATERIALS WITHOUT THE APPROVAL OF THE OWNER.
23. ALL MATERIAL MEASUREMENTS, QUANTITIES, AND LOCATIONS ARE APPROXIMATE AND FOR GENERAL ORIENTATION ONLY. AS HIDDEN CONDITIONS ARE UNCOVERED, ADDITIONAL HAZARDOUS MATERIAL MAY BE UNCOVERED THAT REQUIRE ABATEMENT. REFER TO SPECIFICATIONS FOR ADDITIONAL INFORMATION. REFER TO PHOTOGRAPHS ON HP001 FOR ADDITIONAL INFORMATION REGARDING SPECIFIC KNOWN HAZARDOUS MATERIALS.

KEYNOTES

1. NEW STAIR TOWER, CONSTRUCTED AS PHASE 1, COMPLETED PRIOR TO INTERIOR ASBESTOS ABATEMENT TO PERMIT USAGE OF THE STAIRS FOR ASBESTOS REMOVAL PATHS FROM UPPER FLOORS.
2. WINDOWS SCHEDULED TO BE IMPACTED BY NEW STAIRS. DEMOLITION AND INFILL WILL OCCUR. TRANSITE PANELS AT EQUIPMENT BELOW REMOVED WINDOWS TO BE ABATED. SEALANT AT WINDOW HEADERS CONTAINS ASBESTOS BASED ON HISTORICAL ASBESTOS ASSESSMENTS. ABATE SEALANT.
3. NOT USED
4. ABATE FLOOR FINISH MATERIAL IN AREAS AS INDICATED. SEE LEGEND BELOW.

LEGEND — QUANTITIES - ACM MATERIALS

1-112696-02-A	2818 SF 2818 SF	<1 % CHRYSOTILE FROM HISTORICAL RECORD INFORMATION FROM 2017 ASBESTOS SURVEY BY THOMAS EGAN **TOTAL FLOOR FINISH MATERIAL TO BE ABATED THIS FLOOR**	
TP TRANSITE PANELS	1300 SF ± 10'-0" @ 125SF/ EA	TRANSITE PANELS TO BE ABATED THIS FLOOR	
SAMPLE HA ##	SAMPLE LOCATION	NOT ALL SAMPLE LOCATIONS SHOWN FOR CLARITY. ONLY POSITIVE OR POSITIVE STOP SAMPLES ARE LOCATED. SAMPLE NUMBERS WILL BE PER ASBESTO SURVEY REPORT FROM TERRACON. REFER TO SURVEY REPORT FOR SPECIFIC SAMPLE INFORMATION ONCE AVAILABLE.	
XXX	LAYER INDICATOR	LAYERS OF FLOORING AS INDICATED IN HISTORICAL RECORDS/NEW SAMPLING. TOP ENCAPSULATING LAYER, WHERE OCCURS, IS INDICATED ABOVE USING ARCHITECTURAL ABBREVIATIONS FOR MATERIALS.	
	REMOVAL PATH	PATH INDICATED IS PROVIDED FOR INTENT ONLY. COORDINATE FINAL REMOVAL PATHWAYS, PHASING, AND METHODS WITH GENERAL CONTRACTOR AND COR.	
#	ASBESTOS SAMPLE LOCATION		
#	PAINT CHIP SAMPLE LOCATION		
#	PCB BULK SAMPLE LOCATION		

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Revisions:	Date:

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Office of Construction and Facilities Management
VA U.S. Department of Veterans Affairs

Drawing Title	Phase	Project Title	Project Number
HAZARDOUS ABATEMENT - SECOND FLOOR	DESIGN DEVELOPMENT	RENOVATE B14 ABCD - RESIDENTIAL PROGRAM	620-20-105
			Building Number: B14ABCD
Approved:	FULLY SPRINKLERED	Location: 2094 Albany Post Road, Montrose, NY 10548	Drawing Number: H-103
		Issue Date: 05/04/2021 · Checked: M. Perkins · Drawn: K.BICKEL	

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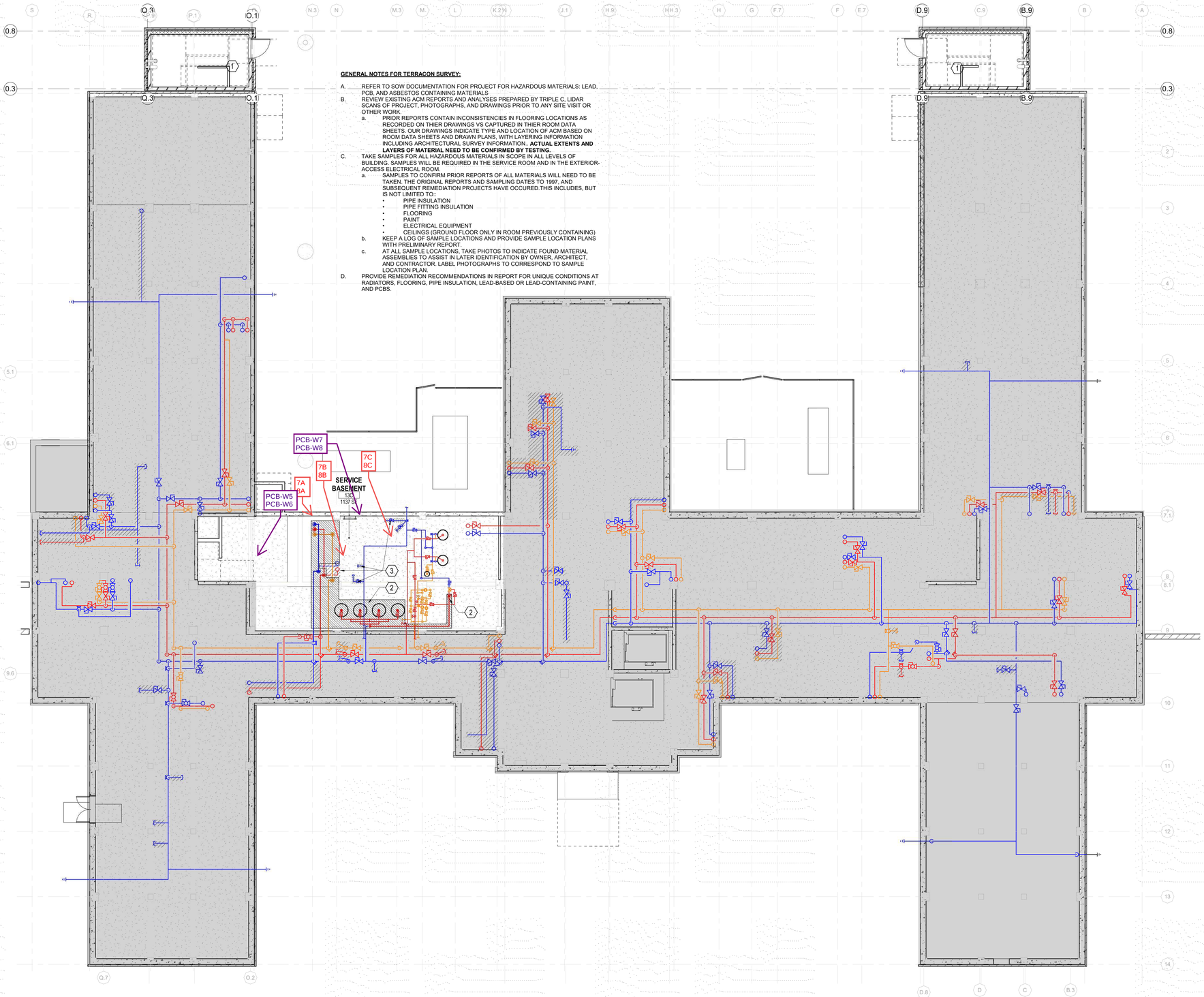

GENERAL NOTES FOR TERRACON SURVEY:

A. REFER TO SOW DOCUMENTATION FOR PROJECT FOR HAZARDOUS MATERIALS: LEAD, PCB, AND ASBESTOS CONTAINING MATERIALS

B. REVIEW EXISTING ACM REPORTS AND ANALYSES PREPARED BY TRIPLE C, LIDAR SCANS OF PROJECT, PHOTOGRAPHS, AND DRAWINGS PRIOR TO ANY SITE VISIT OR OTHER WORK.
   a. PRIOR REPORTS CONTAIN INCONSISTENCIES IN FLOORING LOCATIONS AS RECORDED ON THIER DRAWINGS VS CAPTURED IN THIER ROOM DATA SHEETS. OUR DRAWINGS INDICATE TYPE AND LOCATION OF ACM BASED ON ROOM DATA SHEETS AND DRAWN PLANS, WITH LAYERING INFORMATION INCLUDING ARCHITECTURAL SURVEY INFORMATION. **ACTUAL EXTENTS AND LAYERS OF MATERIAL NEED TO BE CONFIRMED BY TESTING.**

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      - PIPE FITTING INSULATION
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      - ELECTRICAL EQUIPMENT
      - CEILINGS (GROUND FLOOR ONLY IN ROOM PREVIOUSLY CONTAINING)
   b. KEEP A LOG OF SAMPLE LOCATIONS AND PROVIDE SAMPLE LOCATION PLANS WITH PRELIMINARY REPORT.
   c. AT ALL SAMPLE LOCATIONS, TAKE PHOTOS TO INDICATE FOUND MATERIAL ASSEMBLIES TO ASSIST IN LATER IDENTIFICATION BY OWNER, ARCHITECT, AND CONTRACTOR. LABEL PHOTOGRAPHS TO CORRESPOND TO SAMPLE LOCATION PLAN.

D. PROVIDE REMEDIATION RECOMMENDATIONS IN REPORT FOR UNIQUE CONDITIONS AT RADIATORS, FLOORING, PIPE INSULATION, LEAD-BASED OR LEAD-CONTAINING PAINT, AND PCBS.

2 SERVICE ROOM
1/8" = 1'-0"

HAZARDOUS MATERIAL ABATEMENT GENERAL NOTES

1. ALL HAZARDOUS MATERIAL REMOVAL SHALL BE PERFORMED IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS AND ALL APPLICABLE FEDERAL, STATE AND LOCAL LAWS, REGULATIONS, ORDERS AND DIRECTIVES INCLUDING WITHOUT LIMITATIONS THOSE OF THE RESPONSIBLE STATE OF NEW YORK AGENCIES, U.S. ENVIRONMENTAL PROTECTION AGENCY, U.S. DEPARTMENT OF LABOR, OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION, NATIONAL INSTITUTE OF OCCUPATIONAL SAFETY AND HEALTH, STATE OF NEW YORK DEPARTMENT OF PUBLIC HEALTH, AND THE STATE OF NEW YORK DEPARTMENT OF ENVIRONMENTAL CONSERVATION
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4. THE DISTURBANCE OF ANY ACM, OR SUSPECT ACM, SHALL BE PERFORMED BY A NYS LICENSED ASBESTOS ABATEMENT CONTRACTOR.
5. THE DISTURBANCE OF ANY LEAD-BASED PAINT, OR SUSPECT LBP, SHALL BE PERFORMED BY A NYS LICENSED LEAD ABATEMENT CONTRACTOR. LEAD CONTAINING PAINT AND CONTAMINATED MATERIALS SHALL BE REMOVED AND DISPOSED OF IN COMPLIANCE WITH EPA AND OSHA REGULATIONS.
6. CONTRACTOR TO MAINTAIN MEANS OF EGRESS PATHWAYS AT ALL TIMES. COORDINATE ALTERNATE PROVISIONS AND OBTAIN APPROVAL FROM OWNER AND AHJ IF EXISTING MEANS OF EGRESS MUST BE COMPROMISED.OF MATERIAL EQUIPMENT, WASTE TRAILERS/DUMPSTERS, AS WELL AS CONTRACTOR PARKING SHALL BE COORDINATED WITH THE REST OF THE CONTRACT DOCUMENTS, THE GENERAL CONTRACTOR, AND THE COR.
7. CONTRACTOR SHALL DEVELOP AND IMPLEMENT WRITTEN STANDARD OPERATING PROCEDURES FOR ABATEMENT WORK TO ENSURE MAXIMUM PROTECTION AND SAFEGUARDS FOR LEAD AND/OR ASBESTOS EXPOSURE TO WORKERS, PATIENTS, EMPLOYEES, GENERAL PUBLIC, AND THE ENVIRONMENT.
8. THE LOCATIONS OF SITE STORAGE SHALL BE COORDINATED WITH THE VA COR.
9. CONTRACTOR SHALL PROVIDE ALL TOOLS, SCAFFOLDING, LADDERS, BARRIERS, AND ASSOCIATED MATERIALS AND EQUIPMENT REQUIRED TO COMPLETE ALL WORK INDICATED IN THE CONTRACT DOCUMENTS. THE OWNER OR THIER REPRESETATIVE SHALL NOT BE RESPONSIBLE FOR LOST, DAMAGED OR STOLEN ITEMS.
10. CONTRACTOR SHALL PROVIDE ALL SIGNS, LABELS, WARNINGS, AND POSTED INSTRUCTIONS THAT ARE NECESSARY TO PROTECT, INFORM, AND WARN OF THE HAZARD FROM ASBESTOS EXPOSURE.
11. CONTRACTOR SHALL POST IN A PROMINENT AND CONVENIENT PLACE FOR LABORERS, A COPY OF THE LATEST APPLICABLE REGULATIONS FROM OSHA, EPA, NIOSH, NYSDPH, AND THE NYSDEC.
12. CONTRACTOR SHALL COMPLETELY PROTECT ALL CONTROLS, CONDUIT, TUBING, ELECTRICAL PANELS, EQUIPMENT, ETC, SCHEDULED TO REMAIN WITHIN THE WORK AREAS.
13. ALL BUILDING FINISHES, CONSTRUCTION EQUIPMENT, OR OTHER COMPONENTS OF THE BUILDING WHICH ARE SCHEDULED TO REMAIN, THAT ARE DAMAGED OR ARE IN ANY WAY DISRUPTED AS A RESULT OF THE EXECUTION OF THIS CONTRACT ARE TO BE REPLACED OR RESTORED TO ORIGINAL CONDITIONS BY THE CONTRACTOR, WITHOUT ADDITIONAL COST TO THE OWNER.
14. THE VA AND THE HAZARDOUS MATERIAL ABATEMENT CONTRACTOR SHALL MUTUALLY AGREE ON THE NUMBER AND LOCATION OF ANY REMOTE DECONTAMINATION UNITS DURING THE PRE-CONSTRUCTION MEETING. TWO RECOMMENDED LOCATIONS HAVE BEEN PROVIDED ON THE DRAWINGS.
15. SUBMIT DRAWINGS INDICATING THE LOCATION AND NUMBER OF HEPA FILTER EQUIPPED NEGATIVE PRESSURE MACHINES, AIRLOCKS, AND DECONTAMINATION CHAMBERS. SUBMIT CALCULATIONS SHOWING THE NUMBER OF AIR CHANGES FOR EACH CONTAINMENTS AREA.
16. PHASE WORK AS REQUIRED BY THE GENERAL CONTRACTOR AND VA. CONTRACTOR TO COORDINATE DEMOLITION ACTIVITIES WITH COR TO MAINTAIN FULL FUNCTIONALITY OF ADJACENT OCCUPIED SPACES. THE GROUND FLOOR IS INTENDED TO REMAIN OPERATIONAL DURING THIS PROJECT. UTILIZE GLOVEBAG METHODS ON THE GROUND FLOOR TO MINIMIZE IMPACT ON BUILDING OPERATIONS.
17. CONTRACTOR TO PROVIDE FIRE, SMOKE, DIRT, DUST AND NOISE CONTAINMENT BARRIERS BETWEEN WORK AREA AND ADJACENT OCCUPIED SPACES. COORDINATE WITH VA ICRA, ASBESTOS, AND LEAD ABATEMENT REQUIREMENTS, AND THE COR.
18. CONTRACTOR TO COORDINATE ALL UTILITY SYSTEM SHUTDOWN ACTIVITIES IN ADVANCE WITH THE COR. ALL OCCUPIED SPACES ADJACENT TO THE AREA OF WORK ARE TO REMAIN OPERATIONAL.
19. WORK OUTSIDE OF NORMAL HOURS MUST BE APPROVED BY THE COR.
20. THE ASBESTOS ABATEMENT CONTRACTOR AND THE MECHANICAL AND PLUMBING CONTRACTORS SHALL BE RESPONSIBLE FOR DISMANTLING ANY HVAC EQUIPMENT AS NECESSARY TO GAIN ACCESS TO ACM ON HVAC EQUIPMENT FOR PROPER REMOVAL AND DISPOSAL.
21. CONTRACTOR TO REMOVE ALL DEMOLITION AND CONSTRUCTION DEBRIS ON A DAILY BASIS. COORDINATE MEANS, METHODS AND ROUTES WITH VA ASBESTOS AND ICRA REQUIREMENTS, AND THE COR. ALL REMOVED HAZARDOUS MATERIALS AND HAZARDOUS MATERIAL CONTAMINATED WASTE SHALL BE PROPERLY PACKAGED PRIOR TO REMOVAL FROM THE WORK AREAS. WARNING LABELS SHALL BE APPLIED TO ASBESTOS WASTE AS APPROPRIATE. ALL ACM OR LCP REMOVED SHALL BE ACCOMPANIED BY A WASTE SHIPMENT RECORDS. COMPLETED WASTE SHIPMENT RECORDS SHALL BE PROVIDED TO THE OWNER AS A PART OF THE CLOSEOUT DOCUMENTATION, ORIGINAL RECORDS SHALL BE PROVIDED TO THE OWNER WITHIN 35 DAYS OF WASTE LEAVING THE SITE.
22. CONTRACTOR TO ASSUME THAT ALL UNTESTED ORIGINAL BUILDING MATERIALS TO CONTAIN ASBESTOS OR LEAD, UNLESS SAID MATERIAL IS TESTED AND CONFIRMED AS CONTAINING LESS THAN THE REGULATED PERCENTAGE OF ASBESTOS AND/OR LEAD. EXISTING ACM HAS BEEN CONFIRMED IN PIPE INSULATION AND FITTINGS, SPECIFIC ORIGINAL FLOORING MATERIALS, AND IN TRANSITE PANELS AT RADIATORS BELOW WINDOWS. NO ASBESTOS CONTENT HAS BEEN IDENTIFIED IN SAMPLING OF CIELING TILES, DRYWALL, JOINT COMPOUND, SKIM COAT, FIBERBOARD, FIRESTOP, COVE BASE, MASONRY WINDOW CAULK, BATHROOM CAULK, TILE GROUT, TILE GLUE, CERAMIC TILES, OR SPECIFIC FLOORING MATERIALS. LEAD CONTAINING PAINT HAS BEEN IDENTIFIED IN AT LEAST ONE AREA IN THE FACILITY. SHOULD ANY PREVIOUSLY UNIDENTIFIED OR OTHERWISE UNANTICIPATED SUSPECT MATERIAL BE IDENTIFIED DURING CONSTRUCTION, STOP WORK AND NOTIFY OWNER FOR FURTHER DIRECTION. UNDER NO CIRCUMSTANCES SHALL THE CONTRACTOR COLLECT OR ANALYZE BULK SAMPLES OF SUSPECT MATERIALS WITHOUT THE APPROVAL OF THE OWNER.
23. ALL MATERIAL MEASUREMENTS, QUANTITIES, AND LOCATIONS ARE APPROXIMATE AND FOR GENERAL ORIENTATION ONLY. AS HIDDEN CONDITIONS ARE UNCOVERED, ADDITIONAL HAZARDOUS MATERIAL MAY BE UNCOVERED THAT REQUIRE ABATEMENT. REFER TO SPECIFICATIONS FOR ADDITIONAL INFORMATION. REFER TO PHOTOGRAPHS ON HP001 FOR ADDITIONAL INFORMATION REGARDING SPECIFIC KNOWN HAZARDOUS MATERIALS.

KEYNOTES

1. NEW STAIR TOWER, CONSTRUCTED AS PHASE 1, COMPLETED PRIOR TO INTERIOR ASBESTOS ABATEMENT TO PERMIT USAGE OF THE STAIRS FOR ASBESTOS REMOVAL PATHS FROM UPPER FLOORS.
2. ABATE PIPE INSULATION AND PIPE FITTING IN HATCHED AREAS. CONDITIONS ARE BASED ON EXISTING DRAWINGS, AND FIELD CONDITIONS MAY VARY FROM RECORD DRAWINGS. CONFIRM LAYOUT AND PRESENCE OF PIPES IN HATCHED AREAS (SEE LEGEND) AND IN LOCATIONS AS NOTED. ABATEMENT OF THIS MATERIAL ON THIS FLOOR TO BE CARRIED OUT VIA GLOVEBAG METHOD TO MINIMIZE THE IMPACT ON CURRENT OPERATIONS. COORDINATE W/ THE GC AND THE VA COR TO DETERMINE SPECIFIC PHASING AND WASTE REMOVAL REQUIREMENTS .
3. HATCHED AREA INDICATED WITH PREVIOUSLY REMEDIATED OR REMOVED PIPING. VERIFY ABSENCE OF EXISTING PIPING ONLY WHERE OVERLAPPING NEW WORK AREAS. REFER TO 2016 PLUMBING STUDY DRAWINGS.
4. PIPES PREVIOULSLY RECORDED AS ACM-POSITIVE. TEST ALL TYPES OF PIPING AND CONFIRM IF ACM STILL PRESENT IN PIPE AND PIPE INSULATION.

→ ASBESTOS SAMPLE LOCATION

→ PCB WIPE SAMPLE LOCATION

LEGEND	QUANTITIES - ACM MATERIALS
PIPES, DHW HISTORICALLY RECORDED ACM	225 LF ± OF PIPE TO BE ABATED
PIPES, DCW HISTORICALLY RECORDED ACM	50 LF ± OF PIPE TO BE ABATED
PIPES, STEAM HISTORICALLY RECORDED ACM	TBV LF ± OF PIPE TO BE ABATED ABATEMENT TO OCCUR ONLY WHERE EXISTING INSULATION TO BE DISTURBED BY NEW WORK (THIS FLOOR)
PIPE FITTINGS, SYSTEMS VARY NO SPECIFIC SYMBOL SHOWN - VIF LOCATIONS	TBV± NO. PIPE FITTING INS. TO BE ABATED

NOT IN CONTRACT, NO WORK TO BE PERFORMED IN THESE AREAS, TYP.

AREAS INDICATE PIPING SCHEDULED TO BE REMEDIATED IN A PRIOR PROJECT. VIF PRESENCE OF PIPING AND INSULATION WHERE OVERLAPPYING NEW WORK SCHEDULED FOR THIS FLOOR..

AREAS ANTICIPATED TO BE IN-SCOPE OF REQUIRED MODIFICATIONS ON THIS FLOOR, VIF. COORDINATE WITH DEMOLITION AND NEW WORK TO DETERMINE SPECIFIC EXTENTS.

NOT FOR CONSTRUCTION

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Drawing Title	Phase	Project Title	Project Number
HAZARDOUS ABATEMENT - PIPE BASEMENT	DESIGN DEVELOPMENT	RENOVATE B14 ABCD - RESIDENTIAL PROGRAM	620-20-105
Approved:	FULLY SPRINKLERED	Location: 2094 Albany Post Road, Montrose, NY 10548	Building Number: B14ABCD
		Issue Date: 05/04/2021 · Checked: Checker · Drawn: Author	Drawing Number: HC001

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APPENDIX G

PRIOR REPORT, EGAN ENVIRONMENTAL CONSULTING, INC.

ASBESTOS FIELD RESURVEY AND ASSESSMENT
BUILDING 14
FDR VETERANS AFFAIRS MEDICAL CENTER
ROUTE 9
MONTROSE, NEW YORK 10548

2017

PREPARED AND APPROVED BY

EGAN ENVIRONMENTAL CONSULTING, INC.
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THOMAS G. EGAN, CIH
CERTIFIED INDUSTRIAL HYGIENIST

EXECUTIVE SUMMARY

Egan Environmental Consulting, Inc. was retained by the Veterans Administration (VA) to perform an asbestos assessment and resurvey of the majority of their buildings located at the Franklin Delano Roosevelt (FDR) Medical Center in Montrose, New York. The assessment and resurvey was performed in 2017. This assessment and resurvey was performed following an initial assessment survey that was performed by the office of John K. Paik, P.E., Ph.D. in 1996-1997 and a resurvey that was performed by Egan Environmental in 2002-2003, 2008-2009 and 2012.

The results of the assessment and resurvey for Building 14 are presented in this report. Included are the results of sample analyses, field observations, hazard assessment, and drawings showing the location of bulk samples and asbestos-containing materials (ACM's).

Asbestos-containing pipe insulation and fittings are present in the majority of the building. Asbestos-containing pipe and fitting insulation can be identified on steam, domestic hot water, domestic cold water and drain systems. The majority of pipe insulation and fittings are restricted to mechanical spaces, above ceilings, and in pipe spaces. There is hot water tank insulation in the service room.

Asbestos-containing floor tiles and adhesive mastic have been identified throughout the ground, first, and second floors of the building. The floor tiles range in size from 9"x9" to 1'x1'. Asbestos-containing radiator panels (asbestos cement), also known as transite, have been identified behind the radiators underneath each window in the majority of the building. Asbestos-containing ebonite and transite arc shields were identified on the elevator control panel in the attic. Asbestos window caulk is present primarily above the lintels of the buildings. Asbestos gutter drain flashing cement, gutter caulk and gutter bedding compound is present at the roof level of the building.

Materials that tested negative for asbestos include vibration joint cloth, ceiling tiles, certain floor tiles, adhesive mastic, wall plaster and ceiling plaster.

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1.0 INTRODUCTION

Egan Environmental Consulting, Inc. was retained by the Veterans Administration (VA) to perform an asbestos assessment and resurvey of the majority of their buildings located at the Franklin Delano Roosevelt (FDR) Medical Center in Montrose, New York. The assessment and resurvey was performed in 2012. This assessment and resurvey was performed following an initial assessment survey that was performed by the office of John K. Paik, P.E., Ph.D. in 1996-1997 and a resurvey that was performed by Egan Environmental in 2002-2003, 2008-2009 and 2012.

The purpose of the resurvey was to:

a. Update the existing asbestos survey report and drawings;
b. Identify asbestos-containing materials (ACM), including thermal system insulation, surfacing materials, and miscellaneous materials;
c. Assess the condition of the various forms of ACM;
d. Develop a hazard assessment for all ACM identified; and
e. Develop drawings showing the location and amount of ACM identified.

The identification and assessment resurvey involved:

a. An investigation of accessible and inaccessible areas to determine the presence and quantity of suspected ACM;
b. Collection and analysis of bulk samples of suspected ACM;
c. Determination of friability, condition, accessibility, activity, and air movement and vibration of ACM encountered;
d. Preparation of drawings, based on field observations, showing sample locations of materials suspected of containing asbestos, location of ACM, ceiling construction, asbestos insulated piping; and
e. Preparation of this report detailing the resurvey and assessment results.

This report presents the results of the resurvey and assessment for Building 14. Included are the sample analyses (laboratory analysis report), field observations (field data sheets), hazard assessment, and drawings showing where bulk samples were collected. Asbestos insulated pipes, floor coverings and miscellaneous materials are also shown on the drawings.

Fieldwork was performed in 2017 under the direction of Thomas G. Egan, CIH. Mr. Egan is a Certified Asbestos Inspector, meeting the requirements of the U.S. Environmental Protection Agency (EPA) as set forth in 40 Code of Federal Regulations 763, Subpart E. Mr. Egan is also a Certified Industrial Hygienist.

The descriptions and locations of ACM presented in this report are based upon field observations of conditions as of 2017. Egan Environmental survey personnel exercised all reasonable care in reassessing the ACM and in preparing the drawings.

However, Egan Environmental Consulting, Inc. does not represent that its observations and drawings reflect absolutely the as-built conditions throughout the building; in particular, no attempt has been made to reconstruct as-built conditions of plumbing and heating systems and

architectural layout, which is not the intent of this survey, and, also, beyond the scope of work. Where deemed necessary, only the pipes with asbestos insulation are shown on the drawings. Those with foam rubber and fiberglass are omitted as well.

2.0 FIELD SURVEY AND ANALYTICAL PROCEDURES

The field survey entailed a room-by-room and area-by-area inspection for suspected ACM, collection of replicate bulk samples, estimation of quantities of ACM and assessment of conditions. Occupied spaces, service areas, plenums and crawl spaces were inspected for thermal insulation on mechanical systems, surface treatments on walls, ceilings and other structural surfaces, and miscellaneous materials such as floor tiles, asbestos cement panels, and electrical wiring.

The resurvey was performed in substantial accordance with the EPA Guidance Document for Controlling Asbestos-Containing Materials in Buildings, 1985 (EPA 560/5-85-024). Bulk samples were collected from representative materials throughout the survey areas in accordance with good field technique to minimize disturbance of the material. To characterize the need for cleanup activities, bulk samples of debris were collected in areas containing dislodged material.

Field drawings were prepared using the previous asbestos floor plans provided by the V.A. The field drawings, which were later transcribed, show the location at which samples of ACM were collected, location of ACM discovered, asbestos insulated pipes, ceiling substrates, and other areas that contain asbestos.

2.1.1 EXPOSURE POTENTIAL ASSESSMENT

The Exposure Potential Assessment involves the evaluation of the factors that determine whether ACM in a particular area is likely to expose building occupants to airborne asbestos. The Exposure Potential Assessment described here is developed from a modified version of the EPA Region 7 criteria, the NYCDEP interim report on exposure assessment method and Egan Environmental's extensive field assessment experience.

2.1.2 EXPOSURE POTENTIAL ASSESSMENT FACTORS

Several factors have been used in identifying an asbestos-containing materials exposure potential. The factors listed below have been used in developing the hazard assessment score for each ACM identified in the field data sheets.

A. FRIABLILITY- The degree that ACM can be reduced to powder by hand pressure or mechanical pressure. Examples would include:

High-	Sprayed-on Fireproofing.
Medium-	Ceiling tiles, thermal system insulation.
Low-	Floor tiles, radiator panel insulation.

B. CONDITION- The evaluation of the physical state of the ACM.

Good- ACM in good condition has its covering intact and is generally equivalent to newly installed material.

Fair-	ACM in fair condition is slightly deteriorated, weathered, or damaged, but not to the point where the overall installed integrity of the material is in question. Minor punctures, loose covering, or exposed ends may be present. In this condition, asbestos fibers may be released if the material is disturbed.
Poor-	ACM in poor condition is extensively damaged, weathered, or deteriorated to the point where it has lost its installed integrity. There may be hanging or dislodged material, scrapings, indentations, or crumbling. Materials in poor condition will have a high potential to release asbestos fibers as a result of any nearby activity or air movement.

C. ACCESSIBLITY- The degree of physical contact to which ACM may be exposed.

Low-	ACM is located in areas that are enclosed or very difficult to reach, such as pipe chases, tunnels, plenums, crawl spaces, and areas high above the floor such that they can be reached only with great difficulty.
Medium-	ACM is located in out-of-way places, such as above ceiling tiles, behind panels, and in difficult-to-reach areas above the floor.
High-	ACM is located in areas where it can easily come into contact with building occupants. Examples are ceiling tiles, exposed pipe risers, and thermal system insulation located at floor level.

D. OCCUPATION and ACTIVITY-The amount of human activity in an area.

Low-	Areas that are rarely occupied and have no boisterous activity occurring within, such as storage rooms and crawl spaces.
Medium-	Areas with calm activities and limited occupation, such as mechanical spaces, and some offices.
High-	Areas with frequent occupation and movement, such as corridors, shops, patient rooms, offices and waiting areas.

E. AIR EROSION, HUMIDITY and VIBRATION-The degree to which ACM has suffered or may suffer damage from air movement, humidity, and mechanical vibration.

Low-	ACM is located in dry, quite, and still areas.
Medium-	ACM is located in areas with intermittent or low air movement and/or vibration, with generally low humidity.
High-	ACM is located in areas with strong air movement, mechanical vibration, and/or humidity, such as plenums, bathrooms, and mechanical rooms.

F. ASBESTOS CONTENT-As determined by laboratory analysis using Polarized Light Microscopy (PLM) with visual estimation and/or stratified point count.

Low-	0-1% (This material is generally considered non-asbestos)
Medium-	>1-50%.
High-	51-100%

2.1.3 EXPOSURE POTENTIAL ASSESSMENT FACTORS SCORING SYSTEM

The factors listed above have been assigned a numerical value for use in calculating a materials exposure potential. Listed below are the factors and a numerical value assigned to each subcategory within each factor. The numerical values are added together to arrive at a sum, then multiplied by the asbestos content (low, medium, or high) to arrive at an exposure potential value. Materials that do not contain asbestos are assigned an exposure potential value of zero (0). Exposure potential values for asbestos-containing materials can be found in the field data sheets.

FACTOR	RATING	NUMERICAL VALUE
Friability	Low Medium High	0 1 3
Condition	Good Fair Poor	0 2 5
Accessibility	Low Medium High	0 1 4
Occupation & Activity	Low Medium High	0 1 4
Air Erosion, Humidity and Vibration	Low Medium High	0 1 2
Asbestos Content	0-1% >1-50% 51%-100%	0 2 3

2.2 ANALYTICAL PROCEDURES

Samples were analyzed by Eastern Analytical Services (EAS), Inc. in Elmsford, New York, Testwell Laboratories, Inc. in Ossining, New York and Earth Research Laboratories, LLC in Peekskill, New York in accordance with the New York State Environmental Laboratory Approval Program (ELAP) stratified point count and visual estimation method (EPA-600/m4-82-020 and NYSDOH Item 198.1). This method uses polarized light microscopy to determine the types of asbestos in a material sampled, and point counting to determine the percentage of asbestos. The results are reported as volume percentages by composition of constituents. Constituents are categorized as asbestos, fibrous non-asbestos, or non-fibrous non-asbestos. A more detailed description of the analysis of asbestos bulk samples is presented in Appendix A (Quality Control Procedures for Bulk Sampling and Laboratory Analysis). Bulk samples were collected in substantial accordance with the EPA guidelines as set forth in 40 CFR 763, Subpart E.

A detailed summary describing the collection of bulk samples is presented in Appendix A. Laboratory analysis of bulk samples is included in Appendix B (Laboratory Analysis Report). Chain of custody forms are included in Appendix D.

3.0 RESULTS AND OBSERVATIONS

This section describes the condition, general location, and types of ACM's identified for areas resurveyed in Building 14. In addition to materials found to contain asbestos, materials that were suspected of containing asbestos but tested negative are also discussed. The locations of bulk samples are shown on the drawings included as an attachment to this report.

Building 14 was constructed circa 1946 out of brick, concrete, steel and wood. Building 14 consists of three stories plus a basement/pipe space and attic. The floors are as follows: ground, 1st floor and 2nd floor. Underground steam lines supplied from the boiler plant provide steam heat. The steam heat is distributed by risers located throughout the perimeter of the building.

Asbestos-containing pipe insulation and fittings are present in the majority of the building. Asbestos-containing pipe and fitting insulation can be identified on steam, domestic hot water, domestic cold water and drain pipe systems. The majority of pipe insulation and fittings are restricted to mechanical spaces, above ceilings, and in pipe spaces. The pipe insulation occurs in various types. The predominant type is "Erherts" brand insulation that is characterized by its white block appearance (also known as "mag" because it is made up of magnesium silicates). This material is mostly limited to steam and condensate pipe systems. Asbestos-impregnated cardboard type insulation is found primarily on the domestic hot water and cold water systems. White block "mag" has been identified on the hot water tanks located in the service room.

Asbestos-containing floor tiles and adhesive mastic have been identified throughout the ground, first, and second floors of the building. The floor tiles range in size from 9"x9" to 1'x1'. Asbestos-containing radiator panels (asbestos cement), also known as transite, have been identified behind the radiators underneath each window in the majority of the building. Asbestos-containing ebonite and transite arc shields were identified on the elevator control panel in the attic. Asbestos window caulk is present primarily above the lintels of the buildings. Asbestos gutter drain flashing cement, gutter caulk and gutter bedding compound is present at the roof level of the building.

Materials that tested negative for asbestos include vibration joint cloth, ceiling tiles, certain floor tiles, adhesive mastic, wall plaster and ceiling plaster.

3.1 SURVEY SPACES

In the following discussion, "positive" materials contain greater than one percent asbestos and is considered ACM. "Negative" materials contain less than one percent asbestos and are considered non-ACM. The reason that materials, which contain less than one percent asbestos is generally considered non-ACM, has to do with whether or not the material is considered a non-friable organically bound (NOB) material. Examples of this type of material are floor tiles, adhesive mastics, and roofing felts. The State of New York Department of Health (NYSDOH) has issued the following requirements as of August 3, 1992 for laboratories to consider a material to be Non-ACM: "Polarized light microscopy is not consistently reliable in detecting asbestos in floor coverings and similar non-friable organically bound materials. Before this material can be considered or treated as non-asbestos-containing, confirmation must be made by quantitative Transmission Electron Microscopy". Non-friable organically bound (NOB) materials that tested "trace" or less than one percent using transmission electron microscopy therefore, have been

considered nonasbestos-containing in this resurvey and assessment report.

3.2.1 Basement

All asbestos-containing materials were removed from the basement during the steam pipe replacement project in 2013-14.

3.2.2 Ground Floor

Materials that contain asbestos on the ground floor include steam, domestic hot water, domestic cold water pipe and fitting insulation, certain floor tiles and adhesive mastics, and radiator panel insulation. There has been some removal of the radiator heat shields, steam, domestic hot, domestic cold water pipe insulation, floor tile and floor tile mastic on the ground floor since the last resurvey performed in 2012.

3.2.3 1st Floor

Materials that contain asbestos on the first floor include steam, domestic hot water, domestic cold water pipe and fitting insulation, certain floor tiles and adhesive mastics, and radiator panel insulation.

3.2.4 2nd Floor

Materials that contain asbestos on the second floor include steam, domestic hot water, domestic cold water pipe and fitting insulation, certain floor tiles and adhesive mastics, and radiator panel insulation.

3.2.5 Attic

Materials that contain asbestos in the attic include drain downspout insulation, ebonite and asbestos cement board (arc shields) on the elevator control panel.

3.2.6 Roof

Asbestos gutter drain flashing cement, gutter caulk and gutter bedding compound is present at the roof level of the building. The roof was constructed from slate. The tar paper vapor barrier under the shingles tested negative for asbestos in Buildings 6, 8, 9, 10, 11 and 18. It is presumed that the same asbestos-free vapor barrier was used in the construction of Building 14.

3.3 BULK SAMPLES

Bulk samples were collected from materials visually suspected of containing asbestos. A listing of these materials with their associated abbreviations is included in Appendix C (System Identification Codes). Abbreviations are used on the drawings and field data sheets to identify materials that were suspected of containing asbestos.

3.4 PRIORITIZATION LEVELS

The numerical values for each exposure potential assessment factor are summed resulting in a

total exposure potential value. The lowest exposure potential value for an asbestos-containing material is 2 and the highest is 54. Material found no to contain asbestos is assigned a total value of 0.

Individual prioritization levels (exposure potentials) are shown in the field data sheets. A high priority area would have an exposure potential between 36 and 54, with 54 being the worst case. A medium priority area would be from 18 to 36, and a low priority would be from 2 to 18.

3.5 SYSTEM IDENTIFICATION CODES

System identification codes are an abbreviated system for identifying specific materials that are listed in the field data sheets. System identification codes are listed in Appendix C.

3.6 ASBESTOS AUDIT FORMS

The asbestos audit forms contain information pertaining to the specific area that was resurveyed. Information contained within each form include:

- Date
- Building
- Who the information was recorded by
- Floor
- Space Name
- Ceiling Substrate Type
- System for which samples of that material were collected and analyzed for asbestos
- Approximate quantity of the specific material in question if the material tested positive for asbestos
- Sample number for the material in question or the sample number which correlates to that material. Samples enclosed by parenthesis indicate that the material in question was sampled in another area of the building and correlated back to that material; and
- Exposure potential based on the factors discussed previously.

Asbestos audit forms (field data sheets) are listed in Appendix E.

3.7 SAMPLE LOCATION DRAWINGS

Bulk sample locations were recorded on drawings provided by the V.A. The drawings were later transcribed to show the location at which the sample was collected, pipes that were insulated with asbestos, and areas where other asbestos-containing materials were located. Field sample numbers are listed on the drawings for ease of use in referencing between the laboratory analysis report and asbestos audit forms. Additionally, if a sample contained asbestos that field number was marked on the drawing with an asterisk to indicate that it contained asbestos. Asbestos field resurvey drawings are included as an attachment to this report.

3.8 RECOMMENDATIONS

Areas that have a high exposure potential should be abated to limit exposure to the occupants. Areas which have medium exposure potential should be repaired and placed under and Operation

and Maintenance (O&M) Program to maintain the condition of the material and limit incidence of accidental material disturbance. Regulatory agencies now recommend in place management as a useful, cost effective, and in many cases an inherently safer method of dealing with asbestos than removal. Similarly, areas that have a low exposure should also be place under an O&M Program.

The purpose of the O&M Program is to avoid damage or disturbance to ACM. Under this program, an Asbestos Coordinator is designated. The Asbestos Coordinator is responsible for managing daily building operations with regard to asbestos, including the activities of building maintenance personnel, outside contractors and tenants. The O&M program also includes periodic surveillance of ACM. Areas in Building 14 that contain badly damaged ACM in need of removal: none.

APPENDIX A

QUALITY CONTROL PROCEDURES FOR BULK SAMPLING AND LABORATORY ANALYSIS

FIELD SERVICES

All field personnel are trained and perform their work in accordance with recognized industry standards and practices. These standards and practices reflect good industrial hygiene procedures, adherence to state-of-the-art methods of asbestos inspection and survey, and compliance with regulatory requirements. The standards and practices cover asbestos hazard assessment survey technique.

The purpose of the standards and practices are to assure uniform, quality fieldwork demonstrable in accordance with currently acceptable and recommended asbestos control procedures.

QUALITY CONTROL ACCEPTANCE CRITERIA FOR BULK SAMPLES

COLLECTION OF BULK SAMLES

A basic aspect of quality control is the collection of replicate samples of suspect friable materials. Samples of non-friable asbestos-containing materials are collected in a manner sufficient to determine whether the materials are asbestos or not asbestos.

Bulk samples are collected in a statistically random manner that is representative of the sampling area. Samples of homogeneous material are collected as follows:

1. At least three bulk samples of the same material are collected from each sampling area that contains 1,000 square feet or linear feet of the sample material.

2. At least five bulk samples of the same material are collected from each sampling area that contains from 1,000 to 5,000 square feet or linear feet of the sample material.

3. At least seven bulk samples of the same material are collected from each sampling area that contains more than 5,000 square feet or linear feet of the sample material. For every additional 5,000 square feet or linear feet of sample material more than 5,000 square feet, an additional two samples are collected.

Quantitative differences require a discussion between the technicians to resolve the difference.

CORRECTIVE ACTION

The type of corrective action used is on the spot, or immediate, to correct nonconforming data or repair equipment. These are the steps used for a closed-loop corrective action system:

1. Define the problem.

2. Assign responsibility for investigating the problem.

3. Investigate and determine the cause of the problem.

4. Determine a corrective action to eliminate the problem.

QUALITY CONTROL PROGRAM

BULK ASBESTOS ANALYSIS

Quality control for bulk asbestos samples analyzed by polarized light microscopy, regardless of method, consists of the following:

- Review of sample documentation
- Contamination checks
- Instrumentation calibration
- Routine analysis of QC standards
- Blind recounts
- Analysis of laboratory blanks
- Calibration of refraction index liquids
- Participation of proficiency programs
- Interlaboratory testing

Review of Sample Documentation-Review of chain of custody form and data sheet for each batch of samples received by the laboratory.

Contamination Checks-See contamination section.

Instrument Calibration-On a daily basis check that analyzer is in the proper position (in) and that the polarizer is set at 0 thus crossing the polars; that with the red compensator plate in place proper field color is detected; and using a QC standard that proper fiber coloration and extinction are noted. Polarized light microscopes are also to be calibrated after each use from phase contrast alignment. Results of all calibration tests are to be recorded in the Calibration Log assigned to each microscope.

QC-Standard analysis of one QC standard per day or 5% samples analyzed, whichever is greater. Applicable QC standards should be used depending on the method utilized (e.g., if the analyst is performing analysis via NYSDOH Item 198.1, then NOB standards should be used). Analysts must positively identify the type of asbestos, if any, and estimate the percentage thereof. Percentage estimates will be considered out of range if the percent deviation is greater than 50% calculated using the following formula: Percent Deviation + (Lower%/Higher%) * 100 + 100. Exceptions may be made when dealing with percentages between 1 and 20; exception and reason for such must be noted and initiated by the Lab Director.

During data entry in the bulk program, the computer will ask for the standard number and result before allowing analytical data to be imputed for the corresponding twenty samples (or part thereof). The QC section of the program checks the standard against the actual result. If the percent deviation is greater than 50%, the program instructs the analyst to analyze another standard.

Once all data has been entered and draft copies of the reports generated, a printout of QC is automatically generated documenting the analyst, the standard number(s), result of the standard(s), standard deviation of the standard, and number of standards analyzed. In addition, the printout gives the analytical result of all samples analyzed and the laboratory number of those samples. QC standards are made up of proficiency samples. Results of daily QC standards are generated and each day's QC sheets are tabulated monthly.

Blind Recounts-Recounts are to be performed on a daily basis at a rate of 14% samples analyzed. Results of original analyses and recounts are to be compared for proper identification of asbestos fibers, if any, and for percent deviation of estimated percentage of asbestos fibers, if any. Results of recounts are entered into the daily QC computer program where they are compared to the result obtained during the original analysis. Should any percent deviation be greater than 50%, the original and recount results are printed in bold type. Once a "bold" has been printed the sample is analyzed by a third analyst. Should the percent deviation be greater than 50% the sample fails recount criteria and will be recounted by a third analyst and those results compared to the original. Exceptions may be when dealing with percentages between 1 and 20; exception and reason for such must be noted and initialed by the Lab Director on the QC printout.

Blanks-Laboratory blanks will be analyzed at a rate of 14% samples analyzed. Blanks will consists of mounting solution or refractive index oil mounted on a slide and will serve as a daily contamination check for fluids slides, and cove slips (see below). Results of blank samples are to be place in the Bulk Sample Quality Control Log.

Calibrations of RI Liquids-RI liquids are calibrated quarterly or whenever a new batch arrives. P&CAM media is to be calibrated each time a new batch is prepared. Calibration is performed using optical glass (Reference Stet M7). Mount a few grains of optical glass, using the same RI number, in the mounting liquid. The glass will not be visible if the liquid and the glass are the same refractive index. Calibration results are recorded in a Calibration Log.

Proficiency Programs-The laboratory currently participates ion the National Institute Science and Technology (NIST) National Voluntary Laboratory Approval Program (NVLAP) proficiency program. In addition, the laboratory also participates in the New York State Environmental Laboratory Approval Program's Bulk Asbestos proficiency program.

Interlaboratory Testing-Currently, the laboratory exchanges samples with other laboratories in the same field on a quarterly basis. Results of interlaboratory are compared and documented by the QA Director.

CONTAMINATION

Checking laboratory surfaces, equipment and general environment for contamination is a critical step towards ensuring accurate results and work place safety. Proper procedures must be followed at all times when working with environmental hazards such as asbestos, radon, etc. For this reason a contamination detection program must be maintained and used in conjunction with the laboratory safety program. It should be obvious that the most effective way to prevent contamination is to

keep the work area clean when handling samples. Always login, inspect, and prepare asbestos bulk samples under the HEPA filtered hood to prevent fiber release. Wipe counter surfaces under the hood before, during and after you handle samples. This also prevents cross contamination during sample preparation. Clean all prepping implements (i.e. surgical knives, tweezers, etc.) immediately after each use and before prepping the next sample (TEM implements are cleaned using acetone rather than water).

Always dispose of paper towels and wipes in the receptacle kept in the hood and never re-use once it becomes contaminated. Always handle OSHA personal monitoring samples under the hood. Decontaminate all TEM samples under the preparation lab fume hood and place in a new Ziploc bag prior to bringing them into the HEPA-filtered positive pressure clean room. Report any spills immediately, chemical or solid, and clean up using the proper methods and precautions. Results of contamination checks are to be recorded in the Contamination Log.

Cumulative Samples-Cumulative (passive) samples are collected on a monthly basis in the preparation laboratory, main laboratory, and clean room. Cumulative samples are analyzed via TEM with minimum area of 0.060 mm2 and are considered within limits when the average of all samples is less than 18 asbestos structures/mm2 with no one sample having a density greater than 53 asbestos structures/mm2. Should samples exceed these limits, affetected area are thoroughly decontaminated and the source of contamination identified (if possible) and removed. If the clean room is affected, HEPA-filters are checked and changed if necessary, and lab blanks monitored for possible sample contamination. Once contamination has been detected, the frequency of cumulative sampling is increased until contamination levels fall below the acceptable limit.

Fume Hoods-To ensure worker safety and prevent contamination, fume hoods should maintain a face velocity of 75 fpm or greater. Hoods are tested monthly and results recorded in the Fume Hood Safety Log.

REFERENCES

1. National Institute of Occupational Safety and Health, 1985.
   USPHS/NIOSH membrane filter method for evaluation of airborne asbestos fibers.
   U.S. Department of Health, Education and Welfare.

2. United State Environmental Protection Agency, 1987.
   40 Code of Federal Regulations, Part 763.86, Subpart E "Sampling", Subpart F, Appendix A "Interim Method for the Determination of Asbestos in Bulk Insulation Samples".

3. "Standard Operating Procedures: Eastern Analytical Services, Inc., Elmsford, New York", November 1996.

4. "Standard Operating Procedures: Testwell Laboratories, Inc., Ossining, New York", January 2003.

5. "Standard Operating Procedures: Earth Research Laboratories, LLC., Peekskill, New

York", January 2008.

6. "Standard Operating Procedures: Egan Environmental Consulting, Inc., Mahwah, New Jersey", January 2012.

APPENDIX B

LABORATORY ANALYSIS REPORT

Eastern Analytical Services, Inc.

RECEIVED DEC 9 1996 J. K. PAIK, P.E.

Bulk Sample Results

RE: CPN EEC96-028 - VA Montrose Building 14

Client: John K. Paik, P.E., Ph.D.
100 Summit Lake Drive
Valhalla, NY 10595

Date Collected : 11/25/96
Collected by : T. Egan
Date Received : 11/25/96
Date Analyzed : 11/27-12/02/96
Analyzed By : Julio Lopez/Robert Connor
Signature :
Analytical Method : EPA-600/M4-82-020/NYS-DOH 198.1
NVLAP Lab No. 101646-0
NYS Lab No. 10851

Sample ID Number		1-112596-3-A	1-112596-4-A	1-112596-5-A	1-112596-6-A
Layer Number					
Lab ID Number		700141	700142	700143	700144
Sample Location		Not Given	Not Given	Not Given	Not Given
Sample Description		Not Given	Not Given	Not Given	Not Given
Method of Quantification		Visual Estimation	Stratified PC	Visual Estimation	Visual Estimation
Appearance	Layered	No	No	No	No
	Homogenous	Yes	Yes	Yes	Yes
	Fibrous	No	Yes	Yes	Yes
	Color	White	Gray	Tan	Tan
Sample Treatment		None	None	None	None
Asbestos Content	% Amosite	0.0	16.7	0.0	0.0
	% Chrysotile	0.0	26.9	0.0	0.0
	% Other	0.0	0.0	0.0	0.0
	% Total Asbestos	0.0	43.6	0.0	0.0
Other Fibrous Materials Present	% Fibrous Glass	0.0	0.0	0.0	0.0
	% Cellulose	0.0	0.0	98.0	98.0
	% Other	0.0	0.0	0.0	0.0
	% Unidentified	0.0	0.0	0.0	0.0
Non-Fibrous Materials Present	% Silicates	15.0	0.0	2.0	2.0
	% Carbonates	75.0	0.0	0.0	0.0
	% Other	10.0 Binders	0.0	0.0	0.0
	% Unidentified	0.0	56.4	0.0	0.0

Results Applicable To Those Items Tested
Liability Limited To Cost Of Analysis
These Results Can Not Be Used To Claim That HOB Items Tested Are Non-Asbestos Containing
AIHA Accreditation No 418 Rhode Island DOH Re AAL-0017 Massachusetts DOH Re AA 000072 Connecticut DOH Re PH-0622 Maine DEP No LA-824 Vermont DOH No AAS-2025

Eastern Analytical Services, Inc.

Bulk Sample Results

RE: CPN EEC96-028 - VA Montrose Building 14

RECEIVED
DEC 9 1996
I. M. PEIK, P.E. PH.D.

Client: John K. Paik, P.E., Ph.D.
100 Summit Lake Drive
Valhalla, NY 10595

Date Collected : 11/25/96
Collected by : T. Egan
Date Received : 11/25/96
Date Analyzed : 11/27-12/02/96
Analyzed By : Julio Lopez/Robert Connor
Signature :
Analytical Method : EPA-600/M4-82-020/NYS-DOH 198.1
NVLAP Lab No. 101646-0
NYS Lab No. 10851

Sample ID Number		1-112596-7-A	1-112596-8-A	1-112596-9-A	1-112596-10-A
Layer Number					
Lab ID Number		700145	700146	700147	700148
Sample Location		Not Given	Not Given	Not Given	Not Given
Sample Description		Not Given	Not Given	Not Given	Not Given
Method of Quantification		Stratified PC	Stratified PC	Stratified PC	Stratified PC
Appearance	Layered	No	No	No	No
	Homogenous	Yes	Yes	Yes	No
	Fibrous	Yes	Yes	Yes	Yes
	Color	Gray	Gray	White	Gray/White
Sample Treatment		None	None	None	Homogenized
Asbestos Content	% Amosite	0.0	0.0	42.0	12.3
	% Chrysotile	46.2	55.7	17.3	42.0
	% Other	0.0	0.0	0.0	0.0
	% Total Asbestos	46.2	55.7	59.3	54.3
Other Fibrous Materials Present	% Fibrous Glass	0.0	0.0	0.0	0.0
	% Cellulose	0.0	0.0	0.0	0.0
	% Other	0.0	0.0	0.0	0.0
	% Unidentified	0.0	0.0	0.0	0.0
Non-Fibrous Materials Present	% Silicates	0.0	0.0	0.0	0.0
	% Carbonates	0.0	0.0	0.0	0.0
	% Other	0.0	0.0	0.0	0.0
	% Unidentified	53.8	44.3	40.7	45.7

Results Applicable To Those Items Tested
Liability Limited To Cost Of Analysis
These Results Can Not Be Used To Claim That NOB Items Tested Are Non-Asbestos Containing
AIHA Accreditation No. 418 Rhode Island DOH No. AAL-072T3 Massachusetts DOL No. A A.000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AAS-2095

Eastern Analytical Services, Inc.

Bulk Sample Results

RE: CPN EEC96-028 - VA Montrose Building 14

RECEIVED DEC 9 1996 J. K. PAIK, P.E. INC.

Client: John K. Paik, P.E., Ph.D.
100 Summit Lake Drive
Valhalla, NY 10595

Date Collected : 11/25/96
Collected by : T. Egan
Date Received : 11/25/96
Date Analyzed : 11/27-12/02/96
Analyzed By : Julio Lopez/Robert Connor
Signature :
Analytical Method : EPA-600/M4-82-020/NYS-DOH 198.1
NVLAP Lab No. 101646-0
NYS Lab No. 10851

Sample ID Number		1-112596-11-A	1-112596-12-A	1-112596-13-A	1-112596-14-A
Layer Number					
Lab ID Number		700149	700150	700151	700152
Sample Location		Not Given	Not Given	Not Given	Not Given
Sample Description		Not Given	Not Given	Not Given	Not Given
Method of Quantification		Stratified PC	Stratified PC	Stratified PC	Stratified PC
Appearance	Layered	No	No	No	No
	Homogenous	No	No	Yes	Yes
	Fibrous	Yes	Yes	Yes	Yes
	Color	Gray/White	Gray/White	Gray	Gray
Sample Treatment		Homogenized	Homogenized	None	None
Asbestos Content	% Amosite	42.9	2.4	0.0	0.0
	% Chrysotile	3.9	52.4	6.5	48.1
	% Other	0.0	0.0	0.0	0.0
	% Total Asbestos	46.8	54.8	6.5	48.1
Other Fibrous Materials Present	% Fibrous Glass	0.0	0.0	0.0	0.0
	% Cellulose	0.0	0.0	0.0	0.0
	% Other	0.0	0.0	0.0	0.0
	% Unidentified	0.0	0.0	71.1	0.0
Non-Fibrous Materials Present	% Silicates	0.0	0.0	0.0	0.0
	% Carbonates	0.0	0.0	0.0	0.0
	% Other	0.0	0.0	0.0	0.0
	% Unidentified	53.2	45.2	22.4	51.9

Results Applicable To Those Items Tested
Liability Limited To Cost Of Analysis
These Results Can Not Be Used To Claim That NOB Items Tested Are Non-Asbestos Containing
AIHA Accreditation No. 445 Rhode Island DOH No. AAL-0217T1 Massachusetts DOH No. A A 000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AAS-2095

Eastern Analytical Services, Inc.

Bulk Sample Results

RE: CPN EEC96-028 - VA Montrose Building 14

DEC 9 1996

J K PAIK P.E. PH.D.

Date Collected : 11/25/96
Collected by : T. Egan
Date Received : 11/25/96
Date Analyzed : 11/27-12/02/96
Analyzed By : Julio Lopez/Robert Connor
Signature :
Analytical Method : EPA-600/M4-82-020/NYS-DOH 198.1
NVLAP Lab No. 101646-0
NYS Lab No. 10851

Client: John K. Paik, P.E., Ph.D.
100 Summit Lake Drive
Valhalla, NY 10595

Sample ID Number		1-112596-15-A	1-112596-16-A
Layer Number			
Lab ID Number		700153	700154
Sample Location		Not Given	Not Given
Sample Description		Not Given	Not Given
Method of Quantification		Stratified PC	Stratified PC
Appearance	Layered	No	No
	Homogenous	Yes	Yes
	Fibrous	Yes	Yes
	Color	Gray	Gray
Sample Treatment		None	None
Asbestos Content	% Amosite	0.0	0.0
	% Chrysotile	3.1	48.1
	% Other	0.0	0.0
	% Total Asbestos	3.1	48.1
Other Fibrous Materials Present	% Fibrous Glass	0.0	0.0
	% Cellulose	0.0	0.0
	% Other	0.0	0.0
	% Unidentified	84.2	0.0
Non-Fibrous Materials Present	% Silicates	0.0	0.0
	% Carbonates	0.0	0.0
	% Other	0.0	0.0
	% Unidentified	12.7	51.9

Results Applicable To Those Items Tested
Liability Limited To Cost Of Analysis
These Results Can Not Be Used To Claim That HOB Items Tested Are Non-Asbestos Containing
AIHA Accreditation No 418 Rhode Island DOH No AAL-077T3 Massachusetts DOL No A-A 000072 Connecticut DOH No PH-0622 Maine DEP No LA-024 Vermont DOH No AAS-2095

Eastern Analytical Services, Inc.

Bulk Sample Results

RE: CPN EEC96-028 - VA Montrose Building 14

DEC 10 1996

A.K. PAIK, P.E.

Date Collected : 11/26-27/96
Collected by : T. Egan
Date Received : 11/27/96
Date Analyzed : 12/04/96
Analyzed By : Robert Connor
Signature :
Analytical Method : EPA-600/M4-82-020/NYS-DOH 198.1
NVLAP Lab No. 101646-0
NYS Lab No. 10851

Client: John K. Paik, P.E., Ph.D.
100 Summit Lake Drive
Valhalla, NY 10595

Sample ID Number		1-112696-01-A	1-112696-01-A	1-112696-01-B	1-112696-01-B
Layer Number		1	2	1	2
Lab ID Number		701147	701147	701148	701148
Sample Location		Not Given	Not Given	Not Given	Not Given
Sample Description		Not Given	Not Given	Not Given	Not Given
Method of Quantification		Visual Estimation	Visual Estimation	Visual Estimation	Visual Estimation
Appearance	Layered	No	No	No	No
	Homogenous	Yes	Yes	Yes	Yes
	Fibrous	No	Yes	No	Yes
	Color	White	Gray	White	Gray
Sample Treatment		None	None	None	None
Asbestos Content	% Amosite	0.0	0.0	0.0	0.0
	% Chrysotile	0.0	0.0	0.0	0.0
	% Other	0.0	0.0	0.0	0.0
	% Total Asbestos	0.0	0.0	0.0	0.0
Other Fibrous Materials Present	% Fibrous Glass	5.0	30.0	3.0	40.0
	% Cellulose	0.0	30.0	0.0	30.0
	% Other	0.0	0.0	0.0	0.0
	% Unidentified	0.0	0.0	0.0	0.0
Non-Fibrous Materials Present.	% Silicates	20.0	30.0	30.0	20.0
	% Carbonates	15.0	0.0	17.0	0.0
	% Other	0.0	10.0 NFG	0.0	10.0 NFG
	% Unidentified	60.0	0.0	50.0	0.0

Results Applicable To Those Items Tested
Liability Limited To Cost Of Analysis
These Results Can Not Be Used To Claim That NOB Items Tested Are Non-Asbestos Containing
AIHA Accreditation No. 418 Rhode Island DOH No. AAL-072T3 Massachusetts DOL No. A A 000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AAS-2095

Eastern Analytical Services, Inc.

Bulk Sample Results

RE: CPN EEC96-028 - VA Montrose Building 14

DEC 10 1996

Date Collected: 11/26-27/96
Collected by: T. Egan
Date Received: 11/27/96
Date Analyzed: 12/04/96
Analyzed By: Robert Connor
Signature:
Analytical Method: EPA-600/M4-82-020/NYS-DOH 198.1
NVLAP Lab No. 101646-0
NYS Lab No. 10851

Client: John K. Paik, P.E., Ph.D.
100 Summit Lake Drive
Valhalla, NY 10595

Sample ID Number		1-112696-01-C	1-112696-01-C	1-112696-02-A	1-112696-02-A
Layer Number		1	2	1	2
Lab ID Number		701149	701149	701150	701150
Sample Location		Not Given	Not Given	Not Given	Not Given
Sample Description		Not Given	Not Given	Not Given	Not Given
Method of Quantification		Visual Estimation	Visual Estimation	Stratified PC	Visual Estimation
Appearance	Layered	No	No	No	No
	Homogenous	Yes	Yes	Yes	Yes
	Fibrous	No	Yes	No	No
	Color	White	Gray	Gray	Tan
Sample Treatment		None	None	None	None
Asbestos Content	% Amosite	0.0	0.0	0.0	0.0
	% Chrysotile	0.0	0.0	< 1.0	0.0
	% Other	0.0	0.0	0.0	0.0
	% Total Asbestos	0.0	0.0	< 1.0	0.0
Other Fibrous Materials Present	% Fibrous Glass	5.0	40.0	0.0	0.0
	% Cellulose	0.0	30.0	0.0	2.0
	% Other	0.0	0.0	0.0	0.0
	% Unidentified	0.0	0.0	2.3	0.0
Non-Fibrous Materials Present	% Silicates	20.0	20.0	0.0	20.0
	% Carbonates	15.0	0.0	0.0	58.0
	% Other	0.0	10.0 NFG	0.0	20.0 Binders
	% Unidentified	60.0	0.0	97.7	0.0

Results Applicable To Those Items Tested
Liability Limited To Cost Of Analysis
These Results Can Not Be Used To Claim That NOB Items Tested Are Non-Asbestos Containing
AIHA Accreditation No 418 Rhode Island DOH No AAL-072T3 Massachusetts DOL No A A 000072 Connecticut DOH No PH-0022 Maine DEP No. LA-024 Vermont DOH No AAS-2095

Eastern Analytical Services, Inc.

Bulk Sample Results

RE: CPN EEC96-028 - VA Montrose Building 14

DEC 10 1996

Date Collected : 11/26-27/96
Collected by : T. Egan
Date Received : 11/27/96
Date Analyzed : 12/04/96
Analyzed By : Robert Connor
Signature :
Analytical Method : EPA-600/M4-82-020/NYS-DOH 198.1
NVLAP Lab No. 101646-0
NYS Lab No. 10851

Client: John K. Paik, P.E., Ph.D.
100 Summit Lake Drive
Valhalla, NY 10595

Sample ID Number		1-112696-03-A	1-112696-03-A	1-112696-04-A	1-112696-05-A
Layer Number		1	2		
Lab ID Number		701151	701151	701152	701153
Sample Location		Not Given	Not Given	Not Given	Not Given
Sample Description		Not Given	Not Given	Not Given	Not Given
Method of Quantification		Visual Estimation	Visual Estimation	Visual Estimation	Visual Estimation
Appearance	Layered	No	No	No	No
	Homogenous	Yes	Yes	Yes	Yes
	Fibrous	No	No	Yes	No
	Color	Gray/Black	Blue	Black	Brown
Sample Treatment		None	None	None	None
Asbestos Content	% Amosite	0.0	0.0	0.0	0.0
	% Chrysotile	0.0	0.0	0.0	0.0
	% Other	0.0	0.0	0.0	0.0
	% Total Asbestos	0.0	0.0	0.0	0.0
Other Fibrous Materials Present	% Fibrous Glass	0.0	0.0	0.0	0.0
	% Cellulose	3.0	2.0	3.0	2.0
	% Other	0.0	0.0	0.0	0.0
	% Unidentified	0.0	0.0	0.0	0.0
Non-Fibrous Materials Present	% Silicates	30.0	20.0	30.0	20.0
	% Carbonates	27.0	68.0	17.0	68.0
	% Other	40.0 Binders	10.0 Binders	0.0	10.0 Binders
	% Unidentified	0.0	0.0	50.0	0.0

Results Applicable To These Items Tested
Liability Limited To Cost Of Analysis
These Results Can Not Be Used To Claim That NOB Items Tested Are Non-Asbestos Containing
AIHA Accreditation No 416 Rhode Island DOH No. AAL-077T3 Massachusetts DOL No. A A 000072 Connecticut DOH No PH-0622 Maine DEP No LA-024 Vermont DOH No AAS-2095

Eastern Analytical Services, Inc.

Bulk Sample Results

RE: CPN EEC96-028 - VA Montrose Building 14

Date Collected : 11/26-27/96
Collected by : T. Egan
Date Received : 11/27/96
Date Analyzed : 12/04/96
Analyzed By : Robert Connor
Signature :
Analytical Method : EPA-600/M4-82-020/NYS-DOH 198.1
NVLAP Lab No. 101646-0
NYS Lab No. 10851

Client: John K. Paik, P.E., Ph.D.
100 Summit Lake Drive
Valhalla, NY 10595

Sample ID Number		1-112696-06-A	1-112696-06-A	1-112696-07-A	1-112696-07-A
Layer Number		1	2	1	2
Lab ID Number		701154	701154	701155	701155
Sample Location		Not Given	Not Given	Not Given	Not Given
Sample Description		Not Given	Not Given	Not Given	Not Given
Method of Quantification		Visual Estimation	Visual Estimation	Stratified PC	Stratified PC
Appearance	Layered	No	No	No	Yes
	Homogenous	Yes	Yes	Yes	No
	Fibrous	No	No	Yes	Yes
	Color	Brown	Gray	Tan	Gray/Brown
Sample Treatment		None	None	None	Homogenized
Asbestos Content	% Amosite	0.0	0.0	0.0	0.0
	% Chrysotile	0.0	0.0	1.5	20.0
	% Other	0.0	0.0	0.0	0.0
	% Total Asbestos	0.0	0.0	1.5	20.0
Other Fibrous Materials Present	% Fibrous Glass	0.0	0.0	0.0	0.0
	% Cellulose	0.0	0.0	0.0	0.0
	% Other	0.0	0.0	0.0	0.0
	% Unidentified	0.0	0.0	77.8	13.3
Non-Fibrous Materials Present	% Silicates	50.0	30.0	0.0	0.0
	% Carbonates	10.0	40.0	0.0	0.0
	% Other	40.0 Binders	30.0 Binders	0.0	0.0
	% Unidentified	0.0	0.0	20.7	66.7

Results Applicable To Those Items Tested
Liability Limited To Cost Of Analysis
These Results Can Not Be Used To Claim That NOB Items Tested Are Non-Asbestos Containing
AIHA Accreditation No 418 Rhode Island DOH No AAL-072T3 Massachusetts DOL No A A 000072 Connecticut DOH No PH-0622 Maine DEP No LA-024 Vermont DOH No. AAS-2095

DEC 10 1996

Eastern Analytical Services, Inc.

Bulk Sample Results

RE: CPN EEC96-028 - VA Montrose Building

Date Collected : 11/26-27/96
Collected by : T. Egan
Date Received : 11/27/96
Date Analyzed : 12/04/96
Analyzed By : Robert Connor
Signature :
Analytical Method : EPA-600/M4-82-020/NYS-DOH 198.1
NVLAP Lab No. 101646-0
NYS Lab No. 10851

Client: John K. Paik, P.E., Ph.D.
100 Summit Lake Drive
Valhalla, NY 10595

Sample ID Number		1-112696-08-A	1-112696-09-A	1-112696-09-A	1-112696-10-A
Layer Number			1	2	1
Lab ID Number		701156	701157	701157	701158
Sample Location		Not Given	Not Given	Not Given	Not Given
Sample Description		Not Given	Not Given	Not Given	Not Given
Method of Quantification		Visual Estimation	Visual Estimation	Visual Estimation	Visual Estimation
Appearance	Layered	No	No	No	No
	Homogenous	Yes	Yes	Yes	Yes
	Fibrous	No	No	No	No
	Color	White	Black	White	Gray
Sample Treatment		None	None	None	None
Asbestos Content	% Amosite	0.0	0.0	0.0	0.0
	% Chrysotile	0.0	0.0	0.0	0.0
	% Other	0.0	0.0	0.0	0.0
	% Total Asbestos	0.0	0.0	0.0	0.0
Other Fibrous Materials Present	% Fibrous Glass	0.0	0.0	0.0	0.0
	% Cellulose	0.0	1.0	2.0	5.0
	% Other	0.0	0.0	0.0	0.0
	% Unidentified	0.0	0.0	0.0	0.0
Non-Fibrous Materials Present	% Silicates	20.0	39.0	40.0	45.0
	% Carbonates	50.0	0.0	38.0	10.0
	% Other	30.0 Binders	60.0 Binders	20.0 Binders	40.0 Binders
	% Unidentified	0.0	0.0	0.0	0.0

Results Applicable To Those Items Tested
Liability Limited To Cost Of Analysis
These Results Can Not Be Used To Claim That NOB Items Tested Are Non-Asbestos Containing
AIHA Accreditation No 418 Rhode Island DOH No: AAL-072T1 Massachusetts DOL No. A A 000072 Connecticut DOH No PH-0622 Maine DEP No. LA-024 Vermont DOH No AAS-2095

Eastern Analytical Services, Inc.

Bulk Sample Results

RE: CPN EEC96-028 - VA Montrose Building 14

Date Collected : 11/26-27/96
Collected by : T. Egan
Date Received : 11/27/96
Date Analyzed : 12/04/96
Analyzed By : Robert Connor
Signature :
Analytical Method : EPA-600/M4-82-020/NYS-DOH 198.1
NVLAP Lab No. 101646-0
NYS Lab No. 10851

Client: John K. Paik, P.E., Ph.D.
100 Summit Lake Drive
Valhalla, NY 10595

Sample ID Number		1-112696-10-A	1-112696-11-A	1-112696-11-A	1-112696-12-A
Layer Number		2	1	2	1
Lab ID Number		701158	701159	701159	701160
Sample Location		Not Given	Not Given	Not Given	Not Given
Sample Description		Not Given	Not Given	Not Given	Not Given
Method of Quantification		Visual Estimation	Visual Estimation	Visual Estimation	Visual Estimation
Appearance	Layered	No	No	No	No
	Homogenous	Yes	Yes	Yes	Yes
	Fibrous	No	No	No	No
	Color	Tan	Gray	White/Brown	White
Sample Treatment		None	None	None	None
Asbestos Content	% Amosite	0.0	0.0	0.0	0.0
	% Chrysotile	0.0	0.0	0.0	0.0
	% Other	0.0	0.0	0.0	0.0
	% Total Asbestos	0.0	0.0	0.0	0.0
Other Fibrous Materials Present	% Fibrous Glass	0.0	5.0	0.0	5.0
	% Cellulose	2.0	15.0	0.0	0.0
	% Other	0.0	0.0	0.0	0.0
	% Unidentified	0.0	0.0	0.0	0.0
Non-Fibrous Materials Present	% Silicates	60.0	40.0	40.0	20.0
	% Carbonates	28.0	10.0	60.0	15.0
	% Other	10.0 Binders	30.0 Binders	0.0	0.0
	% Unidentified	0.0	0.0	0.0	60.0

Results Applicable To Those Items Tested
Liability Limited To Cost Of Analysis
These Results Can Not Be Used To Claim That NOB Items Tested Are Non-Asbestos Containing
AIHA Accreditation No 418 Rhode Island DOH No. AAL-07273 Massachusetts DOL No A A 000072 Connecticut DOH No PH-0622 Maine DEP No LA-024 Vermont DOH No AAS-2095

Eastern Analytical Services, Inc.

Bulk Sample Results

RE: CPN EEC96-028 - VA Montrose Building 14

Dec 10 1996

J. K. PAIK, P.E., Ph.D.

Date Collected : 11/26-27/96
Collected by : T. Egan
Date Received : 11/27/96
Date Analyzed : 12/04/96
Analyzed By : Robert Connor
Signature :
Analytical Method : EPA-600/M4-82-020/NYS-DOH 198.1
NVLAP Lab No. 101646-0
NYS Lab No. 10851

Client: John K. Paik, P.E., Ph.D.
100 Summit Lake Drive
Valhalla, NY 10595

Sample ID Number		1-112696-12-A	1-112696-12-B	1-112696-12-B	1-112696-12-C
Layer Number		2	1	2	1
Lab ID Number		701160	701161	701161	701162
Sample Location		Not Given	Not Given	Not Given	Not Given
Sample Description		Not Given	Not Given	Not Given	Not Given
Method of Quantification		Visual Estimation	Visual Estimation	Visual Estimation	Visual Estimation
Appearance	Layered	No	No	No	No
	Homogenous	Yes	Yes	Yes	Yes
	Fibrous	Yes	No	Yes	No
	Color	Gray	White	Gray	White
Sample Treatment		None	None	None	None
Asbestos Content	% Amosite	0.0	0.0	0.0	0.0
	% Chrysotile	0.0	0.0	0.0	0.0
	% Other	0.0	0.0	0.0	0.0
	% Total Asbestos	0.0	0.0	0.0	0.0
Other Fibrous Materials Present	% Fibrous Glass	5.0	5.0	40.0	5.0
	% Cellulose	0.0	0.0	30.0	5.0
	% Other	0.0	0.0	0.0	0.0
	% Unidentified	0.0	0.0	0.0	0.0
Non-Fibrous Materials Present	% Silicates	30.0	30.0	20.0	40.0
	% Carbonates	5.0	5.0	0.0	10.0
	% Other	0.0	0.0	10.0 NFG	0.0
	% Unidentified	60.0	60.0	0.0	40.0

Results Applicable To Those Items Tested
Liability Limited To Cost Of Analysis
These Results Can Not Be Used To Claim That NOB Items Tested Are Non-Asbestos Containing
AIHA Accreditation No 418 Rhode Island DOH No AAL-072TJ Massachusetts DOL No A A 000072 Connecticut DOH No PH-0622 Maine DEP No LA-024 Vermont DOH No AAS-2095

Eastern Analytical Services, Inc.

RECEIVED DEC 10 1996 J.K. PAIK, PH.D.

Bulk Sample Results

RE: CPN EEC96-028 - VA Montrose Building #4

Client: John K. Paik, P.E., Ph.D.
100 Summit Lake Drive
Valhalla, NY 10595

Date Collected : 11/26-27/96
Collected by : T. Egan
Date Received : 11/27/96
Date Analyzed : 12/04/96
Analyzed By : Robert Connor
Signature :
Analytical Method : EPA-600/M4-82-020/NYS-DOH 198.1
NVLAP Lab No. 101646-0
NYS Lab No. 10851

Sample ID Number		1-112696-12-C	1-112796-01-A	1-112796-01-A	1-112796-01-B
Layer Number		2	1	2	1
Lab ID Number		701162	701163	701163	701164
Sample Location		Not Given	Not Given	Not Given	Not Given
Sample Description		Not Given	Not Given	Not Given	Not Given
Method of Quantification		Visual Estimation	Visual Estimation	Visual Estimation	Visual Estimation
Appearance	Layered	No	No	No	No
	Homogenous	Yes	Yes	Yes	Yes
	Fibrous	Yes	No	No	No
	Color	Gray	White	Gray	White
Sample Treatment		None	None	None	None
Asbestos Content	% Amosite	0.0	0.0	0.0	0.0
	% Chrysotile	0.0	0.0	0.0	0.0
	% Other	0.0	0.0	0.0	0.0
	% Total Asbestos	0.0	0.0	0.0	0.0
Other Fibrous Materials Present	% Fibrous Glass	40.0	0.0	0.0	0.0
	% Cellulose	30.0	0.0	0.0	0.0
	% Other	0.0	0.0	0.0	0.0
	% Unidentified	0.0	0.0	0.0	0.0
Non-Fibrous Materials Present	% Silicates	20.0	90.0	95.0	90.0
	% Carbonates	0.0	10.0	5.0	10.0
	% Other	10.0 NFG	0.0	0.0	0.0
	% Unidentified	0.0	0.0	0.0	0.0

Results Applicable To Those Items Tested
Liability Limited To Cost Of Analysis
These Results Can Not Be Used To Claim That NOB Items Tested Are Non-Asbestos Containing
AIHA Accreditation No 418 Rhode Island DOH No AAL-072TD Massachusetts DOL No A A 000072 Connecticut DOH No PH-0622 Maine DEP No. LA-024 Vermont DOH No AAS-2095

Eastern Analytical Services, Inc.

Bulk Sample Results

RE: CPN EEC96-028 - VA Montrose Building 14

DEC 10 1996

J. K. PAIK, P.E., Ph.D.

Date Collected : 11/26-27/96
Collected by : T. Egan
Date Received : 11/27/96
Date Analyzed : 12/04/96
Analyzed By : Robert Connor
Signature :
Analytical Method : EPA-600/M4-82-020/NYS-DOH 198.1
NVLAP Lab No. 101646-0
NYS Lab No. 10851

Client: John K. Paik, P.E., Ph.D.
100 Summit Lake Drive
Valhalla, NY 10595

Sample ID Number		1-112796-01-B	1-112796--01-C	1-112796--01-C	1-112796--01-C
Layer Number		2	1	2	3
Lab ID Number		701164	701165	701165	701165
Sample Location		Not Given	Not Given	Not Given	Not Given
Sample Description		Not Given	Not Given	Not Given	Not Given
Method of Quantification		Visual Estimation	Visual Estimation	Visual Estimation	Visual Estimation
Appearance	Layered	No	No	No	No
	Homogenous	Yes	Yes	Yes	Yes
	Fibrous	No	No	No	No
	Color	Gray	Yellow	White	Gray
Sample Treatment		None	None	None	None
Asbestos Content	% Amosite	0.0	0.0	0.0	0.0
	% Chrysotile	0.0	0.0	0.0	0.0
	% Other	0.0	0.0	0.0	0.0
	% Total Asbestos	0.0	0.0	0.0	0.0
Other Fibrous Materials Present	% Fibrous Glass	0.0	0.0	0.0	0.0
	% Cellulose	0.0	0.0	0.0	0.0
	% Other	0.0	0.0	0.0	0.0
	% Unidentified	0.0	0.0	0.0	0.0
Non-Fibrous Materials Present	% Silicates	95.0	0.0	95.0	90.0
	% Carbonates	5.0	20.0	5.0	10.0
	% Other	0.0	0.0	0.0	0.0
	% Unidentified	0.0	80.0	0.0	0.0

Results Applicable To Those Items Tested
Liability Limited To Cost Of Analysis
These Results Can Not Be Used To Claim That NOB Items Tested Are Non-Asbestos Containing
AIHA Accreditation No 418 Rhode Island DOH No AAL-072T3 Massachusetts DOL No A A 000072 Connecticut DOH No PH-0622 Maine DEP No LA-024 Vermont DOH No AAS-2095

Eastern Analytical Services, Inc.

Bulk Sample Results

RE: CPN EEC96-028 - VA Montrose Building 14

DEC 10 1996

Client: John K. Paik, P.E., Ph.D.
100 Summit Lake Drive
Valhalla, NY 10595

Date Collected: 11/26-27/96
Collected by: T. Egan
Date Received: 11/27/96
Date Analyzed: 12/04/96
Analyzed By: Robert Connor
Signature:
Analytical Method: EPA-600/M4-82-020/NYS-DOH 198.1
NVLAP Lab No. 101646-0
NYS Lab No. 10851

Sample ID Number		1-112796-02-A	1-112796-02-A	1-112796-03-A	1-112796-03-A
Layer Number		1	2	1	2
Lab ID Number		701166	701166	701167	701167
Sample Location		Not Given	Not Given	Not Given	Not Given
Sample Description		Not Given	Not Given	Not Given	Not Given
Method of Quantification		Stratified PC	Visual Estimation	Stratified PC	Visual Estimation
Appearance	Layered	No	No	No	No
	Homogenous	Yes	Yes	Yes	Yes
	Fibrous	No	No	No	No
	Color	Black	Gray	Black	Gray
Sample Treatment		None	None	None	None
Asbestos Content	% Amosite	0.0	0.0	0.0	0.0
	% Chrysotile	3.9	0.0	6.2	0.0
	% Other	0.0	0.0	0.0	0.0
	% Total Asbestos	3.9	0.0	6.2	0.0
Other Fibrous Materials Present	% Fibrous Glass	0.0	0.0	0.0	0.0
	% Cellulose	0.0	0.0	0.0	0.0
	% Other	0.0	0.0	0.0	0.0
	% Unidentified	2.6	0.0	1.0	0.0
Non-Fibrous Materials Present	% Silicates	0.0	30.0	0.0	20.0
	% Carbonates	0.0	60.0	0.0	60.0
	% Other	0.0	10.0 Binders	0.0	20.0 Binders
	% Unidentified	93.5	0.0	92.8	0.0

Results Applicable To Those Items Tested
Liability Limited To Cost Of Analysis
These Results Can Not Be Used To Claim That NOB Items Tested Are Non-Asbestos Containing
AIHA Accreditation No. 418 Rhode Island DOH No. AAL-0327J Massachusetts DOL No. A A 000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AAS-2095

Eastern Analytical Services, Inc.

Bulk Sample Results

RE: CPN EEC96-028 - VA Montrose Building 14

Client: John K. Paik, P.E., Ph.D.
100 Summit Lake Drive
Valhalla, NY 10595

Date Collected : 11/26-27/96
Collected by : T. Egan
Date Received : 11/27/96
Date Analyzed : 12/04/96
Analyzed By : Robert Connor
Signature :
Analytical Method : EPA-600/M4-82-020/NYS-DOH 198.1
NVLAP Lab No. 101646-0
NYS Lab No. 10851

Sample ID Number		1-112796-04-A	1-112796-04-A	1-112696-13-A	1-112696-14-A
Layer Number		1	2		
Lab ID Number		701168	701168	701169	701170
Sample Location		Not Given	Not Given	Not Given	Not Given
Sample Description		Not Given	Not Given	Not Given	Not Given
Method of Quantification		Stratified PC	Visual Estimation	Visual Estimation	Visual Estimation
Appearance	Layered	No	No	No	No
	Homogenous	Yes	Yes	Yes	Yes
	Fibrous	No	No	No	No
	Color	Black	Gray	Gray	Pink
Sample Treatment		None	None	None	None
Asbestos Content	% Amosite	0.0	0.0	0.0	0.0
	% Chrysotile	2.6	0.0	0.0	0.0
	% Other	0.0	0.0	0.0	0.0
	% Total Asbestos	2.6	0.0	0.0	0.0
Other Fibrous Materials Present	% Fibrous Glass	0.0	0.0	0.0	0.0
	% Cellulose	0.0	0.0	2.0	2.0
	% Other	0.0	0.0	0.0	0.0
	% Unidentified	1.2	0.0	0.0	0.0
Non-Fibrous Materials Present	% Silicates	0.0	20.0	50.0	40.0
	% Carbonates	0.0	60.0	28.0	38.0
	% Other	0.0	20.0 Binders	20.0 Binders	20.0 Binders
	% Unidentified	96.2	0.0	0.0	0.0

Results Applicable To Those Items Tested
Liability Limited To Cost Of Analysis
These Results Can Not Be Used To Claim That HOB Items Tested Are Non-Asbestos Containing
AIHA Accreditation No 416 Rhode Island DOH No AAL-0727T Massachusetts DOL No. A A 000072 Connecticut DOH No PH-0622 Maine DEP No LA-024 Vermont DOH No AAS-2095

Eastern Analytical Services, Inc.

Bulk Sample Results

RE: CPN EEC96-028 - VA Montrose Building 14

DEC 10 1996

Client: John K. Paik, P.E., Ph.D.
100 Summit Lake Drive
Valhalla, NY 10595

Date Collected : 11/26-27/96
Collected by : T. Egan
Date Received : 11/27/96
Date Analyzed : 12/04/96
Analyzed By : Robert Connor
Signature :
Analytical Method : EPA-600/M4-82-020/NYS-DOH 198.1
NVLAP Lab No. 101646-0
NYS Lab No. 10851

Sample ID Number		1-112696-15-A	1-112696-16-A
Layer Number			
Lab ID Number		701171	701172
Sample Location		Not Given	Not Given
Sample Description		Not Given	Not Given
Method of Quantification		Visual Estimation	Visual Estimation
Appearance	Layered	No	No
	Homogenous	Yes	Yes
	Fibrous	No	No
	Color	Gray	Black
Sample Treatment		None	None
Asbestos Content	% Amosite	0.0	0.0
	% Chrysotile	0.0	0.0
	% Other	0.0	0.0
	% Total Asbestos	0.0	0.0
Other Fibrous Materials Present	% Fibrous Glass	0.0	0.0
	% Cellulose	2.0	0.0
	% Other	0.0	0.0
	% Unidentified	0.0	0.0
Non-Fibrous Materials Present	% Silicates	40.0	20.0
	% Carbonates	38.0	50.0
	% Other	20.0 Binders	30.0 Binders
	% Unidentified	0.0	0.0

Results Applicable To Those Items Tested
Liability Limited To Cost Of Analysis
These Results Can Not Be Used To Claim That NOB Items Tested Are Non-Asbestos Containing
AIHA Accreditation No 418 Rhode Island DOH No AAL-072T3 Massachusetts DOL No. A A 000072 Connecticut DOH No. PH-0622 Maine DEP No LA-024 Vermont DOH No AAS-2095

DEC 1 1996

Eastern Analytical Services, Inc.

Bulk Sample Results

RE: CPN EEC96-028 - VA Montrose - Building 24

Client: John K. Paik, P.E., Ph.D.
100 Summit Lake Drive
Valhalla, NY 10595

Date Collected: 12/02-05/96
Collected by: T. Egan
Date Received: 12/05/96
Date Analyzed: 12/09/96
Analyzed By: Robert Connor
Signature:
Analytical Method: EPA-600/M4-82-020/NYS-DOH 198.1
NVLAP Lab No. 101646-0
NYS Lab No. 10851

Sample ID Number		1-120296-01-A	1-120296-01-A	1-120596-01-A	1-120596-02-A
Layer Number		1	2		1
Lab ID Number		702092	702092	702093	702094
Sample Location		Not Given	Not Given	Not Given	Not Given
Sample Description		Not Given	Not Given	Not Given	Not Given
Method of Quantification		Visual Estimation	Stratified PC	Visual Estimation	Visual Estimation
Appearance	Layered	No	No	No	No
	Homogenous	Yes	Yes	Yes	Yes
	Fibrous	No	No	No	No
	Color	Black	Black	Gray	Yellow
Sample Treatment		None	None	None	None
Asbestos Content	% Amosite	0.0	0.0	0.0	0.0
	% Chrysotile	0.0	3.1	0.0	0.0
	% Other	0.0	0.0	0.0	0.0
	% Total Asbestos	0.0	3.1	0.0	0.0
Other Fibrous Materials Present	% Fibrous Glass	0.0	0.0	0.0	0.0
	% Cellulose	0.0	0.0	0.0	0.0
	% Other	0.0	0.0	0.0	20.0 Synthetics
	% Unidentified	0.0	0.0	0.0	0.0
Non-Fibrous Materials Present	% Silicates	0.0	0.0	25.0	30.0
	% Carbonates	5.0	0.0	75.0	0.0
	% Other	95.0 Binders	0.0	0.0	50.0 Binders
	% Unidentified	0.0	96.9	0.0	0.0

Results Applicable To Those Items Tested
Liability Limited To Cost Of Analysis
These Results Can Not Be Used To Claim That HCM Items Tested Are Non-Asbestos Containing
AIHA Accreditation No. 414 Rhode Island DOH No. AAL 0720 Massachusetts DOL No. A-A 000073 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AAS-2095

TESTWELL LABORATORIES, INC.
Environmental Laboratory
47 Hudson Street, Ossining, New York 10562

NYS ELAP # 11142
NVLAP # 200083-0
AIHA # 100147

CERTIFICATE OF LABORATORY ANALYSIS FOR ASBESTOS CONTENT

CLIENT: Egan Environmental Consulting, Inc.
P.O. Box 128
Buchanan, New York 10511-0128
Client Proj: EEC02-031
PROJECT: V.A.M.C.
Route 9, Montrose
Building 14

Project No: NTV-001AB
Collected By: Client
Date Sampled: 11/14/02
Date Analyzed: 12/26/02
PLM Analyst: *V. Binchkauskas*
TEM Analyst: *M. V.*

NUMBER:	LAB ID #	DESCRIPTION	MATRIX	RESULTS (%)
1-111402-1-A	02PLM# 8647 02TEM# 9355	Floor Tile Room 13B	NOB	NAD by TEM

(1) Sample Information provided on chain of custody assumed correct (2) Samples homogenized by mortar & pestle prior to analysis. (3) Results only pertain to those items tested. (4) The laboratory has non control over sample collection. This certificate of analysis shall not be reproduced expect in full, without the written approval of Testwell Laboratories, Inc.

AIHA NVLAP

Deborah McCarl-Laboratories Director

(as it pertains to bulk sample analysis under certification 200083-0)

This report and use of above logos must not be used to claim endorsement by AIHA, NVLAP, NIST or any other Federal or State regulatory agencies

TESTWELL® LABORATORIES, INC.
Total Commitment to Quality

Environmental Laboratory
47 Hudson Street, Ossining, New York 10562
Telephone: (914) 944-2560
Facsimile: (914) 941-4154

NYS ELAP # 11142

CERTIFICATE OF LABORATORY ANALYSIS FOR ASBESTOS CONTENT

LIENT: **Egan Environmental Consulting, Inc.**
14 High Street
Mahwah, New Jersey 07430

PROJECT: Stauton Chow Engineers, P.C.
Steam System Study
For VAMC, Route 9, Montrose, NY
EEC06-019

Project No:	NTV-001AB
Collected By:	Client
Date Sampled:	6/1&2/06
Date Received:	06/07/06
Date Analyzed:	6/8,8,13/06
PLM Analyst:	D. Agrest
PLM Analyst:	M. Stein
TEM Analyst:	M. Stein

UMBER:	LAB ID #	DESCRIPTION	MATRIX	COLOR	RESULTS (%)
01	06PLM# 2809 06TEM# 1210	Bldg 12 - Room 8 - Window Glazing	NOB	Gray	**NAD by NAD**
02	06PLM# 2810 06TEM# 1211	Bldg 4 - Room 9 - Window Glazing	NOB	Gray	**NAD by NAD**
03	06PLM# 2811 06TEM# 1212	Bldg 3 - Room 9 - Window Glazing	NOB	Gray	**NAD by NAD**
04	06PLM# 2812	Bldg 13 - Room 7A - Window Caulk	NOB	Gray	**Chrysotile = 3.65%**
05	06PLM# 2813	Bldg 14 - MER - Window Caulk	NOB	Gray	**Chrysotile = 5.24%**
06	06PLM# 2814	Bldg 1 - MER - Window Caulk	NOB	Gray	**Chrysotile = 3.34%**
07	06PLM# 2815	Bldg 26 - MER - Window Caulk	NOB	Gray	**Chrysotile = 6.24%**
08	06PLM# 2816	Bldg 17 - Room 105 - Window Caulk	NOB	Gray	**Chrysotile = 3.18%**
09	06PLM# 2817 06TEM# 1213	Manhole 2 - Steam Pipe Insulation	NOB	Gray	**NAD by NAD**
10	06PLM# 2818 06TEM# 1214	Manhole 2 - Condensate Pipe Insulation	NOB	Gray	**NAD by NAD**

Asbestos results greater than 1% are considered Asbestos Containing Material (ACM)

) Sample information provided on chain of custody assumed correct. (2) Samples homogenized by mortar & pestle prior to analysis. (3) Results only pertain to ose items tested. (4) The laboratory has no control over sample collection. (5) Analytical Methods: Friable - NYSDOH 198.1, NOB - NYSDOH 198.4. (6) This certificate of analysis shall not be reproduced expect in full, without the written approval of Testwell Laboratories, Inc.

Mark Stein - Laboratory Director

This report must not be used to claim endorsement by any Federal or State regulatory agencies

Earth Research Laboratories, LLC.
160 N. Water Street, Peekskill, NY 10566, P: (914) 734-2119, F: (914) 734-1698, E: lab@earthresearch.us

NYS ELAP #: 11818

Certificate of Analysis

Client: Egan Environmental
14 High Street
Mahwah, NJ 07430

Account No.: 727

Collected By: Client
Sampled: 12 / 12 / 07
Received: 12 / 21 / 07
PLM Analysis: 12 / 27 / 07
TEM Analysis:

Time: 3:00 PM
TAT: 72 Hours

Report File: 79565

Project Site: Stanton Chow Engineers
FDR VAMC / Building 14
Montrose, NY 10548

Client's Project #: EEC07-031

PLM Method: NYSDOH ELAP 198.1/198.6 PLM Analyst: D. Parrucclo

TEM Method: TEM Analyst:

Analyst's Signature: Date: 12 / 27 / 07

Analyst's Signature: Date:

Client Number	Lab Number	Client Supplied Sample Data: Location	Description	Color	Matrix	Microscopic Examination: Type	Asbestos Analysis Results	Asbestos Content: Type	Volume/PC %	Weight %	Suspect Materials/Minerals: Type	Content
14 - 1	07 - 8565	Roof	Drain Flashing Cement	Black	NOB	PLM	Asbestos Detected 15.4 % Total Asbestos	Chrysotile	40.0 %	15.4 %	Non - Fibrous	60.0 %
14 - 2	07 - 8566	Roof	Gutter Flashing Cement	Black	NOB	PLM	Asbestos Detected 18.1 % Total Asbestos	Chrysotile	66.7 %	18.1 %	Non - Fibrous	33.3 %
14 - 3	07 - 8567	Roof	Gutter Caulk/Bedding	Gray	NOB	PLM	Asbestos Detected 5.7 % Total Asbestos	Chrysotile	12.9 %	5.7 %	Non - Fibrous	87.1 %

Date: 12 / 27 / 07

nic A. Parrucclo
ory Director

Sample information provided by client is unaudited except. Samples results are for the identified sample only. Results pertain only to samples as received. Results pertain only to those items tested. NA = Not Applicable, Not Analyzed
Analytical Methods: PLM - NYSDOH ELAP 198.1/198.6, TEM NOB - NYSDOH 198.4. Polarized Light microscopy is not a conclusive method of identifying asbestos in floor coverings and similar materials especially fibrous materials.
Microscopic examination/analysis necessary to correctly the only method that can be used to determine if the material contains asbestos or asbestos containing.
Samples that are analyzed directly by TEM are found to be inconclusive or suspect by PLM are a quality control check.
Results of laboratory analysis shall not be used by the client to claim product endorsement by the NY State Environmental Laboratory Approval Program (ELAP), National Environmental Laboratory Accreditation Program (NELAP), National Voluntary Laboratory Accreditation Program (NVLAP) or any agency of the United States Government.
Reproduction of analytical results shall not be permissible except in full, without the written approval of Earth Research Laboratories, LLC.

ATC ASSOCIATES INC

104 E. 25th Street, 10th Floor
New York, NY 10010
Tel. 212-353-8280
Fax: 212-353-8306

Client: EGAN ENVIROMENTAL CONSULTING, INC.
14 HIGH ST.
MAHWAH , NJ 07430
Fax: (201) 848-7791 **Phone:** (201) 848-7790

Project: VAMC / 2094 ALBANY POST ROAD, MONTROSE, NY 10548

Sample Date : 4/28/2010
Date Received : 5/3/2010
Date Analyzed : 5/7/2010
ATC Batch # 19652
Methods: EPA 600/M4-82-020
ELAP 198.1, 198.6 and 198.4

Location: BLDG. 14 - ROOM 6

Bulk Asbestos Analysis Results

Sample #	Location	Type of Material	Method	Non-Asbestos % Fibrous	Non-Asbestos % Non-Fibrous	NOB % Type	Asbestos % Type
01A 19652 -1	ROOM 6	CEILING TILE GLUE Color: BROWN	NOB-TEM			54.5% Organic 39% Residue 6.5% Carbonate	NONE DETECTED
Analyzed By: Emily Mylnt		Second Analyst: Alex Barengolts		Comments: PLM inconclusive, NOB-PLM inconclusive			
01B 19652 -2	ROOM 6	CEILING TILE GLUE Color: BROWN	NOB-TEM			52.7% Organic 38.8% Residue 8.5% Carbonate	NONE DETECTED
Analyzed By: Emily Mylnt		Second Analyst: Alex Barengolts		Comments: PLM inconclusive, NOB-PLM inconclusive			
02A 19652 -3	ROOM 6	CEILING SHEETROCK Color: GRAY	PLM	8% Cellulose 2% FiberGlass	90% Mineral Filler		NONE DETECTED
Analyzed By: Emily Mylnt							
02B 19652 -4	ROOM 6	CEILING SHEETROCK Color: GRAY	PLM	10% Cellulose 2% FiberGlass	88% Mineral Filler		NONE DETECTED
Analyzed By: Emily Mylnt							
02C 19652 -5	ROOM 6	CEILING SHEETROCK Color: GRAY	PLM	7% Cellulose 3% FiberGlass	90% Mineral Filler		NONE DETECTED
Analyzed By: Emily Mylnt							
03A 19652 -6	ROOM 6D	CEILING PLASTER Color: WT/BRN	PLM	2% Cellulose	98% Mineral Filler		NONE DETECTED
Analyzed By: Emily Mylnt							
03B 19652 -7	ROOM 6D	CEILING PLASTER Color: WT/BRN	PLM	3% Cellulose	97% Mineral Filler		NONE DETECTED
Analyzed By: Emily Mylnt							

Report Prepared By: Inna Kipen

Batch # 19652

ATC ASSOCIATES INC
104 E. 25th Street, 10th Floor
New York, NY 10010
Tel. 212-353-8280
Fax: 212-353-8306

Sample #	Location	Type of Material	Method	Non-Asbestos % Fibrous	Non-Asbestos % Non-Fibrous	NOB % Type	Asbestos % Type
03C	ROOM 6D	CEILING PLASTER	PLM	2% Cellulose	98% Mineral Filler		
19652 -8							NONE DETECTED

Color: WT/BRN

Analyzed By: Emily Myint

Comments:

NOTES:

1) The Limit of Detection is the same as the Reporting Limit for these results.

2) The Reporting Limit (RL) is the Limit of Quantitation. For point counts the limit of quantitation of 0.25%; based on one asbestos point counter over 400 non-empty points.

3) Asbestos Containing Material (ACM) Definition: > 1% asbestos by weight is considered an ACM

4) Disclaimer: The laboratory is not responsible for sample collection. Please refer to enclosed letter. This report may not be reproduced, except in full, without written approval by ATC Associates Inc. This report may not be used to claim product endorsement by NVLAP or any other agency of the U.S. Government. This report relates only to the samples reported above as described in the chain of custody. Quality control data is available upon request.

5) Accredited by NVLAP #101187-0 and by NY State ELAP #10879

6) Confidentiality Notice: The document(s) contained herein are confidential and privileged information, intended for the exclusive use of the individual or entity named above.

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8) When the results display more than three digits, only the first three are significant. The data within this report is reliable to 3 significant figures.

9) The condition of all samples was acceptable upon receipt.

10) The laboratory certifies that the test results meet all requirements of NELAC.

11) Supplement to test report batch # _____, Amendments: _____ Amendment Dates: _____, Amended by: _____

12) PLM Letter is attached to this report.

13) TRACE = LESS THAN LIMIT OF QUANTITATION (<0.25%)

14) ATC certifies that this report is an accurate and authentic report of the results obtained from the laboratory analysis

Emily Myint

Analyst: A. ANSARI FOR EMILY MYINT

Mei Wang

Analyst: A. ANSARI FOR MEI WANG

Aleks Barengolts

Analyst: A. ANSARI FOR ALEKS B.

Milena Bonezzi M. Bonezzi

Approved by
Laboratory Director:

Eastern Analytical Services, Inc.

Bulk Sample Results

Date Collected : 04/13/2009
Collected By : Kimberly Keever
Date Received : 04/16/2009
Date Analyzed : 04/21/2009
Analyzed By : Ernest Sanchez
Signature :
Analytical Method : NYS-DOH 198.4
NVLAP Lab No. 101646-0
NYS Lab No. 10851

Client V.A. Hudson Valley Health Care System
2094 Albany Post Road - Bldg. 16
Montrose, NY 10548

Sample ID Number		620-09-0020A	620-09-0021	620-09-0022
Layer Number				
Lab ID Number		1762244	1762245	1762246
Sample Location		Building 14 - Room 6 - Computer Lab Rehab.	Building 14 - Room 6 - Computer Lab Rehab.	Building 14 - Room 6 - Computer Lab Rehab.
Sample Description		Adhesive Glue w/Remnents of Attached Material (2 Layers)	Brown Burlap Wall Covering (Left Far Corner)	Adhesive/Paint Behind Brown Wall Covering on Left Wall - Right Side of Window in Corner
Analytical Method		Tem	Tem	Tem
Appearance	Layered	Yes	Yes	No
	Homogenous	No	No	Yes
	Fibrous	Yes	Yes	No
	Color	Brown	White/Brown	White
Asbestos Content	% Amosite	0.0	0.0	0.0
	% Chrysotile	11.4	0.0	0.0
	% Other	0.0	0.0	0.0
	% Total Asbestos	11.4	0.0	0.0
Other Materials Present	% Organic	54.1	28.1	28.3
	% Carbonates	25.2	20.5	33.1
	% Other Inorganic	9.3	51.4	38.6

Results Applicable To Those Items Tested. Report Cannot be Reproduced, Except Entirely, Without Written Approval of the Laboratory.
Liability Limited To Cost Of Analysis. This Report Must Not be Used by the Client to Claim Product Endorsement by NVLAP or Any Agency of the US Government.
AIHA Accreditation No. 100263 Rhode Island DOH No. AAL-07273 Massachusetts DOL No. A A 000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AAS-2095

iATL INTERNATIONAL
Asbestos Testing Laboratories

9000 Commerce Parkway, Ste B
Mount Laurel, NJ 08054
Toll Free 877-428-4285
Local: 856-231-9449
Fax: 856-231-9818

CERTIFICATE OF ANALYSIS

Client: Egan Environmental Consultants
14 High Street
Mahwah NJ 07430

Report Date: 6/26/2012
Report No: 277515
Project: 2094 Albany Post Road
Project No.: EEC12-020

BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 4699043 **Description / Location:** White Ceiling Plaster
Client No.: 07A Building 14

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 4699043 **Description / Location:** Grey Ceiling Plaster **Layer No.:** 2
Client No.: 07A Building 14

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
None Detected	None Detected	None Detected	None Detected	100

Lab No.: 4699044 **Description / Location:** Tan/Grey Window/Door Caulk
Client No.: 08A Building 14

% Asbestos	Type	% Non-Asbestos Fibrous Material	Type	% Non-Fibrous Material
10	Chrysotile	None Detected	None Detected	90

Accreditation **NIST-NVLAP No. 101165-0** **NY-DOH No. 11021** **AIHA-LAP, LLC No. 100188**

This confidential report relates only to those item(s) tested and does not represent an endorsement by NIST-NVLAP, AIHA or any agency of the U.S. government
This report shall not be reproduced except in full, without written approval of the laboratory.

Analytical Method: EPA 600/R-93/116, by Polarized Light Microscopy

Comments: Quantification at <0.25% by volume is possible with this method. (PC) Indicates Stratified Point Count Method performed. (PC-Trace) means that asbestos was detected but is not quantifiable under the Point Counting regimen. Analysis includes all distinct separable layers in accordance with EPA 600 Method. If not reported or otherwise noted, layer is either not present or the client has specifically requested that it not be analyzed (ex. analyze until positive instructions). Small asbestos fibers may be missed by PLM due to resolution limitations of the optical microscope. Therefore, PLM is not consistently reliable in detecting asbestos in non-friable organically bound (NOB) materials. Quantitative transmission electron microscopy (TEM) is currently the only method that can pronounce materials as non-asbestos containing.

Analysis Performed By: R. Kennedy

Date: 6/26/2012

ATC ASSOCIATES INC

104 E. 25th Street, 10th Floor
New York, NY 10010
Tel. 212-353-8280
Fax: 212-353-8306

Client: EGAN ENVIROMENTAL CONSULTING, INC.
14 HIGH ST.
MAHWAH , NJ 07430
Fax: (201) 848-7791 **Phone:** (201) 848-7790

Project: VAMC

Sample Date : 9/8/2011
Date Received : 9/12/2011
Date Analyzed : 9/13/2011
ATC Batch # 22320
Methods: EPA 600/M4-82-020
ELAP 198.1, 198.6 and 198.4

Location: BLDG. 14, 2094 ALBANY POST ROAD, MONTROSE, NY
Project # EEC11-024

Bulk Asbestos Analysis Results

Sample #	Location	Type of Material	Method	Non-Asbestos % Fibrous	Non-Asbestos % Non-Fibrous	NOB % Type	Asbestos % Type
01A	ROOM 234	CEILING TILE (1'X1')	NOB-TEM			25.9% Organic 30.7% Residue 43.4% Carbonate	NONE DETECTED
22320 -1							
Analyzed By: George Hlay		Second Analyst: Mark Peysakhov		Comments: NOB PLM Inconclusive			
01B	ROOM 235	CEILING TILE (1'X1')	NOB-TEM			20.6% Organic 23% Residue 56.4% Carbonate	NONE DETECTED
22320 -2							
Analyzed By: George Hlay		Second Analyst: Mark Peysakhov		Comments: NOB PLM Inconclusive			

ATC ASSOCIATES INC

104 E. 25th Street, 10th Floor
New York, NY 10010
Tel. 212-353-8280
Fax: 212-353-8306

Sample #	Location	Type of Material	Method	Non-Asbestos % Fibrous	Non-Asbestos % Non-Fibrous	NOB % Type	Asbestos % Type

NOTES:

1) The Limit of Detection is the same as the Reporting Limit for these results.

2) The Reporting Limit (RL) is the Limit of Quantitation. For point counts the limit of quantitation of 0.25%; based on one asbestos point counter over 400 non-empty points.

3) Asbestos Containing Material (ACM) Definition: > 1% asbestos by weight is considered an ACM

4) Disclaimer: The laboratory is not responsible for sample collection. Please refer to enclosed letter. This report may not be reproduced, except in full, without written approval by ATC Associates Inc. This report may not be used to claim product endorsement by NVLAP or any other agency of the U.S. Government. This report relates only to the samples reported above as described in the chain of custody. Quality control data is available upon request.

5) Accredited by NVLAP #101187-0 and by NY State ELAP #10879

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8) When the results display more than three digits, only the first three are significant. The data within this report is reliable to 3 significant figures.

9) The condition of all samples was acceptable upon receipt

10) The laboratory certifies that the test results meet all requirements of NELAC.

11) Supplement to test report batch # _____. Amendments: ____. Amendment Dates: _____, Amended by: _____

12) PLM Letter Available Upon Request

13) TRACE = LESS THAN LIMIT OF QUANTITATION (<0.25%)

14) ATC certifies that this report is an accurate and authentic report of the results obtained from the laboratory analysis

15) The uncertainty for these test results is available upon request.

George Htay AA for GH
Analyst:

Milena Bonezzi M. Bonezzi
Approved by
Laboratory Director:

Mark Peysakhov AA for MP
Analyst:

Eastern Analytical Services, Inc.

Bulk Sample Results

RE: Building 14 - West Point

Client: V.A. Hudson Valley Health Care System
2094 Albany Post Road - Bldg. 16
Montrose, NY 10548

Date Collected : 03/07/2011
Collected By : Sue Keever
Date Received : 03/09/2011
Date Analyzed : 03/09/2011
Analyzed By : Ghayath Elias
Signature :
Analytical Method : EPA/600/R-93/116/NYS-DOH 198.1 (PLM)
NVLAP Lab No. 101646-0
NYS Lab No. 10851

Sample ID Number		620-11-09	620-11-10	620-11-11	620-11-12
Layer Number					
Lab ID Number		1993414	1993415	1993416	1993417
Sample Location		Building 14 - Room 157 - Bathroom	Building 14 - Room 157 - Bathroom	Building 14 - Room 157 - Bathroom	Building 14 - Room 156 - Bathroom
Sample Description		12" x 12" White Ceiling Tile - Small Hole Fissured Tile, Replacement, White	12" x 12" White Ceiling Tile - Small Hole Fissured Tile, Replacement, White	12" x 12" White Ceiling Tile - Small Hole Fissured Tile, Replacement, White	12" x 12" White Ceiling Tile - Field Tile
Method of Quantification		Visual Estimation	Visual Estimation	Visual Estimation	Visual Estimation
Appearance	Layered	Yes	Yes	Yes	Yes
	Homogenous	No	No	No	No
	Fibrous	Yes	Yes	Yes	Yes
	Color	White/Gray	White/Gray	White/Gray	White/Gray
Sample Treatment		Homogenized	Homogenized	Homogenized	Homogenized
Asbestos Content	% Amosite	0.0	0.0	0.0	0.0
	% Chrysotile	0.0	0.0	0.0	0.0
	% Other	0.0	0.0	0.0	0.0
	% Total Asbestos	0.0	0.0	0.0	0.0
Other Fibrous Materials Present	% Fibrous Glass	30.0	30.0	30.0	40.0
	% Cellulose	40.0	40.0	40.0	20.0
	% Other	0.0	0.0	0.0	0.0
	% Unidentified	0.0	0.0	0.0	0.0
Non-Fibrous Materials Present	% Silicates	10.0	10.0	10.0	10.0
	% Carbonates	0.0	0.0	0.0	0.0
	% Other	0.0	0.0	0.0	0.0
	% Unidentified	20.0	20.0	20.0	30.0

Results Applicable To Those Items Tested. Report Cannot be Reproduced, Except Entirely, Without Written Approval of the Laboratory.
Liability Limited To Cost Of Analysis. This Report Must Not be Used by the Client to Claim Product Endorsement by NVLAP or Any Agency of the US Government.
These Results Can Not Be Used To Claim That NOB Items Tested Are Non-Asbestos Containing. Overall Lab Accuracy ± 17%.
AIHA Accreditation No. 100263 Rhode Island DOH No. AAL-072T3 Massachusetts DOL No. A A 000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-026 Vermont DOH No. AAS-2095

Eastern Analytical Services, Inc.

Bulk Sample Results

RE: Building 14 - West Point

Client: V.A. Hudson Valley Health Care System
2094 Albany Post Road - Bldg. 16
Montrose, NY 10548

Date Collected : 03/07/2011
Collected By : Sue Keever
Date Received : 03/09/2011
Date Analyzed : 03/09/2011
Analyzed By : Ghayath Elias
Signature :
Analytical Method : EPA/600/R-93/116/NYS-DOH 198.1 (PLM)
NVLAP Lab No. 101646-0
NYS Lab No. 10851

Sample ID Number		620-11-13	620-11-14	620-11-18	620-11-19
Layer Number					
Lab ID Number		1993418	1993419	1993420	1993421
Sample Location		Building 14 - Room 156 - Bathroom	Building 14 - Room 156 - Bathroom	Building 14 - Corner Near Room 157 - Bathroom	Building 14 - Room 157 - Back Room - Bathroom
Sample Description		12" x 12" White Ceiling Tile - Field Tile	12" x 12" White Ceiling Tile - Field Tile	Yellow Ceramic Tile	Yellow Ceramic Tile
Method of Quantification		Visual Estimation	Visual Estimation	Visual Estimation	Visual Estimation
Appearance	Layered	Yes	Yes	Yes	Yes
	Homogenous	No	No	No	No
	Fibrous	Yes	Yes	No	No
	Color	White/Gray	White/Gray	Yellow	Yellow
Sample Treatment		Homogenized	Homogenized	Homogenized	Homogenized
Asbestos Content	% Amosite	0.0	0.0	0.0	0.0
	% Chrysotile	0.0	0.0	0.0	0.0
	% Other	0.0	0.0	0.0	0.0
	% Total Asbestos	0.0	0.0	0.0	0.0
Other Fibrous Materials Present	% Fibrous Glass	40.0	40.0	0.0	0.0
	% Cellulose	20.0	20.0	0.0	0.0
	% Other	0.0	0.0	0.0	0.0
	% Unidentified	0.0	0.0	0.0	0.0
Non-Fibrous Materials Present	% Silicates	10.0	10.0	35.0	35.0
	% Carbonates	0.0	0.0	0.0	0.0
	% Other	0.0	0.0	0.0	0.0
	% Unidentified	30.0	30.0	65.0	65.0

Results Applicable To Those Items Tested. Report Cannot be Reproduced, Except Entirely, Without Written Approval of the Laboratory.
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AIHA Accreditation No. 100263 Rhode Island DOH No. AAL-07273 Massachusetts DOL No. A A 000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AAS-2095

Eastern Analytical Services, Inc.

Bulk Sample Results

RE: Building 14 - West Point

Client: V.A. Hudson Valley Health Care System
2094 Albany Post Road - Bldg. 16
Montrose, NY 10548

Date Collected : 03/07/2011
Collected By : Sue Keever
Date Received : 03/09/2011
Date Analyzed : 03/09/2011
Analyzed By : Ghayath Elias
Signature :
Analytical Method : EPA/600/R-93/116/NYS-DOH 198.1 (PLM)
NVLAP Lab No. 101646-0
NYS Lab No. 10851

Sample ID Number		620-11-20	620-11-21	620-11-22	620-11-23
Layer Number					
Lab ID Number		1993422	1993423	1993424	1993425
Sample Location		Building 14 - Room 157 - Back Room - Bathroom	Building 14 - Room 157 - Bathroom Walls	Building 14 - Room 157 - Bathroom Walls	Building 14 - Room 157 - Bathroom Walls
Sample Description		Yellow Ceramic Tile	White Grout for Ceramic Tile	White Grout for Ceramic Tile	White Grout for Ceramic Tile
Method of Quantification		Visual Estimation	Visual Estimation	Visual Estimation	Visual Estimation
Appearance	Layered	Yes	No	No	No
	Homogenous	No	No	No	Yes
	Fibrous	No	No	No	No
	Color	Yellow	White	White	White
Sample Treatment		Homogenized	Homogenized	Homogenized	None
Asbestos Content	% Amosite	0.0	0.0	0.0	0.0
	% Chrysotile	0.0	0.0	0.0	0.0
	% Other	0.0	0.0	0.0	0.0
	% Total Asbestos	0.0	0.0	0.0	0.0
Other Fibrous Materials Present	% Fibrous Glass	0.0	0.0	0.0	0.0
	% Cellulose	0.0	0.0	0.0	0.0
	% Other	0.0	0.0	0.0	0.0
	% Unidentified	0.0	0.0	0.0	0.0
Non-Fibrous Materials Present	% Silicates	35.0	10.0	10.0	10.0
	% Carbonates	0.0	30.0	30.0	30.0
	% Other	0.0	0.0	0.0	0.0
	% Unidentified	65.0	60.0	60.0	60.0

Results Applicable To Those Items Tested. Report Cannot be Reproduced, Except Entirely, Without Written Approval of the Laboratory.
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AIHA Accreditation No. 100263 Rhode Island DOH No. AAL-07ZT3 Massachusetts DOL No. A A 000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AAS-2095

Eastern Analytical Services, Inc.

Bulk Sample Results

RE: FDR - Building 14 - 1st Floor - B-Side

Client: V.A. Hudson Valley Health Care System
2094 Albany Post Road - Bldg. 16
Montrose, NY 10548

Date Collected : 03/11/2011
Collected By : Sue Keover
Date Received : 03/18/2011
Date Analyzed : 03/22/2011
Analyzed By : Damien Warner
Signature :
Analytical Method : NYS-DOH 198.6
NVLAP Lab No. 101646-0
NYS Lab No. 10851

Sample ID Number		620-11-54	620-11-57	620-11-58	620-11-59
Layer Number				1	1
Lab ID Number		1997800	1997803	1997804	1997805
Sample Location		FDR, Building 14, 1st Floor, B-Side, Room 146	FDR, Building 14, 1st Floor, B-Side, Room 146	FDR, Building 14, 1st Floor, B-Side, Room 154	FDR, Building 14, 1st Floor, B-Side, Room 154
Sample Description		Gray 1x1 Tile with Black Mastic (Mastic Layer)	Gray 1x1 Tile with Black Mastic (Mastic Layer)	Gray/Brown/Mottled Tile with Mastic (Tile Layer)	Gray/Brown/Mottled Tile with Mastic (Tile Layer)
Analytical Method		Plm	Plm	Plm	Plm
Appearance	Layered	Yes	Yes	No	No
	Homogenous	No	No	Yes	Yes
	Fibrous	No	No	No	No
	Color	Yellow/Black	Yellow/Black	Gray	Gray
Asbestos Content	% Amosite	0.0	0.0	0.0	0.0
	% Chrysotile	0.0	0.0	0.0	0.0
	% Other	0.0	0.0	0.0	0.0
	% Total Asbestos	0.0	0.0	0.0	0.0
Other Materials Present	% Organic	40.1	45.6	17.8	16.8
	% Carbonates	31.8	36.5	79.1	79.4
	% Other Inorganic	28.1	17.9	3.1	3.8

Results Applicable To Those Items Tested. Report Cannot be Reproduced, Except Entirely, Without Written Approval of the Laboratory.
Liability Limited To Cost Of Analysis. This Report Must Not be Used by the Client to Claim Product Endorsement by NVLAP or Any Agency of the US Government.
These Results Cannot Be Used To Claim That NOB Items Tested Are Non-Asbestos Containing (Unless "% Other Inorganic", As Reported Above, Is Less Than One Percent).
AIHA Accreditation No. 100263 Rhode Island DOH No. AAL-07273 Massachusetts DOL No. A A 000072 Connecticut DOB No. PH-0622 Maine DEP No. LA-021 Vermont DOH No. AAS-2095

Eastern Analytical Services, Inc.

Bulk Sample Results

RE: FDR - Building 14 - 1st Floor - B-Side

Client: V.A. Hudson Valley Health Care System
2094 Albany Post Road - Bldg. 16
Montrose, NY 10548

Date Collected : 03/11/2011
Collected By : Sue Keever
Date Received : 03/18/2011
Date Analyzed : 03/22/2011
Analyzed By : Damien Warner
Signature :
Analytical Method : NYS-DOH 198.6
NVLAP Lab No. 101646-0
NYS Lab No. 10851

Sample ID Number		620-11-60	620-11-61
Layer Number		1	1
Lab ID Number		1997806	1997807
Sample Location		FDR, Building 14, 1st Floor, B-Side, Room 154	FDR, Building 14, 1st Floor, B-Side, Room 164
Sample Description		Gray Tile with Black Mastic (Tile Layer)	Gray Tile with Black Mastic (Tile Layer)
Analytical Method		Plm	Plm
Appearance	Layered	No	No
	Homogenous	Yes	Yes
	Fibrous	No	No
	Color	Gray	Gray
Asbestos Content	% Amosite	0.0	0.0
	% Chrysotile	0.0	0.0
	% Other	0.0	0.0
	% Total Asbestos	0.0	0.0
Other Materials Present	% Organic	16.6	18.8
	% Carbonates	79.0	79.5
	% Other Inorganic	4.4	1.7

Results Applicable To Those Items Tested. Report Cannot be Reproduced, Except Entirely, Without Written Approval of the Laboratory.
Liability Limited To Cost Of Analysis. This Report Must Not be Used by the Client to Claim Product Endorsement by NVLAP or Any Agency of the US Government.
These Results Cannot Be Used To Claim That NOB Items Tested Are Non-Asbestos Containing (Unless "% Other Inorganic", As Reported Above, Is Less Than One Percent).
AIHA Accreditation No. 100263 Rhode Island DOH No. AAL-07213 Massachusetts DOL No. A A 000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AAS-2095

Eastern Analytical Services, Inc.

Bulk Sample Results

RE: FDR - Building 14 - 1st Floor - B-Side

Client: V.A. Hudson Valley Health Care System
2094 Albany Post Road - Bldg. 16
Montrose, NY 10548

Date Collected : 03/11/2011
Collected By : Sue Keever
Date Received : 03/18/2011
Date Analyzed : 03/22/2011
Analyzed By : Ernest Sanchez
Signature :
Analytical Method : NYS-DOH 198.4
NVLAP Lab No. 101646-0
NYS Lab No. 10851

Sample ID Number		620-11-54	620-11-57	620-11-58	620-11-58
Layer Number				1	2
Lab ID Number		1997800	1997803	1997804	1997804
Sample Location		FDR, Building 14, 1st Floor, B-Side, Room 146	FDR, Building 14, 1st Floor, B-Side, Room 146	FDR, Building 14, 1st Floor, B-Side, Room 154	FDR, Building 14, 1st Floor, B-Side, Room 154
Sample Description		Gray 1x1 Tile with Black Mastic (Mastic Layer)	Gray 1x1 Tile with Black Mastic (Mastic Layer)	Gray/Brown/Mottled Tile with Mastic (Tile Layer)	Gray/Brown/Mottled Tile with Mastic (Mastic Layer)
Analytical Method		Tem	Tem	Tem	Tem
Appearance	Layered	Yes	Yes	No	No
	Homogenous	No	No	Yes	Yes
	Fibrous	No	No	No	No
	Color	Yellow/Black	Yellow/Black	Gray	Black
Asbestos Content	% Amosite	0.0	0.0	0.0	0.0
	% Chrysotile	0.6	0.2	0.3	5.3
	% Other	0.0	0.0	0.0	0.0
	% Total Asbestos	0.6	0.2	0.3	5.3
Other Materials Present	% Organic	40.1	45.6	17.8	70.4
	% Carbonates	31.8	36.5	79.1	18.9
	% Other Inorganic	27.5	17.7	2.8	5.4

Results Applicable To Those Items Tested. Report Cannot be Reproduced, Except Entirely, Without Written Approval of the Laboratory.
Liability Limited To Cost Of Analysis. This Report Must Not be Used by the Client to Claim Product Endorsement by NVLAP or Any Agency of the US Government.
AIHA Accreditation No. 100263 Rhode Island DOH No. AAL-072T3 Massachusetts DOL No. A A 000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AAS-2095

Eastern Analytical Services, Inc.

Bulk Sample Results

RE: FDR - Building 14 - 1st Floor - B-Side

Client: V.A. Hudson Valley Health Care System
2094 Albany Post Road - Bldg. 16
Montrose, NY 10548

Date Collected : 03/11/2011
Collected By : Sue Keever
Date Received : 03/18/2011
Date Analyzed : 03/22/2011
Analyzed By : Ernest Sanchez
Signature :
Analytical Method : NYS-DOH 198.4
NVLAP Lab No. 101646-0
NYS Lab No. 10851

Sample ID Number		620-11-59	620-11-59	620-11-60	620-11-60
Layer Number		1	2	1	2
Lab ID Number		1997805	1997805	1997806	1997806
Sample Location		FDR, Building 14, 1st Floor, B-Side, Room 154	FDR, Building 14, 1st Floor, B-Side, Room 154	FDR, Building 14, 1st Floor, B-Side, Room 154	FDR, Building 14, 1st Floor, B-Side, Room 154
Sample Description		Gray/Brown/Mottled Tile with Mastic (Tile Layer)	Gray/Brown/Mottled Tile with Mastic (Mastic Layer)	Gray Tile with Black Mastic (Tile Layer)	Gray Tile with Black Mastic (Mastic Layer)
Analytical Method		Tem	Tem	Tem	Tem
Appearance	Layered	No	No	No	No
	Homogenous	Yes	Yes	Yes	Yes
	Fibrous	No	No	No	No
	Color	Gray	Black	Gray	Black
Asbestos Content	% Amosite	0.0	0.0	0.0	0.0
	% Chrysotile	< 0.1	3.4	< 0.1	3.3
	% Other	0.0	0.0	0.0	0.0
	% Total Asbestos	< 0.1	3.4	< 0.1	3.3
Other Materials Present	% Organic	16.8	62.4	16.6	65.3
	% Carbonates	79.4	30.1	79.0	25.1
	% Other Inorganic	3.8	4.1	4.4	6.3

Results Applicable To Those Items Tested. Report Cannot be Reproduced, Except Entirely, Without Written Approval of the Laboratory.
Liability Limited To Cost Of Analysis. This Report Must Not be Used by the Client to Claim Product Endorsement by NVLAP or Any Agency of the US Government.
AIHA Accreditation No. 100263 Rhode Island DOH No. AAL-07273 Massachusetts DOL No. A A 000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AAS-2895

Eastern Analytical Services, Inc.

Bulk Sample Results

RE: FDR - Building 14 - 1st Floor - B-Side

Client: V.A. Hudson Valley Health Care System
2094 Albany Post Road - Bldg. 16
Montrose, NY 10548

Date Collected : 03/11/2011
Collected By : Sue Keever
Date Received : 03/18/2011
Date Analyzed : 03/22/2011
Analyzed By : Ernest Sanchez
Signature :
Analytical Method : NYS-DOH 198.4
NVLAP Lab No. 101646-0
NYS Lab No. 10851

Sample ID Number		620-11-61	620-11-61	620-11-62	620-11-63
Layer Number		1	2		
Lab ID Number		1997807	1997807	1997808	1997809
Sample Location		FDR, Building 14, 1st Floor, B-Side, Room 164	FDR, Building 14, 1st Floor, B-Side, Room 164	FDR, Building 14, 1st Floor, B-Side, Room 164, Under Top Tile Layer, Right of Door	FDR, Building 14, 1st Floor, B-Side, Room 164, Under Top Tile Layer, Right of Door
Sample Description		Gray Tile with Black Mastic (Tile Layer)	Gray Tile with Black Mastic (Mastic Layer)	Black - Bottom Layer Tile/Mastic (Tile Layer - Insufficient Mastic)	Black - Bottom Layer Tile/Mastic (Tile Layer - Insufficient Mastic)
Analytical Method		Tem	Tem	Tem	Tem
Appearance	Layered	No	No	No	No
	Homogenous	Yes	Yes	Yes	Yes
	Fibrous	No	No	No	No
	Color	Gray	Black	Black	Black
Asbestos Content	% Amosite	0.0	0.0	0.0	0.0
	% Chrysotile	0.2	19.5	23.5	3.0
	% Other	0.0	0.0	0.0	0.0
	% Total Asbestos	0.2	19.5	23.5	3.0
Other Materials Present	% Organic	18.8	28.2	26.3	26.8
	% Carbonates	79.5	32.7	26.6	67.8
	% Other Inorganic	1.5	19.6	23.6	2.4

Results Applicable To Those Items Tested. Report Cannot be Reproduced, Except Entirely, Without Written Approval of the Laboratory.
Liability Limited To Cost Of Analysis. This Report Must Not be Used by the Client to Claim Product Endorsement by NVLAP or Any Agency of the US Government.
AIHA Accreditation No. 100263 Rhode Island DOH No. AAL-07273 Massachusetts DOL No. A A 000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AAS-2095

Eastern Analytical Services, Inc.

Bulk Sample Results

RE: FDR - Building 14 - 1st Floor - B-Side

Client V.A. Hudson Valley Health Care System
2094 Albany Post Road - Bldg. 16
Montrose, NY 10548

Date Collected : 03/11/2011
Collected By : Sue Keever
Date Received : 03/18/2011
Date Analyzed : 03/22/2011
Analyzed By : Ernest Sanchez
Signature :
Analytical Method : NYS-DOH 198.4
NVLAP Lab No. 101646-0
NYS Lab No. 10851

Sample ID Number	620-11-64
Layer Number	
Lab ID Number	1997810
Sample Location	FDR, Building 14, 1st Floor, B-Side, Room 164, Under Top Tile Layer, Right of Door
Sample Description	Black - Bottom Layer Tile/Mastic (Tile Layer - Insufficient Mastic)

Analytical Method		Tem
Appearance	Layered	No
	Homogenous	Yes
	Fibrous	No
	Color	Black
Asbestos Content	% Amosite	0.0
	% Chrysotile	24.4
	% Other	0.0
	% Total Asbestos	24.4
Other Materials Present	% Organic	25.8
	% Carbonates	29.9
	% Other Inorganic	19.9

Results Applicable To Those Items Tested. Report Cannot be Reproduced, Except Entirely, Without Written Approval of the Laboratory.
Liability Limited To Cost Of Analysis. This Report Must Not be Used by the Client to Claim Product Endorsement by NVLAP or Any Agency of the US Government.
AIHA Accreditation No. 100263 Rhode Island DOH No. AAL-072T3 Massachusetts DOL No. A A 000072 Connecticut DOH No. PH-0672 Maine DEP No. LA-024 Vermont DOH No. AAS-2095

Eastern Analytical Services, Inc.

Bulk Sample Results

RE: West Point Project - FDR - Building 14

Client: V.A. Hudson Valley Health Care System
2094 Albany Post Road - Bldg. 16
Montrose, NY 10548

Date Collected : 03/23/2011
Collected By : Sue Keever
Date Received : 03/25/2011
Date Analyzed : 03/27/2011
Analyzed By : Damien Warner
Signature :
Analytical Method : NYS-DOH 198.6
NVLAP Lab No. 101646-0
NYS Lab No. 10851

Sample ID Number	620-11-84
Layer Number	
Lab ID Number	2000033
Sample Location	FDR Building 14 - 1st Floor B-Side - Room 146
Sample Description	Black Mastic Layer Under Gray Thin Set Coating
Analytical Method	Plm

Appearance	Layered	No
	Homogenous	Yes
	Fibrous	No
	Color	Black

Asbestos Content	% Amosite	0.0
	% Chrysotile	0.0
	% Other	0.0
	% Total Asbestos	0.0

Other Materials Present	% Organic	41.5
	% Carbonates	57.4
	% Other Inorganic	1.1

Results Applicable To Those Items Tested. Report Cannot be Reproduced, Except Entirely, Without Written Approval of the Laboratory.
Liability Limited To Cost Of Analysis. This Report Must Not be Used by the Client to Claim Product Endorsement by NVLAP or Any Agency of the US Government.
These Results Cannot Be Used To Claim That NOB Items Tested Are Non-Asbestos Containing (Unless "% Other Inorganic", As Reported Above, Is Less Than One Percent).
AIHA Accreditation No. 100263 Rhode Island DOH No. AAL-07273 Massachusetts DOL No. A A 000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AAS-2095

Eastern Analytical Services, Inc.

Bulk Sample Results

RE: FDR - Building 14 - 2nd Floor - B-Side

Date Collected : 03/11/2011
Collected By : Sue Keever
Date Received : 03/18/2011
Date Analyzed : 03/21/2011
Analyzed By : Damien Warner
Signature :
Analytical Method : EPA/600/R-93/116/NYS-DOH 198.1 (PLM)
NVLAP Lab No. 101646-0
NYS Lab No. 10851

Client: V.A. Hudson Valley Health Care System
2094 Albany Post Road - Bldg. 16
Montrose, NY 10548

Sample ID Number		620-11-54	620-11-55	620-11-56	620-11-57
Layer Number					
Lab ID Number		1997800	1997801	1997802	1997803
Sample Location		FDR, Building 14, 1st Floor, B-Side, Room 146	FDR, Building 14, 1st Floor, B-Side, Room 146	FDR, Building 14, 1st Floor, B-Side, Room 146	FDR, Building 14, 1st Floor, B-Side, Room 146
Sample Description		Gray 1 x 1 Tile w/Black Mastic (Tile Layer)	Gray Tile	Gray Grout Under Tile	Gray 1 x 1 Tile w/Black Mastic (Tile Layer)
Method of Quantification		Visual Estimation	Visual Estimation	Visual Estimation	Visual Estimation
Appearance	Layered	No	No	Yes	No
	Homogenous	Yes	Yes	No	Yes
	Fibrous	No	No	No	No
	Color	Gray	Gray	Gray	Gray
Sample Treatment		None	None	Homogenized	None
Asbestos Content	% Amosite	0.0	0.0	0.0	0.0
	% Chrysotile	0.0	0.0	0.0	0.0
	% Other	0.0	0.0	0.0	0.0
	% Total Asbestos	0.0	0.0	0.0	0.0
Other Fibrous Materials Present	% Fibrous Glass	0.0	0.0	0.0	0.0
	% Cellulose	0.0	0.0	0.0	0.0
	% Other	0.0	0.0	0.0	0.0
	% Unidentified	0.0	0.0	0.0	0.0
Non-Fibrous Materials Present	% Silicates	20.0	20.0	35.0	20.0
	% Carbonates	0.0	0.0	50.0	0.0
	% Other	0.0	0.0	0.0	0.0
	% Unidentified	80.0	80.0	15.0	80.0

Results Applicable To Those Items Tested. Report Cannot be Reproduced, Except Entirely, Without Written Approval of the Laboratory.
Liability Limited To Cost Of Analysis. This Report Must Not be Used by the Client to Claim Product Endorsement by NVLAP or Any Agency of the US Government.
These Results Can Not Be Used To Claim That NOB Items Tested Are Non-Asbestos Containing. Overall Lab Accuracy ± 17%.
AIHA Accreditation No. 100263 Rhode Island DOH No. AAL-072T3 Massachusetts DOL No. A A 0000/2 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AAS-2095

Eastern Analytical Services, Inc.

Bulk Sample Results

RE: West Point Project - FDR - Building 14

Date Collected : 03/23/2011
Collected By : Sue Keever
Date Received : 03/25/2011
Date Analyzed : 03/25/2011
Analyzed By : Ghayath Elias
Signature :
Analytical Method : NYS-DOH 198.4
NVLAP Lab No. 101646-0
NYS Lab No. 10851

Client V.A. Hudson Valley Health Care System
2094 Albany Post Road - Bldg. 16
Montrose, NY 10548

Sample ID Number		620-11-80	620-11-81	620-11-82	620-11-83
Layer Number					
Lab ID Number		2000029	2000030	2000031	2000032
Sample Location		FDR Building 14 - 1st Floor B-Side - Room 146 - Tile Under Tub (Tub Removed)	FDR Building 14 - 1st Floor B-Side - Room 146 - Tile Under Tub (Tub Removed)	FDR Building 14 - 1st Floor B-Side - Room 146 - Tile Under Tub (Tub Removed)	FDR Building 14 - 1st Floor B-Side - Room 146
Sample Description		Tile - Brown/Red	Tile - Brown/Red (Prepped, not Analyzed)	Tile - Brown/Red (Prepped, not Analyzed)	Black Mastic Layer Under Gray Thin Set Coating (Insufficient Quantity)
Analytical Method		Tem	Tem	Tem	Tem
Appearance	Layered	No	No	No	No
	Homogenous	Yes	Yes	Yes	Yes
	Fibrous	No	No	No	No
	Color	Brown	Brown	Brown	Black
Asbestos Content	% Amosite	0.0	NA	NA	NA
	% Chrysotile	18.8	NA	NA	NA
	% Other	0.0	NA	NA	NA
	% Total Asbestos	18.8	NA	NA	NA
Other Materials Present	% Organic	23.0	NA	NA	NA
	% Carbonates	23.4	NA	NA	NA
	% Other Inorganic	34.8	NA	NA	NA

Results Applicable To Those Items Tested. Report Cannot be Reproduced, Except Entirely, Without Written Approval of the Laboratory.
Liability Limited To Cost Of Analysis. This Report Must Not be Used by the Client to Claim Product Endorsement by NVLAP or Any Agency of the US Government.
AIHA Accreditation No. 100263 Rhode Island DOH No. AAL-072T3 Massachusetts DOL No. A A 000072 Connecticut DOH No. PH-0632 Maine DEP No. LA-024 Vermont DOH No. AAS-2095

Eastern Analytical Services, Inc.

Bulk Sample Results

RE: West Point Project - FDR - Building 14

Client: V.A. Hudson Valley Health Care System
2094 Albany Post Road - Bldg. 16
Montrose, NY 10548

Date Collected : 03/23/2011
Collected By : Sue Keever
Date Received : 03/25/2011
Date Analyzed : 03/25/2011
Analyzed By : Ghayath Elias
Signature :
Analytical Method : NYS-DOH 198.4
NVLAP Lab No. 101646-0
NYS Lab No. 10851

Sample ID Number		620-11-84	620-11-85
Layer Number			
Lab ID Number		2000033	2000034
Sample Location		FDR Building 14 - 1st Floor B-Side - Room 146	FDR Building 14 - 1st Floor B-Side - Room 146
Sample Description		Black Mastic Layer Under Gray Thin Set Coating	Black Mastic Layer Under Gray Thin Set Coating (Insufficient Quantity)
Analytical Method		Tem	Tem
Appearance	Layered	No	No
	Homogenous	Yes	Yes
	Fibrous	No	No
	Color	Black	Black
Asbestos Content	% Amosite	0.0	NA
	% Chrysotile	0.0	NA
	% Other	0.0	NA
	% Total Asbestos	0.0	NA
Other Materials Present	% Organic	41.5	NA
	% Carbonates	57.4	NA
	% Other Inorganic	1.1	NA

Results Applicable To Those Items Tested. Report Cannot be Reproduced, Except Entirely, Without Written Approval of the Laboratory.
Liability Limited To Cost Of Analysis. This Report Must Not be Used by the Client to Claim Product Endorsement by NVLAP or Any Agency of the US Government.
AIHA Accreditation No. 100283 Rhode Island DOH No. AAL-07273 Massachusetts DOH No. AA 000972 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AAS-2095

Eastern Analytical Services, Inc.

Bulk Sample Results

RE: Building 14 - West Point

Client: V.A. Hudson Valley Health Care System
2094 Albany Post Road - Bldg. 16
Montrose, NY 10548

Date Collected : 03/07/2011
Collected By : Sue Keever
Date Received : 03/09/2011
Date Analyzed : 03/10/2011
Analyzed By : Kevin Stascavage
Signature :
Analytical Method : NYS-DOH 198.4
NVLAP Lab No. 101646-0
NYS Lab No. 10851

Sample ID Number		620-11-15	620-11-16	620-11-17
Layer Number				
Lab ID Number		1993840	1993841	1993842
Sample Location		Building 14 - Room 157 - Bathroom Corner Near Door	Building 14 - Room 157 - Bathroom Back Room	Building 14 - Room 157 - Bathroom Back Room
Sample Description		Ceramic Tile - Glue - Brown	Ceramic Tile - Glue - Brown	Ceramic Tile - Glue - Brown
Analytical Method		Tem	Tem	Tem
Appearance	Layered	No	No	No
	Homogenous	Yes	Yes	Yes
	Fibrous	No	No	No
	Color	Beige	Beige	Beige
Asbestos Content	% Amosite	0.0	0.0	0.0
	% Chrysotile	0.0	0.0	0.0
	% Other	0.0	0.0	0.0
	% Total Asbestos	0.0	0.0	0.0
Other Materials Present	% Organic	54.8	54.8	61.2
	% Carbonates	1.1	7.9	0.5
	% Other Inorganic	44.1	37.3	38.3

Results Applicable To Those Items Tested. Report Cannot be Reproduced, Except Entirely, Without Written Approval of the Laboratory.
Liability Limited To Cost Of Analysis. This Report Must Not be Used by the Client to Claim Product Endorsement by NVLAP or Any Agency of the US Government.
AIHA Accreditation No. 100263 Rhode Island DOH No. AAL-072T3 Massachusetts DOL No: A A 000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AAS-2095

Eastern Analytical Services, Inc.

Bulk Sample Results

RE: West Point - Building 14 - Side B

Client: V.A. Hudson Valley Health Care System
2094 Albany Post Road - Bldg. 16
Montrose, NY 10548

Date Collected : 03/07/2011
Collected By : Sue Keever
Date Received : 03/09/2011
Date Analyzed : 03/10/2011
Analyzed By : Damien Warner
Signature :
Analytical Method : NYS-DOH 198.6
NVLAP Lab No. 101646-0
NYS Lab No. 10851

Sample ID Number		620-11-34	620-11-35	620-11-37
Layer Number				
Lab ID Number		1993845	1993846	1993847
Sample Location		Building 14 - Room 160 - Under Right Window	Bldg 14 - Room 161 - Next to Right External Wall Window - By Radiator - Lower Rt	Building 14 - Room 162 - Under Window
Sample Description		White/Green Strips Wallpaper w/Glue	White Wallpaper w/Glue Remnants	Green Wallpaper & Glue
Analytical Method		Plm	Plm	Plm
Appearance	Layered	Yes	Yes	Yes
	Homogenous	No	No	No
	Fibrous	Yes	Yes	Yes
	Color	White/Blue	Gray	White/Green
Asbestos Content	% Amosite	0.0	0.0	0.0
	% Chrysotile	0.0	0.0	0.0
	% Other	0.0	0.0	0.0
	% Total Asbestos	0.0	0.0	0.0
Other Materials Present	% Organic	61.6	78.9	50.2
	% Carbonates	19.1	19.3	16.1
	% Other Inorganic	19.3	1.8	33.7

Results Applicable To Those Items Tested. Report Cannot be Reproduced, Except Entirely, Without Written Approval of the Laboratory.
Liability Limited To Cost Of Analysis. This Report Must Not be Used by the Client to Claim Product Endorsement by NVLAP or Any Agency of the US Government.
These Results Cannot Be Used To Claim That NOB Items Tested Are Non-Asbestos Containing (Unless "% Other Inorganic", As Reported Above, Is Less Than One Percent).
AIHA Accreditation No. 100263 Rhode Island DOH No. AAL-072T3 Massachusetts DOL No. A A 000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AAS-2095

Eastern Analytical Services, Inc.

Bulk Sample Results

RE: West Point - Building 14 - Side B

Client: V.A. Hudson Valley Health Care System
2094 Albany Post Road - Bldg. 16
Montrose, NY 10548

Date Collected : 03/07/2011
Collected By : Sue Keever
Date Received : 03/09/2011
Date Analyzed : 03/10/2011
Analyzed By : Kevin Stascavage
Signature :
Analytical Method : NYS-DOH 198.4
NVLAP Lab No. 101646-0
NYS Lab No. 10851

Sample ID Number		620-11-34	620-11-35	620-11-37
Layer Number				
Lab ID Number		1993845	1993846	1993847
Sample Location		Building 14 - Room 160 - Under Right Window	Bldg 14 - Room 161 - Next to Right External Wall Window - By Radiator - Lower Rt	Building 14 - Room 162 - Under Window
Sample Description		White/Green Strips Wallpaper w/Glue	White Wallpaper w/Glue Remnants	Green Wallpaper & Glue
Analytical Method		Tem	Tem	Tem
Appearance	Layered	Yes	Yes	Yes
	Homogenous	No	No	No
	Fibrous	Yes	Yes	Yes
	Color	White/Blue	Gray	White/Green
Asbestos Content	% Amosite	0.0	0.0	0.0
	% Chrysotile	0.0	0.0	0.0
	% Other	0.0	0.0	0.0
	% Total Asbestos	0.0	0.0	0.0
Other Materials Present	% Organic	61.6	78.9	50.2
	% Carbonates	19.1	19.3	16.1
	% Other Inorganic	19.3	1.8	33.7

Results Applicable To Those Items Tested. Report Cannot be Reproduced, Except Entirely, Without Written Approval of the Laboratory.
Liability Limited To Cost Of Analysis. This Report Must Not be Used by the Client to Claim Product Endorsement by NVLAP or Any Agency of the US Government.
AIHA Accreditation No. 100263 Rhode Island DOH No. AAL-072T3 Massachusetts DOL No. A A 000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AAS-2095

Eastern Analytical Services, Inc.

Bulk Sample Results

RE: West Point - Building 14 - Side B

Client: V.A. Hudson Valley Health Care System
2094 Albany Post Road - Bldg. 16
Montrose, NY 10548

Date Collected : 03/07/2011
Collected By : Sue Keever
Date Received : 03/09/2011
Date Analyzed : 03/09/2011
Analyzed By : Ghayath Elias
Signature :
Analytical Method : EPA/600/R-93/116/NYS-DOH 198.1 (PLM)
NVLAP Lab No. 101646-0
NYS Lab No. 10851

Sample ID Number		620-11-32	620-11-33	620-11-36	620-11-36
Layer Number				1	2
Lab ID Number		1993427	1993428	1993429	1993429
Sample Location		Building 14 - Room 159 - Right Corner - Above Ceiling	Bldg 14 - Room 160 - Above Ceiling - Plaster Under Blue Paint - Right of Left	Building 14 - Room 161 - Right of Left External Wall	Building 14 - Room 161 - Right of Left External Wall
Sample Description		White Plaster	White Plaster	White & Gray Plaster (Paint & Plaster Layer)	White & Gray Plaster (Scratch Layer)
Method of Quantification		Visual Estimation	Visual Estimation	Visual Estimation	Visual Estimation
Appearance	Layered	Yes	Yes	Yes	No
	Homogenous	No	No	No	Yes
	Fibrous	No	No	No	No
	Color	White	White	White/Orange	Gray
Sample Treatment		Homogenized	Homogenized	Homogenized	None
Asbestos Content	% Amosite	0.0	0.0	0.0	0.0
	% Chrysotile	0.0	0.0	0.0	0.0
	% Other	0.0	0.0	0.0	0.0
	% Total Asbestos	0.0	0.0	0.0	0.0
Other Fibrous Materials Present	% Fibrous Glass	0.0	0.0	0.0	0.0
	% Cellulose	0.0	0.0	0.0	0.0
	% Other	0.0	0.0	0.0	0.0
	% Unidentified	0.0	0.0	0.0	0.0
Non-Fibrous Materials Present	% Silicates	30.0	30.0	30.0	40.0
	% Carbonates	10.0	10.0	20.0	10.0
	% Other	0.0	0.0	0.0	0.0
	% Unidentified	60.0	60.0	50.0	50.0

Results Applicable To Those Items Tested. Report Cannot be Reproduced, Except Entirely, Without Written Approval of the Laboratory.
Liability Limited To Cost Of Analysis. This Report Must Not be Used by the Client to Claim Product Endorsement by NVLAP or Any Agency of the US Government.
These Results Can Not Be Used To Claim That NOB Items Tested Are Non-Asbestos Containing. Overall Lab Accuracy ± 17%.
AIHA Accreditation No. 100263 Rhode Island DOH No. AAL-07273 Massachusetts DOL No. A A 000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AAS-2095

Eastern Analytical Services, Inc.

Bulk Sample Results

RE: West Point - Building 14 - Side B

Client: V.A. Hudson Valley Health Care System
2094 Albany Post Road - Bldg. 16
Montrose, NY 10548

Date Collected : 03/07/2011
Collected By : Sue Keever
Date Received : 03/09/2011
Date Analyzed : 03/09/2011
Analyzed By : Ghayath Elias
Signature :
Analytical Method : EPA/600/R-93/116/NYS-DOH 198.1 (PLM)
NVLAP Lab No. 101646-0
NYS Lab No. 10851

Sample ID Number		620-11-38	620-11-39	620-11-40
Layer Number				
Lab ID Number		1993430	1993431	1993432
Sample Location		Building 14 - Room 164 - Above Ceiling - Back Wall - Middle	Building 14 - Room 164 - Above Ceiling - Back Wall - Middle	Building 14 - Room 164 - Above Ceiling - Back Wall - Middle
Sample Description		Plaster in Wire Mesh (No Wire)	Plaster in Wire Mesh (No Wire)	Plaster in Wire Mesh (No Wire)
Method of Quantification		Visual Estimation	Visual Estimation	Visual Estimation
Appearance	Layered	No	No	No
	Homogenous	Yes	Yes	Yes
	Fibrous	No	No	No
	Color	Gray	Gray	Gray
Sample Treatment		None	None	None
Asbestos Content	% Amosite	0.0	0.0	0.0
	% Chrysotile	0.0	0.0	0.0
	% Other	0.0	0.0	0.0
	% Total Asbestos	0.0	0.0	0.0
Other Fibrous Materials Present	% Fibrous Glass	0.0	0.0	0.0
	% Cellulose	0.0	0.0	0.0
	% Other	0.0	0.0	0.0
	% Unidentified	0.0	0.0	0.0
Non-Fibrous Materials Present	% Silicates	30.0	30.0	30.0
	% Carbonates	20.0	20.0	20.0
	% Other	0.0	0.0	0.0
	% Unidentified	50.0	50.0	50.0

Results Applicable To Those Items Tested. Report Cannot be Reproduced, Except Entirely, Without Written Approval of the Laboratory.
Liability Limited To Cost Of Analysis. This Report Must Not be Used by the Client to Claim Product Endorsement by NVLAP or Any Agency of the US Government.
These Results Can Not Be Used To Claim That NOB Items Tested Are Non-Asbestos Containing. Overall Lab Accuracy ± 17%.
AIHA Accreditation No. 100263 Rhode Island DOH No. AAL-07273 Massachusetts DOL No. A A 000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AAS-2095

Eastern Analytical Services, Inc.

Bulk Sample Results

RE: West Point - Building 14 - Side B

Client: V.A. Hudson Valley Health Care System
2094 Albany Post Road - Bldg. 16
Montrose, NY 10548

Date Collected : 03/08/2011
Collected By : Sue Keever
Date Received : 03/09/2011
Date Analyzed : 03/10/2011
Analyzed By : Damien Warner
Signature :
Analytical Method : NYS-DOH 198.6
NVLAP Lab No. 101646-0
NYS Lab No. 10851

Sample ID Number		620-11-42	620-11-43	620-11-43
Layer Number			1	2
Lab ID Number		1993843	1993844	1993844
Sample Location		Building 14 - Room 148 - Right Corner of Corridor Wall	Building 14 - Room 150 - Under Radiator - Right Side	Building 14 - Room 150 - Under Radiator - Right Side
Sample Description		Wallpaper - White & Green - Glue	Tile - Brown Flecks w/Reddish Mastic (Tile Layer)	Tile - Brown Flecks w/Reddish Mastic (Mastic Layer)
Analytical Method		Plm	Plm	Plm
Appearance	Layered	Yes	No	Yes
	Homogenous	No	Yes	No
	Fibrous	Yes	No	No
	Color	White/Green	Gray	Brown/Red
Asbestos Content	% Amosite	0.0	0.0	0.0
	% Chrysotile	0.0	0.0	0.0
	% Other	0.0	0.0	0.0
	% Total Asbestos	0.0	0.0	0.0
Other Materials Present	% Organic	73.7	22.3	54.4
	% Carbonates	20.3	75.7	24.7
	% Other Inorganic	6.0	2.0	20.9

Results Applicable To Those Items Tested. Report Cannot be Reproduced, Except Entirely, Without Written Approval of the Laboratory.
Liability Limited To Cost Of Analysis. This Report Must Not Be Used by the Client to Claim Product Endorsement by NVLAP or Any Agency of the US Government.
These Results Cannot Be Used To Claim That NOB Items Tested Are Non-Asbestos Containing (Unless "% Other Inorganic", As Reported Above, Is Less Than One Percent).
AIHA Accreditation No. 100263 Rhode Island DOH No. AAL-07273 Massachusetts DOL No. A A 000072 Connecticut DOH No. PH-0622 Maine DHP No. LA-024 Vermont DOH No. AAS-2095

Eastern Analytical Services, Inc.

Bulk Sample Results

RE: West Point - Building 14 - Side B

Client: V.A. Hudson Valley Health Care System
2094 Albany Post Road - Bldg. 16
Montrose, NY 10548

Date Collected : 03/08/2011
Collected By : Sue Keever
Date Received : 03/09/2011
Date Analyzed : 03/10/2011
Analyzed By : Kevin Stascavage
Signature :
Analytical Method : NYS-DOH 198.4
NVLAP Lab No. 101646-0
NYS Lab No. 10851

Sample ID Number		620-11-42	620-11-43	620-11-43
Layer Number			1	2
Lab ID Number		1993843	1993844	1993844
Sample Location		Building 14 - Room 148 - Right Corner of Corridor Wall	Building 14 - Room 150 - Under Radiator - Right Side	Building 14 - Room 150 - Under Radiator - Right Side
Sample Description		Wallpaper - White & Green - Glue	Tile - Brown Flecks w/Reddish Mastic (Tile Layer)	Tile - Brown Flecks w/Reddish Mastic (Mastic Layer)
Analytical Method		Tem	Tem	Tem
Appearance	Layered	Yes	No	Yes
	Homogenous	No	Yes	No
	Fibrous	Yes	No	No
	Color	White/Green	Gray	Brown/Red
Asbestos Content	% Amosite	0.0	0.0	0.0
	% Chrysotile	0.0	0.0	0.0
	% Other	0.0	0.0	0.0
	% Total Asbestos	0.0	0.0	0.0
Other Materials Present	% Organic	73.7	22.3	54.4
	% Carbonates	20.3	75.7	24.7
	% Other Inorganic	6.0	2.0	20.9

Results Applicable To Those Items Tested. Report Cannot be Reproduced, Except Entirely, Without Written Approval of the Laboratory.
Liability Limited To Cost Of Analysis. This Report Must Not be Used by the Client to Claim Product Endorsement by NVLAP or Any Agency of the US Government.
AIHA Accreditation No. 100263 Rhode Island DOH No. AAL-072T3 Massachusetts DOL No. A A 000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AAS-2095

Eastern Analytical Services, Inc.

Bulk Sample Results

RE: Building 14 - West Point - Side B

Client: V.A. Hudson Valley Health Care System
2094 Albany Post Road - Bldg. 16
Montrose, NY 10548

Date Collected : 03/08/2011
Collected By : Sue Keever
Date Received : 03/09/2011
Date Analyzed : 03/09/2011
Analyzed By : Ghayath Elias
Signature :
Analytical Method : EPA/600/R-93/116/NYS-DOH 198.1 (PLM)
NVLAP Lab No. 101646-0
NYS Lab No. 10851

Sample ID Number	620-11-41
Layer Number	
Lab ID Number	1993426
Sample Location	Building 14 - Room 154 - Under Sink Behind Demo Wall Pipe Insulation
Sample Description	Gray Paper

Method of Quantification		Point Count
Appearance	Layered	No
	Homogenous	No
	Fibrous	Yes
	Color	Gray/Brown
Sample Treatment		Homogenized
Asbestos Content	% Amosite	0.0
	% Chrysotile	5.6
	% Other	0.0
	% Total Asbestos	5.6
Other Fibrous Materials Present	% Fibrous Glass	0.0
	% Cellulose	29.6
	% Other	0.0
	% Unidentified	0.0
Non-Fibrous Materials Present	% Silicates	0.0
	% Carbonates	0.0
	% Other	0.0
	% Unidentified	64.8

Results Applicable To Those Items Tested. Report Cannot be Reproduced, Except Entirely, Without Written Approval of the Laboratory.
Liability Limited To Cost Of Analysis. This Report Must Not Be Used by the Client to Claim Product Endorsement by NVLAP or Any Agency of the US Government.
These Results Can Not Be Used To Claim That NOB Items Tested Are Non-Asbestos Containing. Overall Lab Accuracy ± 17%.
AIHA Accreditation No. 100263 Rhode Island DOH No. AAL-072T3 Massachusetts DOL No. A A 000072 Connecticut DOH No. PH-0622 Maine DEP No. LA-024 Vermont DOH No. AAS-2095

iATL INTERNATIONAL
ASBESTOS TESTING LABORATORIES

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client: Egan Environmental Consulting, Inc
14 High Street
Mahwah NJ 07430

Client: EGA136

Report Date: 8/22/2017
Report No.: 543805 - TEM NOB
Project: 2094 Albany Post Road, Montrose, NY 10548
Project No.: EEC17-005

TEM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6313683
Client No.: 072017-02-CLLI
Description: Tan Ceiling Tile
% Asbestos Detected:
None Detected

Facility:
Location: Bldg 13-Room 201-2nd Floor Office

% Non-Asbestos Fibrous Material:
None Detected

Organic Fraction: 34.7 %
Gravimetrically Reduced Subsample: 65.3%

% Non-Fibrous Material:
65.3 Other

Lab No.: 6313684
Client No.: 072717-01-CLLI
Description: Tan Ceiling Tile
% Asbestos Detected:
None Detected

Facility:
Location: Bldg 14-Room 13-Ground Floor

% Non-Asbestos Fibrous Material:
None Detected

Organic Fraction: 16.3 %
Gravimetrically Reduced Subsample: 83.7%

% Non-Fibrous Material:
83.7 Other

Lab No.: 6313685
Client No.: 072717-02-CLLI
Description: Tan Ceiling Tile
% Asbestos Detected:
None Detected

Facility:
Location: Bldg 14-Room 168-1st Floor

% Non-Asbestos Fibrous Material:
None Detected

Organic Fraction: 14.6 %
Gravimetrically Reduced Subsample: 85.4%

% Non-Fibrous Material:
85.4 Other

Lab No.: 6313686
Client No.: 080117-01-CLLI
Description: Tan Ceiling Tile
% Asbestos Detected:
None Detected

Facility:
Location: Bldg 12-Room 14A-Ground Floor

% Non-Asbestos Fibrous Material:
None Detected

Organic Fraction: 17.1 %
Gravimetrically Reduced Subsample: 82.9%

% Non-Fibrous Material:
82.9 Other

Lab No.: 6313687
Client No.: 080117-02-CLLI
Description: Tan Ceiling Tile
% Asbestos Detected:
None Detected

Facility:
Location: Bldg 12-Room 107K-1st Floor

% Non-Asbestos Fibrous Material:
None Detected

Organic Fraction: 17.0 %
Gravimetrically Reduced Subsample: 83.0%

% Non-Fibrous Material:
83 Other

Please refer to the Preface of this report for further information regarding your analysis.

Date Received: 8/12/2017
Date Analyzed: 08/22/2017
Signature:
Analyst: Ben Reich

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

AIRTEK ENVIRONMENTAL CORP.
39-37 29TH STREET
LONG ISLAND CITY, NY 11101

MONTROSE VA HOSPITAL-LOTHROP ASSOCIATION
BUILDING 14

SAMPLE DATE: 6/12/2013
DATE RECEIVED: 6/17/2013
REPORT DATE: 7/19/13 KP

POLARIZED LIGHT MICROSCOPY (PLM)
PROJECT: 13-0853

Sample/ Lab ID	LOCATION	APPEARANCE	SAMPLE TREATMENT	ASBESTOS TYPE %	VERMICULITE %	FIBROUS TYPE %	NON-FIBROUS TYPE %
272 214932	CERAMIC FLOOR TILE GROUT, BUILDING #14-ROOM 14A	BROWN, HOMOGENEOUS, NON-FIBROUS	CRUSHED TEASED	NONE	NONE		CARBONATES 100%
273 214933	CERAMIC FLOOR TILE GROUT, BUILDING #14-ROOM 14A	BROWN, HOMOGENEOUS, NON-FIBROUS	CRUSHED TEASED	NONE	NONE		CARBONATES 100%
274 214934	CERAMIC FLOOR TILE GROUT, BUILDING #14-ROOM 14A	BROWN, HOMOGENEOUS, NON-FIBROUS	CRUSHED TEASED	NONE	NONE		CARBONATES 100%
275 214935	CERAMIC FLOOR TILE MORTAR, BUILDING #14-ROOM 14A	BROWN, HOMOGENEOUS, NON-FIBROUS	CRUSHED TEASED	NONE	NONE		CARBONATES 100%
276 214936	CERAMIC FLOOR TILE MORTAR, BUILDING #14-ROOM 14A	BROWN, HOMOGENEOUS, NON-FIBROUS	CRUSHED TEASED	NONE	NONE		CARBONATES 100%
277 214937	CERAMIC FLOOR TILE MORTAR, BUILDING #14-ROOM 14A	BROWN, HOMOGENEOUS, NON-FIBROUS	CRUSHED TEASED	NONE	NONE		CARBONATES 100%
278 214938	SHEETROCK, BUILDING #14-ROOM 14	BROWN, HOMOGENEOUS, NON-FIBROUS	TEASED	NONE	NONE	CELLULOSE TRACE	GYPSUM 100%
2ND LAYER		BROWN, LAYERED, FIBROUS	TEASED	NONE	NONE	CELLULOSE 100%	
TOTAL		BROWN/BROWN, LAYERED, FIBROUS	TEASED	NONE	NONE	CELLULOSE 1%	GYPSUM 99%

NOTE: Materials containing 10% or more vermiculite are reported as Asbestos Containing Material (ACM).

Approved Signatory: Joan Bennett Analyst: J.BENNETT Date Analyzed: 6/25/13
Microscope: Nikon Labophot POL. Method: PLM With EPA 600/M4/82/020, ELAP 198.1 AND ELAP 198.6
Methods of stratified point-counting or negative scanning are used on 4 mounts.
Polarized light microscopy is not consistently reliable in detecting asbestos in floor covering/non-friable organically bound materials (NOB's).
NOB's should be analyzed by quantitative TEM. The above test report relates only to item tested.
Layered samples are analyzed by layer. Any positive layer will be reported separately.
Asbestos % is based on visual estimate using point counting rules described in ELAP 198.1.
The sample results are accurate to within +/- 5-10 percent as measured by the calibrated visual method.
Airtek collects samples in accordance with EPA 40 CFR Part 763.
This report should not be used to claim product certification, approval or endorsement by NVLAP,
NIST or any agency of the federal government and may not be reproduced, except in full, without written approval by Airtek.
Currently approved by ELAP (11040) for Asbestos in Friable Material EPA 600/M4/82/020. Accreditation Valid Through: April 1, 2014.
Currently accredited by the NVLAP lab code 102011-0 for Bulk Asbestos Analysis (PLM). Accreditation Valid Through: March 31, 2014.
Currently accredited by AIHA (100275) for Industrial Hygiene Laboratory Accreditation Program. Accreditation Valid Through: June 1, 2015.
This report relates only to the samples reported above and must not be reproduced except in full with the approval of the laboratory.

AIRTEK ENVIRONMENTAL CORP.
39-37 29TH STREET
LONG ISLAND CITY, NY 11101

MONTROSE VA HOSPITAL-LOTHROP ASSOCIATION
BUILDING 14

SAMPLE DATE: 6/12/2013
DATE RECEIVED: 6/17/2013
REPORT DATE: 7/10/13 KP

POLARIZED LIGHT MICROSCOPY (PLM)
PROJECT: 13-0853

Sample/ Lab ID	LOCATION	APPEARANCE	SAMPLE TREATMENT	ASBESTOS TYPE %	VERMICULITE %	FIBROUS TYPE %	NON-FIBROUS TYPE %
279 214939	SHEETROCK, BUILDING #14-ROOM 14	WHITE, HOMOGENEOUS, NON-FIBROUS	TEASED	NONE	NONE		CARBONATES 100%
280 214940	SHEETROCK, BUILDING #14-ROOM 14	TAN, HETEROGENEOUS, FIBROUS	TEASED	NONE	NONE	CELLULOSE TRACE	GYPSUM 100%
2ND LAYER		BROWN, LAYERED, FIBROUS	TEASED	NONE	NONE	CELLULOSE 100%	
TOTAL		TAN/BROWN, LAYERED, FIBROUS	TEASED	NONE	NONE	CELLULOSE 2%	GYPSUM 98%
281 214941	CERAMIC WALL TILE GROUT, BUILDING #14-ROOM 14A	WHITE, HOMOGENEOUS, NON-FIBROUS	CRUSHED TEASED	NONE	NONE		CARBONATES QUARTZ 100%
282 214942	CERAMIC WALL TILE GROUT, BUILDING #14-ROOM 14A	WHITE, HOMOGENEOUS, NON-FIBROUS	CRUSHED TEASED	NONE	NONE		CARBONATES QUARTZ 100%
283 214943	CERAMIC WALL TILE GROUT, BUILDING #14-ROOM 14A	CREAM, HOMOGENEOUS, NON-FIBROUS	CRUSHED TEASED	NONE	NONE		CARBONATES QUARTZ 100%
284 214944	CERAMIC WALL TILE MORTAR, BUILDING #14-ROOM 14A	CREAM, HOMOGENEOUS, NON-FIBROUS	CRUSHED TEASED	NONE	NONE		CARBONATES QUARTZ 100%
285 214945	CERAMIC WALL TILE MORTAR, BUILDING #14-ROOM 14A	CREAM, HOMOGENEOUS, NON-FIBROUS	CRUSHED TEASED	NONE	NONE		CARBONATES QUARTZ 100%

NOTE: Materials containing 10% or more vermiculite are reported as Asbestos Containing Material (ACM).

Approved Signatory: _____ Analyst: J.BENNETT Date Analyzed: 6/25/13
Microscope: Nikon Labophot POL Method: PLM With EPA 600/M4/82/020, ELAP 198.1 AND ELAP 198.6
Methods of stratified point-counting or negative scanning are used on 4 mounts.
Polarized light microscopy is not consistently reliable in detecting asbestos in floor covering/non-friable organically bound materials (NOB's).
NOB's should be analyzed by quantitative TEM. The above test report relates only to item tested.
Layered samples are analyzed by layer. Any positive layer will be reported separately.
Asbestos % is based on visual estimate using point counting rules described in ELAP 198.1.
The sample results are accurate to within +/- 5-10 percent as measured by the calibrated visual method.
Airtek collects samples in accordance with EPA 40 CFR Part 763.
This report should not be used to claim product certification, approval or endorsement by NVLAP,
NIST or any agency of the federal government and may not be reproduced, except in full, without written approval by Airtek.
Currently approved by ELAP (11040) for Asbestos in Friable Material EPA 600/M4/82/020. Accreditation Valid Through: April 1, 2014.
Currently accredited by the NVLAP lab code 102011-0 for Bulk Asbestos Analysis (PLM). Accreditation Valid Through: March 31, 2014.
Currently accredited by AIHA (100275) for Industrial Hygiene Laboratory Accreditation Program. Accreditation Valid Through: June 1, 2015.
This report relates only to the samples reported above and must not be reproduced except in full with the approval of the laboratory.

AIRTEK ENVIRONMENTAL CORP.
39-37 29TH STREET
LONG ISLAND CITY, NY 11101

MONTROSE VA HOSPITAL-LOTHROP ASSOCIATION
BUILDING 14

SAMPLE DATE: 6/12/2013
DATE RECEIVED: 6/17/2013
REPORT DATE: 7/19/13 KP

POLARIZED LIGHT MICROSCOPY (PLM)
PROJECT: 13-0853

Sample/ Lab ID	LOCATION	APPEARANCE	SAMPLE TREATMENT	ASBESTOS TYPE %	VERMICULITE %	FIBROUS TYPE %	NON-FIBROUS TYPE %
285 214946	CERAMIC WALL TILE MORTAR, BUILDING #14-ROOM 14A	CREAM, HOMOGENEOUS, NON-FIBROUS	CRUSHED TEASED	NONE	NONE		CARBONATES QUARTZ 100%
287 214947	WHITE WALL PLASTER, BUILDING #14-ROOM 14A	WHITE, HOMOGENEOUS, NON-FIBROUS	CRUSHED TEASED	NONE	NONE		CARBONATES QUARTZ 100%
288 214948	WHITE WALL PLASTER, BUILDING #14-ROOM 14	WHITE, HOMOGENEOUS, NON-FIBROUS	CRUSHED TEASED	NONE	NONE		CARBONATES QUARTZ 100%
289 214949	WHITE WALL PLASTER, BUILDING #14-ROOM 14	WHITE, HOMOGENEOUS, NON-FIBROUS	TEASED	NONE	NONE	CELLULOSE 2%	GYPSUM 98%
290 214950	BROWN WALL PLASTER. BUILDING #14-ROOM 14A	BROWN, HOMOGENEOUS, NON-FIBROUS	CRUSHED TEASED	NONE	NONE		CARBONATES QUARTZ 100%
291 214951	BROWN WALL PLASTER, BUILDING #14-ROOM 14	BROWN, HOMOGENEOUS, NON-FIBROUS	CRUSHED TEASED	NONE	NONE		CARBONATES QUARTZ 100%
292 214952	BROWN WALL PLASTER, BUILDING #14-ROOM 14	BROWN, HOMOGENEOUS, NON-FIBROUS	CRUSHED TEASED	NONE	NONE		CARBONATES QUARTZ 100%
293 214953	FIRE STOPPING, BUIDLING #14-ROOM 14A	RED, HETEROGENEOUS, FIBROUS	NOB	NONE/INCONCLUSIVE	NONE	FIBERGLASS 10%	ORGANIC MATRIX 75.1%, RESIDUE 14.9%
294 214954	FIRE STOPPING, BUIDLING #14-ROOM 14	RED, HETEROGENEOUS, FIBROUS	NOB	NONE/INCONCLUSIVE	NONE	FIBERGLASS 5%	ORGANIC MATRIX 80.6%, RESIDUE 14.4%

NOTE: Materials containing 10% or more vermiculite are reported as Asbestos Containing Material (ACM).

Approved Signatory: Joan Bennett Analyst: J.BENNETT Date Analyzed: 6/25/13
Microscope: Nikon Labophot POL. Method: PLM With EPA 600/M4/82/020, ELAP 198.1 AND ELAP 198.6
Methods of stratified point-counting or negative scanning are used on 4 mounts.
Polarized light microscopy is not consistently reliable in detecting asbestos in floor covering/non-friable organically bound materials (NOB's).
NOB's should be analyzed by quantitative TEM. The above test report relates only to item tested.
Layered samples are analyzed by layer. Any positive layer will be reported separately.
Asbestos % is based on visual estimate using point counting rules described in ELAP 198.1.
The sample results are accurate to within +/- 5-10 percent as measured by the calibrated visual method.
Airtek collects samples in accordance with EPA 40 CFR Part 763.
This report should not be used to claim product certification, approval or endorsement by NVLAP,
NIST or any agency of the federal government and may not be reproduced, except in full, without written approval by Airtek.
Currently approved by ELAP (11040) for Asbestos in Friable Material EPA 600/M4/82/020. Accreditation Valid Through: April 1, 2014.
Currently accredited by the NVLAP lab code 102011-0 for Bulk Asbestos Analysis (PLM). Accreditation Valid Through: March 31, 2014.
Currently accredited by AIHA (100275) for Industrial Hygiene Laboratory Accreditation Program. Accreditation Valid Through: June 1, 2015.
This report relates only to the samples reported above and must not be reproduced except in full with the approval of the laboratory.

AIRTEK ENVIRONMENTAL CORP.
39-37 29TH STREET
LONG ISLAND CITY, NY 11101

MONTROSE VA HOSPITAL-LOTHROP ASSOCIATION
BUILDING 14

SAMPLE DATE: 6/12/2013
DATE RECEIVED: 6/17/2013
REPORT DATE: 7/19/13 KP

POLARIZED LIGHT MICROSCOPY (PLM)
PROJECT: 13-0863

Sample/ Lab ID	LOCATION	APPEARANCE	SAMPLE TREATMENT	ASBESTOS TYPE %	VERMICULITE %	FIBROUS TYPE %	NON-FIBROUS TYPE %
295 214955	FIRE STOPPING, BUILDING #14-ROOM 14	RED, HETEROGENEOUS, FIBROUS	NOB	NONE/INCONCLUSIVE	NONE	FIBERGLASS 5%	ORGANIC MATRIX 80.3%, RESIDUE 14.7%
296 214956	WHITE CEILING PLASTER, BUILDING #14-ROOM 14A	WHITE, HOMOGENEOUS, NON-FIBROUS	CRUSHED TEASED	NONE	NONE		CARBONATES 100%
297 214957	WHITE CEILING PLASTER, BUILDING #14-ROOM 14	WHITE, HOMOGENEOUS, NON-FIBROUS	CRUSHED TEASED	NONE	NONE		CARBONATES 100%
298 214958	WHITE CEILING PLASTER, BUILDING #14-ROOM 14	WHITE, HOMOGENEOUS, NON-FIBROUS	CRUSHED TEASED	NONE	NONE		CARBONATES 100%
299 214959	BROWN CEILING PLASTER, BUILDING #14-ROOM 14A	BROWN, HOMOGENEOUS, NON-FIBROUS	CRUSHED TEASED	NONE	NONE		CARBONATES QUARTZ 100%
300 214960	BROWN CEILING PLASTER, BUILDING #14-ROOM 14	BROWN, HOMOGENEOUS, NON-FIBROUS	CRUSHED TEASED	NONE	NONE		CARBONATES QUARTZ 100%
301 214961	BROWN CEILING PLASTER, BUILDING #14-ROOM 14	BROWN, HOMOGENEOUS, NON-FIBROUS	CRUSHED TEASED	NONE	NONE		CARBONATES QUARTZ 100%

NOTE: Materials containing 10% or more vermiculite are reported as Asbestos Containing Material (ACM).

Approved Signatory: Robin Bennett Analyst: J.BENNETT Date Analyzed: 6/25/13
Microscope: Nikon Labophot POL Method: PLM With EPA 600/M4/82/020, ELAP 198.1 AND ELAP 198.6
Methods of stratified point-counting or negative scanning are used on 4 mounts.
Polarized light microstopy is not consistently reliable in detecting asbestos in floor covering/non-friable organically bound materials (NOB's).
NOB's should be analyzed by quantitative TEM. The above test report relates only to item tested.
Layered samples are analyzed by layer. Any positive layer will be reported separately.
Asbestos % is based on visual estimate using point counting rules described in ELAP 198.1.
The sample results are accurate to within +/- 5-10 percent as measured by the calibrated visual method.
Airtek collects samples in accordance with EPA 40 CFR Part 763.
This report should not be used to claim product certification, approval or endorsement by NVLAP,
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Currently approved by ELAP (11040) for Asbestos in Friable Material EPA 600/M4/82/020. Accreditation Valid Through: April 1, 2014.
Currently accredited by the NVLAP lab code 102011-0 for Bulk Asbestos Analysis (PLM). Accreditation Valid Through: March 31, 2014.
Currently accredited by AIHA (100275) for Industrial Hygiene Laboratory Accreditation Program. Accreditation Valid Through: June 1, 2015.
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LABORATORY TESTING SERVICES INC.
45-09 GREENPOINT AVE.
LIC, NY 11104
Ph.: (718) 389 3470, Fax: (718) 389 3471

BULK (NOB) ASBESTOS ANALYSIS BY POLARIZED LIGHT MICROSCOPY AND TRANSMISSION ELECTRON MICROSCOPY

CLIENT/ ADDRESS: Airtek Environmental / 39-37 29th St., L.I.C., NY 11101	**PROJECT:** Montrose VA Hosp. **Project #:** 13-0853
ANALYT. METHODOLOGIES: ELAP 198.4	**LABORATORY ID #:** 13-06-305
DATES OF ANALYSIS: 06/21/13	**DATE OF REPORT:** 06/21/13

LABORATORY RESULTS

CLIENT #	LAB. ID #	LOCATION	%ORG	%ASI	%AII	PLM RESULTS	TYPE OF ASBEST.	TEM RESULTS	TYPE OF ASBEST.	POSIT. / NEGAT.
293	13-06-305-01	Fire Stopping			14.9	**NA**	NA	**NAD**	NA	**Negat.**
294	13-06-305-02	Fire Stopping			14.4	**NA**	NA	**NAD**	NA	**Negat.**
295	13-06-305-03	Fire Stopping			14.7	**NA**	NA	**NAD**	NA	**Negat.**

ANALYST
E. Loukianova

LABORATORY DIRECTOR
E. Dimitrakas

LABORATORY ACCREDITATION NUMBERS: NVLAP Lab Code 101958-0, ELAP 10955

- Samples will be stored for sixty (60) days. LTS Inc. should be notified within this time frame for a true duplicate analysis.
- The report relates only to items tested. This report must not be used to claim product endorsement by NVLAP or any other agency of the U.S. Government. Test reports may not be reproduced except in full and with prior approval of LTS Inc.
- NAD: No Asbestos Detected
- The liability of LTS Inc. with respect to the services charged, shall in no event exceed the amount of the invoice.

APPENDIX C

SYSTEM IDENTIFICATION CODES

SYSTEM IDENTIFICATION CODES	DESCRIPTION
ACPL	Acoustical Plaster
ATIN	Attic Insulation
CL	Ceiling (Type Not Specific)
CLGL	Ceiling-Glued Tile
CLLI	Ceiling Tile-Lay in
CLPL	Ceiling Plaster
CLSFP	Ceiling Sprayed-on Fireproofing
CLSH	Ceiling-Sheetrock
CLSP	Ceiling Tile-Splined
CLTH	Cloth
CLTX	Textured Acoustical Finish
DEB	Debris (Type Not Specific)
DOOR	Door Core Insulation-Fire Door
ELWI	Electrical Wire Insulation
FICHW	Chilled Water System Fitting
FICOND	Condensate System Fitting
FICW	Domestic Cold Water System Fitting
FIHW	Domestic Hot Water System Fitting
FIDR	Drain System Fitting
FIFG	Fitting on Fiberglass Insulated Pipe
FIREEF	Refrigeration System Fitting
FISTM	Steam System Fitting
FIT	Fitting (Type Not Specific)
FLVCS	Vinyl Composite Sheet Flooring
FLMAS	Floor Adhesive Mastic
FLVCT	Floor Tile
HDUCT	Mechanical Duct Insulation
HDUPT	HVAC-Duct Joint Tape/Compound
HFANH	HVAC-Fan Housing/Plenum
MBLR	Mechanical Boiler Insulation
MBRCH	Mechanical Breeching Insulation
MCHLR	Mechanical Chiller Insulation
MDHWTK	Mechanical Hot Water Tank Insulation
MEQGA	Mechanical Gasket Insulation
MEQIN	Mechanical Insulation
MFILT	Mechanical Filter
MFLUE	Mechanical Flue Insulation
MHX	Mechanical Heat Exchanger Insulation
MLAM	Miscellaneous Surface Laminate
MTK	Mechanical Equipment Tank
PI	Pipe Insulation (Type Not Specific)
PICHW	Chilled Water System Pipe Insulation
PICOND	Condensate System Pipe Insulation

SYSTEM IDENTIFICATION CODES	DESCRIPTION
PICW	Domestic Cold Water System Pipe Insulation
PIHW	Domestic Hot Water System Pipe Insulation
PIFIRE	Fire Protection System Pipe Insulation
PISTM	Steam System Pipe Insulation
RADIATOR PAD	Radiator Pad Insulation
ROOF	Roofing Material (Type Not Specific)
SFP	Sprayed-on Fireproofing
TANK	Hot Water Tank Insulation
TRNST	Asbestos-Cement (Type Not Specific)
VJC	Vibration Joint Cloth
WLACP	Wall-Acoustical Tile
WL	Wall (Type Not Specific)
WLCT	Wall (Coating Not Specific)
WLPL	Wall Plaster
WLSH	Wall Sheetrock

APPENDIX D

CHAIN OF CUSTODY FORMS

Not included in Specifications -
Available upon request

APPENDIX E

FIELD DATA SHEETS

Not included in Specifications -
Available upon request

APPENDIX F

ACM QUANTITY TABLE

BUILDING 14

ASBESTOS-CONTAINING MATERIALS QUANTITY TABLE

LOCATION	MATERIAL	QUANTITY
Basement	Pipe Insulation	0 L.F. <4" 0 Fittings <4" 0 L.F. 4-8" 0 Fittings 4-8" 0 L.F. >8" 0 Fittings >8"
Basement	Hot Water Tank Insulation	0 S.F.
Ground Floor	Pipe Insulation	1,910 L.F. <4" 288 Fittings <4" 20 L.F. 4-8" 6 Fittings 4-8"
Ground Floor	Radiator Heat Shield (Transite)	696 S.F.
Ground Floor	Floor Tile and Mastic	5,240 S.F.
1st Floor	Pipe Insulation	1,686 L.F. <4" 115 Fittings <4"
1st Floor	Radiator Heat Shield (Transite)	1,140 S.F.
1st Floor	Floor Tile and Mastic	6,774 S.F.
2nd Floor	Pipe Insulation	132 L.F. <4" 46 Fittings <4"
2nd Floor	Radiator Heat Shield (Transite)	1,128 S.F.
2nd Floor	Floor Tile and Mastic	2,435 S.F.
Attic	Pipe Insulation	0 Fittings <4"
Attic	Elevator Control Panel (Ebonite)	16 S.F.
Attic	Elevator Control Panel (Transite)	2 S.F.
Building 14 Total	Pipe Insulation	3,728 L.F. <4" 449 Fittings <4" 20 L.F. 4-8" 6 Fittings 4-8" 0 L.F. >8" 0 Fittings >8"
Building 14 Total	Hot Water Tank Insulation	0 S.F.
Building 14 Total	Floor Tile and Mastic	14,449 S.F.
Building 14 Total	Radiator Heat Shield (Transite)	2,964 S.F.
Building 14 Total	Elevator Control Panel (Ebonite)	16 S.F.

TRIPLE-C Project Submittal Log

Project Name / Number

620-20-105 Montrose Renovate Building 14AB for Homeless Residential Program (Package 2)

Project Location / Website Address

VA Hudson Valley Health Care System
2094 Albany Post Road, Montrose NY 10548
Website

Status Key
O = Open C = Closed

STATUS (pending, open, or closed)	Critical submittals	DIVISION	SPECIFICATION SECTION NUMBER	SPECIFICATION SECTION NAME	SUBMITTAL TYPE
OPEN/CLOSE	Critial / Preconstruction	DIVISION	SecNum	SecName	Type
	Preconstruction	1	01 32 16.15	Project Schedules (Small Projects - Design-Bid-Build)	
					Scheduler Qualifications
					Interim Project Schedule
					Baseline Schedule
					Final Project Schedule
	Preconstruction	1	01 33 23	Shop Drawings, Product Data, and Samples	
	Preconstruction	1	01 35 26	Safety Requirements	Accident prevention plan and Activity Hazard Analyses
	Preconstruction	1	01 45 00	QUALITY CONTROL	See Section 01 33 23 Shop Drawings, Product Data, and Samples and Samples
	Preconstruction	1	01 57 19	Temporary Environmental Controls	See Section, 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES
					Approval of the Contractor's Environmental Protection Plan
	Preconstruction	1	01 74 19	Construction Waste Management	Demolition debris management plan
					Designated Manager responsible for instructing personnel
					Monthly summary of construction and demolition debris diversion and disposal
					Target waste diversion rate by material and an overall diversion rate.
					Final report documenting the results of implementation of the preconstruction waste management plan.
	Pre-mobilization	1	01 81 13	Sustainable Construction Requirements	Sustainability Action Plan
					Low Pollutant-Emitting Materials Tracking Spreadsheet
					Construction Indoor Air Quality (IAQ) Management Plan
					Product Submittals
					Sustainable Construction Progress Reports
					Closeout Submittals
	Preconstruction	1	01 91 00	General Commissioning Requirements	Preliminary Commissioning Plan Submittal
					Final Commissioning Plan Submittal
					Systems Functional Performance Test Procedure
					Pre-Functional Checklists
					Test and Inspection Reports
					Corrective Action Documents
					Preliminary Commissioning Report Submittal
					Final Commissioning Report Submittal
					Data for Commissioning
	Preconstruction	2	02 82 11	Traditional Asbestos Abatement	Detailed work schedule for the entire project
					Staff organization chart
					Asbestos Hazard Abatement Plan
					Specifics of the materials and equipment
					Name, location, and phone number of the approved landfill
					Required notifications and arrangements made with regulatory agencies
					Name, location and verification of the laboratory
					Qualifications verification
					Information on personnel
					State license for asbestos abatement
	Preconstruction	2	02 82 13.13	Glovebag Asbestos Abatement	Detailed work schedule for the entire project
					Staff organization chart
					Asbestos Hazard Abatement Plan
					Specifics of the materials and equipment
					Name, location, and phone number of the approved landfill
					Required notifications and arrangements made with regulatory agencies
					Name, location and verification of the laboratory
					Qualifications verification
					Information on personnel
					State license for asbestos abatement
	Preconstruction	2	02 83 33.13	Lead-Based Paint Removal and Disposal	Manufacturer's Literature and Data
					Test Reports
					Certificates
					Qualifications
					Record Documents
	Critical	3	03 30 00	Cast-In-Place Concrete	Shop Drawings
					Mill Test Reports
					Manufacturer's Certificates
					Testing Agency for Concrete Mix Design
					Test Report for Concrete Mix Designs
					Test reports on splitting tensile strength (Fct) of lightweight concrete.
		4	04 01 00	Maintenance of Masonry	Manufacturer's Literature and Data
					Samples
					Test reports
		4	04 05 13	Masonry Mortaring	Manufacturer's Literature and Data
					Test Reports
					Certificates
					Qualifications
		4	04 20 00	Unit Masonry	Submittal Drawings
					Manufacturer's Literature and Data
					Samples
					Sustainable Construction Submittals
					Certificates

		4	04 72 00	Cast Stone Masonry	Samples
					Shop Drawings
					Certificates
					Manufacturers test results of cast stone previously made by manufacturer.
					Laboratory Data
					List of jobs furnished by the manufacturer, which were similar in scope and at least three (3) years of age.
	Critical	5	05 12 00	Structural Steel Framing	Submittal Drawings
					Sustainable Construction Submittals
					Test Reports
					Certificates
					Qualifications
					Record Surveys
		5	05 50 00	Metal Fabrications	Shop Drawings
					Manufacturer's Literature and Data
					Design of the light gauge
					Blast Design Calculations
					Sustainable Construction Submittals
		5	05 51 00	Metal Stairs	
					Shop Drawings
					Fabrication qualifications.
					Installer qualifications.
					Calculations.
					Welding qualifications.
		6	06 10 00	Rough Carpentry	Sustainable Design Submittals
					Manufacturer's Literature and Data
					Manufacturer's certificate for unmarked lumber.
		7	07 01 50.19	Preparation for Re-Roofing	Submittal Drawings
					Manufacturer's Literature and Data
					Photographs
					Field Inspection Reports
					Infared Roof Moisture Survey Report
		7	07 22 00	Roof and Deck Insulation	Submittal Drawings
					Manufacturer's Literature and Data
					Samples
					Sustainable Construction Submittals
					Qualifications
		7	07 46 46	Fiber-Cement Siding	
					Product Data
					Shop Drawings
					Selection Samples
					Verification Samples
		7	07 54 23	TPO Roofing	Submittal Drawings
					Manufacturer's Literature and Data
					Samples
					Sustainable Construction Submittals
					Certificates
					Field quality control reports.
					Temporary protection plan. Include list of proposed temporary materials.
					Operation and Maintenance Data
		7	07 60 00	Flashing and Sheet Metal	Shop Drawings
					Manufacturer's Literature and Data
					Certificates
		7	07 72 00	Roof Accessories	Samples
					Shop Drawings
					Manufacturer's Literature and Data
					Certificates
		7	07 81 00	Applied Fireproofing	Sustainable Design Submittals
					Installer qualifications.
					Testing laboratory accreditations.
					Manufacturer's Literature and Data
					Certificates
					Miscellaneous
		7	07 84 00	Firestopping	Installer qualifications.
					Inspector qualifications.
					Manufacturers literature, data, and installation instructions
					List of FM, UL, or WH classification number of systems installed.
					Certified laboratory test reports
					Submit certificates from manufacturer attesting that firestopping materials comply with the specified requirements.
		7	07 92 00	Joint Sealants	Installer qualifications.
					Contractor certification.
					Manufacturer's installation instructions for each product used.
					Cured samples of exposed sealants for each color.
					Manufacturer's Literature and Data
					Manufacturer warranty.
	Critical	8	08 11 13	Hollow Metal Doors and Frames	Submittal Drawings
					Manufacturer's Literature and Data
					Sustainable Construction Submittals
					Test reports
					Qualifications
	Critical	8	08 14 00	Interior Wood Doors	Submittal Drawings
					Manufacturer's Literature and Data
					Sustainable Construction Submittals
					Test Reports
					Operation and Maintenance Data
	Critical	8	08 31 13	ACCESS DOORS AND FRAMES	Submittal Drawings
					Manufacturer's Literature and Data
					Sustainable Construction Submittals
	Critical	8	08 36 36.13	High Performance Barn (Sliding) Door	Product Data
					Shop Drawings
					Samples
					Manufactirer's Certification
					Warranty Documantation

					Test Reports
	Critical	8	08 71 00	Door Hardware	Hardware Schedule
					Samples and Manufacturers' Literature
					Certificate of Compliance and Test Reports
		8	08 80 00	Glazing	Sustainable Construction Submittals
					Certificates
					Warranty
					Manufacturer's Literature and Data
					Samples
					Preconstruction Adhesion and Compatibility Test Report
		8	08 90 00	Louvers and Vents	Shop Drawings
					Manufacturer's Literature and Data
					Color Samples
		9	09 05 16	Subsurface Preparation for Floor Finishes	Written approval confirming product compatibility with subfloor material manufacturer and the flooring manufacturer
					Product Data
					Test Data
		9	09 22 16	Non-Structural Metal Framing	Manufacturer's Literature and Data
					Shop Drawings
					Test Results
		9	09 29 00	Gypsum Board	Manufacturer's Literature and Data
					Shop Drawings
					Samples
					Test Results
					Certificates
		9	09 51 00	Acoustical Ceilings	Submittal Drawings
					Manufacturer's Literature and Data
					Samples
					Sustainable Construction Submittals
					Certificates
					Qualifications
					Operation and Maintenance Data
		9	09 65 13	Resilient Base and Accessories	Manufacturer's Literature and Data
					Samples
					Sustainable Construction Submittals
					Operation and Maintenance Data
		9	09 65 19	Resilient Tile Flooring	Sustainable Design Submittals
					Manufacturer's Literature and Data
					Samples
					Shop Drawings
					Test Reports
		9	09 91 00	Painting	Sustainable Design Submittals
					Painter qualifications.
					Manufacturer's Literature and Data
					Sample Panels
					Sample of identity markers if used.
					Manufacturers' Certificates indicating compliance with specified requirements
		10	10 14 00	Signage	Sustainable Design Submittals
					Interior Sign Samples
					Exterior Sign Samples
					Manufacturer's Literature
					Sign Location Plan
					Shop Drawings
					Full size layout patterns for dimensional letters.
					Manufacturer's qualifications.
					Installer's qualifications.
		10	10 26 00	Wall and Door Protection	Sustainable Design Submittals
					Shop Drawings
					Manufacturer's Literature and Data
					Test Report
					Manufacturer's qualifications.
					Installer's qualifications.
					Warranty
					Manufacturer's qualifications.
		10	10 44 13	Fire Extinguisher Cabinets	Manufacturer's Literature and Data
		12	12 24 00	Window Shades	Samples
					Manufacturer's literature and data
					Shop Drawings
					Fire Testing
					Manufacturer's warranty.
		12	12 32 00	Manufactured Wood Casework	Samples
					Manufacturer's literature and data
					Shop Drawings
					Certification
		12	12 36 00	Countertops	Shop Drawings
					Samples
		12	13 05 41	Seismic Restraint Requirements for non-structural Components	Equipment anchorage drawings prior to installation
					Bracing drawings for seismic protection
					Design calculations prepared and sealed by the registered structural engineer
					Concrete anchors, the appropriate ICBC evaluation reports, OSHPD pre-approvals, or lab test reports
		21	21 08 00	Commissioning of Fire Suppression System	See Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, and SAMPLES for further details.
					See Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.
	Critical	21	21 13 13	Wet-Pipe Sprinkler System	Qualifications
					Drawings
					Manufacturers Data Sheets
					Calculation Sheets
					Valve Charts
					Final Document Submittals
		22	22 05 11	Common Work Results for Plumbing	Submit as one package in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES
		22	22 05 23	General-Duty Valves for Plumbing Piping	Manufacturer's Literature and Data
					Test and Balance reports for balancing valves.

					Complete operating and maintenance manuals
					Completed System Readiness Checklist
					Training plans and instructor qualifications
		22	22 07 11	Plumbing Insulation	Manufacturer's Literature and Data
					Shop Drawings
					Samples
					Completed System Readiness Checklist
		22	22 08 00	Commissioning of Plumbing Systems	See Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, and SAMPLES for further details.
					See Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.
		22	22 11 00	Facility Water Distribution	Manufacturer's Literature and Data
					Complete operating and maintenance manuals including wiring diagrams, technical data sheets and information for ordering replacement parts
					Completed System Readiness Checklist
					Training plans and instructor qualifications
		22	22 13 00	Facility Sanitary and Vent Piping	Manufacturer's Literature and Data including
					Detailed shop drawing of clamping device and extensions
					Complete operating and maintenance manuals
					Completed System Readiness Checklist
					Training plans and instructor qualifications
		22	22 14 00	Facility Storm Drainage	Manufacturer's Literature and Data including
					Detailed shop drawing of clamping device and extensions
					Completed System Readiness Checklist
					Training plans and instructor qualifications
		22	22 40 00	Plumbing Fixtures	Manufacturer's Literature and Data
					Operating Instructions
					System Readiness Checklist
					Training plans and instructor qualifications
	Critical	23	23 05 11	Common Work Results for HVAC	Submittals and shop drawings for interdependent items
					Samples
					Mock-ups
					Coordination/Shop Drawings
					Manufacturer's Literature and Data
					Rigging Plan
					HVAC Maintenance Data and Operating Instructions
					Provide copies of approved HVAC equipment submittals to the TAB and Commissioning Subcontractor.
					Completed System Readiness Checklist
					Training plans and instructor qualifications
	Critical	23	23 05 12	General Motor Requirements for HVAC and Steam Generation Equipment	Submit motor submittals with driven equipment.
					Shop Drawings
					Manufacturer's Literature and Data including
					Complete operating and maintenance manuals
					Certification
					Completed System Readiness Checklist
					Submit training plans and instructor qualifications
	Critical	23	23 05 41	Noise and Vibration Control for HVAC Piping and Equipment	Manufacturer's Literature and Data Including
					Load calculations for selection of isolators
	Critical	23	23 05 93	Testing, Adjusting, and Balancing for HVAC	Submit names and qualifications of TAB agency and TAB Specialists
					Reports
					Completed Test and Balance report for the area with noted critical paths.
	Critical	23	23 07 11	HVAC, Plumbing, and Boiler Plant Insulation	Shop Drawings
					Samples
	Critical	23	23 08 00	Commissioning of HVAC Systems	See Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, and SAMPLES
					See Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.
	Critical	23	23 09 23	Direct-Digital Control System for HVAC	Manufacturer's Literature and Data
					Product Certificates
					Validation Test Plan
					Licenses
					As Built Control Drawings
					Operation and Maintenance (O/M) Manuals)
					Submit Performance Report to COR prior to final inspection.
	Critical	23	23 21 13	Hydronic Piping	Manufacturer's Literature and Data
					Manufacturer's certified data report
					Welder's qualifications
					Coordination Drawings
					As-Built Piping Diagrams
					Complete operating and maintenance manuals
					Completed System Readiness Checklist
					Training plans and instructor qualifications
	Critical	23	23 21 23	Hydronic Pumps	Manufacturer's Literature and Data
					Characteristic Curves
					Operating and Maintenance Manual
					System Readiness Checklist
					Training plans and instructor qualifications
	Critical	23	23 22 13	Steam and Condensate Heating Piping	Manufacturer's Literature and Data
					Manufacturer's certified data report
					Coordination Drawings
					As-Built Piping Diagrams
					Complete operating and maintenance manuals
					Completed System Readiness Checklist
					Training plans and instructor qualifications
	Critical	23	23 22 23	Steam Condensate Pumps	Manufacturer's Literature and Data
					Characteristic Curves
					Operating and Maintenance Manual
					System Readiness Checklist
					Training plans and instructor qualifications
	Critical	23	23 23 00	Refrigeration Piping	Shop Drawings
					Certification
					Design Manual
	Critical	23	23 25 00	HVAC Water Treatment	Manufacturer's Literature and Data
					Water analysis verification.
					Materials Safety Data Sheet

	Critical	23	23 31 00	HVAC Ducts and Casings	Manufacturer's Literature and Data
					Coordination Drawings
					Complete operating and maintenance manuals
	Critical	23	23 34 00	HVAC Fans	Manufacturers Literature and Data
					Certified sound power levels for each fan.
					Motor ratings, types, electrical characteristics, and accessories.
					Certified fan performance curves
					Complete operating and maintenance manuals
					Completed System Readiness Checklist
					Training plans and instructor qualifications
	Critical	23	23 36 00	Air Terminal Units	Manufacturer's Literature and Data
					Samples
					Complete operating and maintenance manuals
					Completed System Readiness Checklist
					Training plans and instructor qualifications
	Critical	23	23 37 00	Air Outlets and Inlets	Manufacturer's Literature and Data
					Complete operating and maintenance manuals
	Critical	23	23 40 00	HVAC Air Cleaning Devices	Manufacturer's Literature and Data Including
					Air Filter performance reports.
					Suppliers warranty.
					Complete operating and maintenance manuals
	Critical	23	23 64 00	Packaged Water Chillers	Manufacturer’s literature and data
					Test Report
					Product Certificates
					Seismic Restraints
					Operating and Maintenance Manual
					Completed System Readiness Checklists
					Training plans and instructor qualification
	Critical	23	23 73 00	Indoor Central-Station Air -Handling Units	Manufacturer’s literature and data
					Test Procedures and Reports
					Shipping Information
					Operating and Maintenance Manual
					Completed System Readiness Checklists
					Training plans and instructor qualification
	Critical	23	23 81 00	Decentralized Unitary HVAC Equipment	Manufacturer’s literature and data Including
					Certification
					Performance Rating
					Operating and Maintenance Manual
					Completed System Readiness Checklists
	Critical	23	23 82 00	Convection Heating and Cooling Units	Manufacturer's Literature and Data Including
					Certificates
					Complete operating and maintenance manuals
					Completed System Readiness Checklists
					Training plans and instructor qualifications
	Critical	23	23 82 16	Air Coils	Manufacturer's Literature and Data Including
					Provide installation, operating and maintenance instructions.
					Certification Compliance
					Complete operating and maintenance manuals
	Critical	26	26 05 11	Requirements for Electrical Installations	Submit to the COR in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
	Critical	26	26 05 19	Low-Voltage Electrical Power Conductors and Cables	Shop Drawings
					Certifications
	Critical	26	26 05 26	Grounding and Bonding for Electrical Systems	Shop Drawings
					Test Reports
					Certifications
	Critical	26	26 05 33	Raceway and Boxes for Electrical Systems	Shop Drawings
					Certifications
	Critical	26	26 05 41	Underground Electrical Construction	Shop Drawings
					Certifications
	Critical	26	26 05 73	Overcurrent Protective Device Coordination Study	See Section 26 05 11 Requirements for Electrical Installations
	Critical	26	26 08 00	Commissioning of Electrical Systems	See Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS
	Critical	26	26 09 23	Lighting Controls	Shop Drawings
					Manuals
					Certifications
	Critical		26 24 16	Panelboards	Shop Drawings
					Manuals
					Certifications
	Critical	26	26 25 11	Busways	Shop Drawings
					Manuals
					Certifications
	Critical	26	26 27 26	Wiring Devices	Shop Drawings
					Manuals
					Certifications
	Critical	26	26 29 11	Motor Controllers	Shop Drawings
					Manuals
					Certifications
	Critical	26	26 29 21	Enclosed Switches and Circuit Breakers	Shop Drawings
					Manuals
					Certifications
	Critical	26	26 43 13	Surge Protective Devices	Shop Drawings
					Manuals
					Certifications
	Critical	26	26 51 00	Interior Lighting	Shop Drawings
					Manuals
					Certifications
	Critical	26	26 56 00	Exterior Lighting	Shop Drawings
					Manuals
					Certifications
		27	27 05 11	Requirements for Communications Installations	Provide parts list including quantity of spare parts.
					Provide manufacturer product information
					Provide Source Quality Control Submittal
					Installer Qualifications

					Provide delegated design submittals
					Test Equipment List
					Submittal Drawings
					Provide sustainable design submittals.
					Furnish electronic certified test reports
					Provide following closeout submittals prior to project closeout date
					Maintenance and Operation Manuals
					Record Wiring Diagrams
					Service Qualifications
		27	27 05 26	Grounding and Bonding for Communications Systems	Plan indicating location of system grounding electrode connections and routing
					Riser diagram
					Closeout Submittals
			27 05 33	Raceways and Boxes for Communications Systems	Coordination drawings
					Certification
		27	27 05 36	Cable Trays for Communications Systems	See Section 27 05 11 Common Work Results for Communication Systems
		27	27 05 53	Identification for Communications Systems	See Section 27 05 11 Common Work Results for Communication Systems
		27	27 08 00	Commissioning of Communications Systems	Pre-Functional Checklists
					Training agendas and trainer resumes
		27	27 10 00	Control, Communication and Signal Wiring	Submit written certification from OEM
					Environmental specifications on technical submittals
					Power
					Provide conduit size requirements.
					Closeout Submittals
		27	27 10 00.1	Structured Cabling	See Section 27 05 11 Common Work Results for Communication Systems
		27	27 11 00	Telecommunications Room Fittings	Pictoral layout drawings
					Equipment technical literature detailing
					Environmental requirements
		27	27 11 16	Communications Cabinets, Racks, Frames, and Enclosures	See Section 27 05 11 Common Work Results for Communication Systems
		27	27 11 19	Communications Termination Blocks and Patch Panels	See Section 27 05 11 Common Work Results for Communication Systems
		27	27 11 26	Communications Rack Mounted Power Protection and Power Strips	See Section 27 05 11 Common Work Results for Communication Systems
					Construction details for each type of product
		27	27 13 13	Communications Copper Backbone Cabling	See Section 27 05 11 Common Work Results for Communication Systems
		27	27 13 13.13	Communications Copper Cable Splicing and Terminations	See Section 27 05 11 Common Work Results for Communication Systems
		27	27 13 23	Communications Optical Fiber Backbone Cabling	See Section 27 05 11 Common Work Results for Communication Systems
		27	27 15 00	Communications Structured Cabling	Pictoral layout drawings
					List of test equipment
					Certifications
					Closeout Submittal
		27	27 15 13	Communication Copper Horizontal Cabling	See Section 27 05 11 Common Work Results for Communication Systems
		27	27 15 13.13	Communication Optical Fiber Splicing and Terminations	See Section 27 05 11 Common Work Results for Communication Systems
		27	27 16 19	Communication Patch Cords, Station Cords, and Cross Connect Wire	See Section 27 05 11 Common Work Results for Communication Systems
		27	27 51 23	Intercommunications and Program Systems	
					Certifications
					Warranty
					Needs Assessment Report
					Maintenance Material Submission
		27	27 52 23	Nurse Call and Code Blue Systems	
					Catalog sheets, product data sheets, diagrams, and charts published by the manufacturer
					Provide interconnection methods, conduit (where not already installed), junction boxes (J-Boxes), cable, interface fixtures and equipment lists
					Equipment technical literature
					Engineering drawings of the System
					Surveys Required as a Part of The Technical Submittal
					Drawings and product data on all proposed equipment and system
					Catalog sheets, product data sheets, diagrams, and charts published by the manufacturer
					Complete and thorough equipment list of equipment
	Critical	28	28 05 00	Common Work Results for Electronic Safety and Security	Group 1 Technical Data Package
					Group II Technical Data Package
					Group III Technical Data Package
					Group IV Technical Data Package
					Group V Technical Data Package
					Completed System Readiness Checklists
	Critical	28	28 05 13	Conductors and Cables for Electronic Safety and Security	Manufacturer's Literature and Data
					Certificates
					Shop Drawings
					Wiring Diagrams
					Cable Administration Drawings
					Project Planning Documents
					Maintenance Data
	Critical	28	28 05 26	Grounding and Bonding for Electronic Safety and Security	Shop Drawings
					Test Reports
					Certifications
	Critical	28	28 05 28.33	Conduits and Backboxes for Electronic Safety and Security	Shop Drawings
					Certification
					Completed System Readiness Checklists
					Product Data
					Coordination Drawings
					Manufacturer Seismic Qualification Certification
					Source quality-control test reports.
	Critical	28	28 08 00	Commissioning of Electronic Safety and Security Systems	See Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS

	Critical	28	28 13 00	Physical Access Control Systems	Certificates of compliance with Section 1.3, Quality Assurance.
					Pre-installation and as-built design package
					Pre-installation design packages
					Manufacturer security system product cut-sheets
					Manufacture's certification of Underwriters Laboratories, Inc. (UL)
					Group 1 Technical Data Package
					Group II Technical Data Package
					Group III Technical Data Package
					Group IV Technical Data Package
					Group V Technical Data Package
					FIPS 201 Compliance Certificates
					Completed System Readiness Checklists
	Critical	28	28 23 00	Video Surveillance	Certificates of compliance with Section 1.4, Quality Assurance.
					Pre-installation design packages
					Manufacturer security system product cut-sheets
					Manufacture's certification of Underwriters Laboratories, Inc. (UL)
					System Readiness Checklist
	Critical	28	28 31 00	Fire Detection and Alarm	Drawings
					Manuals
					Certifications
		31	31 20 00	Earthwork	Rock Excavation Report
		31	31 23 19	Dewatering	Drawings and Design Data
					Inspection Reports.
					All required permits.
		31	31 23 23.33	Flowable Fill	Flowable fill Mix Design
					Admixture supplier has experience
					Manufacturer's Certificates
		32	32 05 23	Cement and Concrete for Exterior Improvements	Submittal Drawings
					Manufacturer's Literature and Data
					Samples
					Test reports
					Certificates
					Qualifications
					Concrete mix design.
					Select subbase jobmix design.
					Proposed hot and cold weather concreting methods.
					Land surveyor's construction staking notes, before placing concrete.
		32	32 90 00	Planting	Manufacturer's Literature and Data
					Sustainable Construction Submittals
					Test reports
					Certificates
					Qualifications
					Operation and Maintenance Data

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VHA Infection Control Risk Assessment for Construction, Renovation and Maintenance

Introductory Information and Instructions

Use this template as a baseline for performing facility Infection Control Risk Assessments (ICRAs) for construction, renovation, and maintenance work (referred to as the "activity" in this document). The template provides minimum requirements for categorizing activity types and patient risk to determine the level of precautions needed to prevent infection risks. Facilities may customize this template to incorporate site-specific information and/or to add more stringent criteria.

This VHA ICRA template pertains specifically to infection prevention. It must be used if required by the VHA Pre-Construction Risk Assessment (PCRA) for the activity. *NOTE: The PCRA addresses other activity-related safety concerns (e.g., vibration, noise, hazardous materials) outside the scope of the ICRA.*

To complete the template:

1. Use **Table 1** to identify the category of the construction, renovation and/or maintenance activity.
2. Use **Table 2** to identify the areas affected by the activity.
3. Use **Table 3** to identify the overall patient risk category that will be affected by the activity.
4. Use **Table 4** to determine the level of infection prevention and control precautions needed for the activity.

Once all 4 steps above are completed: Refer to **Table 5** for the minimum required control measures for the level of infection prevention and control precautions needed for the activity. Refer to **Table 6** for the minimum infection prevention and control measures required on completion of the activity.

PERMIT: See the last page of this document for a fillable permit form to be used for posting at the activity site as needed.

Table 1 - Construction, Renovation, and/or Maintenance Activity Category

NOTE: *If any of the bulleted criteria in a higher activity category pertains to the work that will be done (even if the other criteria are in a lower category), use the higher activity category for the VHA ICRA.*

Activity Category determined from Table 1 (*A, B, C, or D*): ☐

Category A	**Inspection and/or facility upkeep generally defined as follows**: • Work can be completed in a single shift, not to exceed 10 hours. • Patients and/or employees may be in the area depending on the activity. • Work that does not create dust or debris. • Removal of ceiling tile or access to mechanical or electrical chase for visual inspection limited to 1 tile per 50 square feet with limited exposure time (not to exceed an hour for each tile) within the shift. • Minor interior updates (e.g., replacing floor or ceiling tiles, carpentry work to include hanging signage, and painting without sanding) that do not create dust or debris. • Limited building system maintenance such as basic plumbing on potable systems (e.g., faucet replacement) or basic electrical work such as replacement of light bulbs, receptacles, or switches.
Category B	**General maintenance and repair work generally defined as follows:** • Prolonged inspection and work that may take longer than a single shift but not exceeding a week. • Patients and employees are not to be in the area until activity is completed. • Work that creates minimal dust and debris.

	• Interior finish or surface repairs, updates, or modifications such as repair of firewalls and barriers, and new flooring that produces minimal dust and debris. Controlled sanding activities (e.g., wet or dry sanding) that produce minimal dust and debris. • Plumbing work such as installation or replacement of a single fixture or piping for a single fixture. Any work on sanitary plumbing including snaking of drains. • Electrical work such as installation of cabling/wiring/conduit for a single device, installation of new device such as a light fixture that produces minimal dust and debris. • Air Handler and/or fan shutdown/startup and HVAC work such as replacement of a single diffuser, single terminal unit or a single device that produces minimal dust and debris.
Category C	**Small-scale construction, renovation, or maintenance generally defined as follows**: • Work requiring longer than a single week to complete but not exceeding 6 months. • Patients and employees are not to be in the area until activity is completed. • Demolition/removal of preexisting floor covering, casework, lay-in ceiling, or other architectural elements. • Demolition/removal of more than 32 ft^2 of drywall/framing, hard ceilings, and doors/framing and minimal infrastructure such as electrical circuits and branch piping. • Installation of new walls, ceilings and doors including framing, drywall/plaster and associated work. • Plumbing work such as the installation of new sinks, showers and toilets and associated plumbing. • Shut down of sections of potable water systems. • Electrical work such as installation of conduit and wire for lighting, receptacles and switches for an area, the installation of conduit and wire for new devices such as terminal units, fans etc. • Modification of existing fire alarm and suppression systems. • Mechanical work such as the installation of ductwork, diffusers, and terminal units for an area.

Category D	**Large-scale construction, renovation, or maintenance generally defined as follows**:
	• Work exceeding 6 months in duration.
	• Patients and employees are not to be in the area until activity is completed.
	• Large-scale demolition of building components and infrastructure including removal of multiple doors, walls, framing, ceilings, flooring, piping, electrical and HVAC.
	• The installation building components such as new walls, ceilings and doors including framing, drywall and associated plaster work.
	• Plumbing work such as the installation of:
	  ○ new medical gas systems,
	  ○ steam/heating hot water, condensate systems,
	  ○ multiple sinks, showers and toilets including associated plumbing.
	• Shutdown of potable water, steam/heating hot water, condensate, and medical gas systems.
	• Electrical work such as installation of electrical feeders, distribution panels, conduit and wire for lighting, receptacles and switches for an area, the installation of conduit and wire for new devices such as terminal units, fans etc.
	• Installation of fire alarm and suppression systems.
	• Electrical shutdown of multiple panels.
	• Mechanical work such as the installation of air handling equipment, associated ductwork, diffusers, heat exchangers, terminal units and controls.

Table 2 - Affected Area Assessment

Identify the areas and associated patients that will be affected by the construction/renovation/maintenance activity (see the Figure for a visual representation of adjacent affected areas).

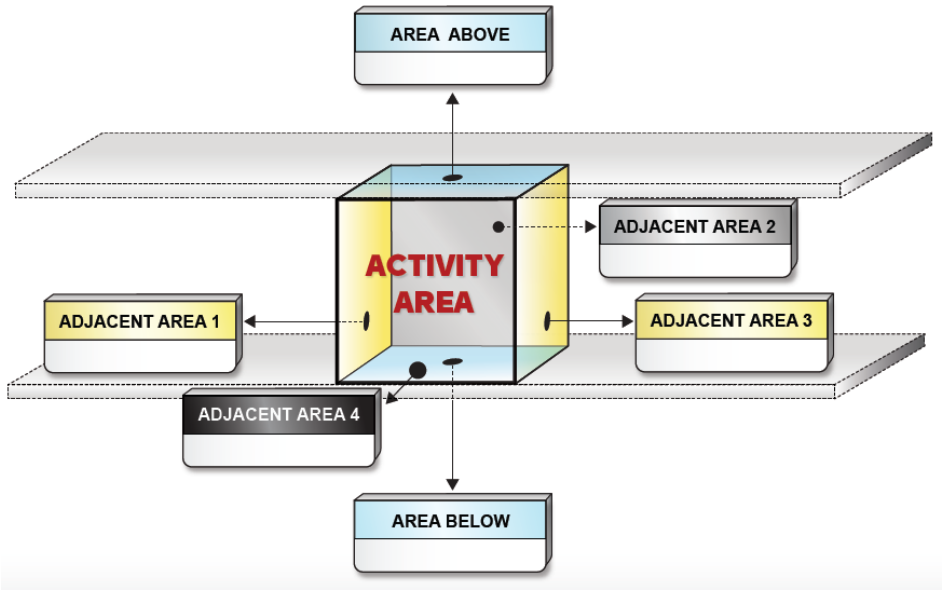

Figure: Isometric drawing of affected area assessment

Area	Service(s)/Type(s) of Area(s) *(e.g., OR, Unit/Ward, Sterile Processing, Administrative, etc.)**	Point of Contact (POC)	POC Contact Information
Activity Area**			
Area Above			
Area Below			
Adjacent Area 1			
Adjacent Area 2			
Adjacent Area 3			
Adjacent Area 4			

* There may be more than one Service/type of area for each row. List all.

** List the area(s) in which the construction/renovation/maintenance activity will occur. ***NOTE: When the Activity Category is B, C, or D, the control measures are determined by the Patient Risk in the adjacent affected areas.***

VHA Infection Control Risk Assessment for Construction, Renovation and Maintenance

Table 3 - Patient Risk Category

Using Table 3, identify the patient risk category for each area listed in Table 2. Of the patient risk categories identified, select the one with the greatest risk as the overall Patient Risk Category for the activity.

Overall Patient Risk Category determined from Table 3 (*Low, Medium, High, or Highest*): [ ]

Low Risk	Medium Risk	High Risk	Highest Risk
Non-patient care areas such as:	Patient care support areas such as:	Patient care areas such as:	Procedural, invasive, sterile support and highly compromised patient care areas such as:
• Public hallways and gathering areas not in clinical areas • Office areas not in clinical areas • Breakrooms not in clinical areas • Bathrooms or locker rooms not in clinical areas • Mechanical/electrical rooms not in clinical areas	• Waiting areas • Clinical engineering (biomedical) • Materials management • Sterile processing department – dirty side • Kitchen, cafeteria, gift shop, coffee shop, and food kiosks	• Patient care rooms and areas, including spinal cord injury units • All acute care units, including mental health • All outpatient units and clinics • Emergency department • Community Living Centers, domiciliaries, and transitional residences • Employee health • Pharmacy – general work zone • Medication rooms and clean utility rooms • Imaging suites – diagnostic imaging • Laboratory	• All transplant units • All intensive care units • All oncology units and chemotherapy/infusion centers • OR theaters and restricted areas • Hemodialysis units • Procedural rooms* • Pharmacy compounding area • Sterile processing department – clean side • Transfusion services • Imaging suites – interventional imaging • Dedicated isolation wards/units for infectious diseases

***** Procedural Rooms are designated for the performance of patient care activities that may require high-level disinfected or sterile instruments and some environmental controls but is not required to be performed with the environmental controls of an operating room (OR). The room is intended for procedures that are performed in an aseptic surgical field and penetrates the protective surfaces of a patient's body (e.g., subcutaneous tissue, mucous membranes, cornea) or entry into or opening of a sterile body cavity. Examples of these spaces include, and are not limited to, Cardiac Catheterization Suites, Electrophysiology Suites, Endovascular/GI Suites, Angio Suites and other spaces which may have high risk patient populations.

Table 4 - Level of Infection Prevention and Control Precautions

Match the Overall Patient Risk Category (*Low, Medium, High, Highest*) determined from Table 3 with the planned Construction/Renovation/Maintenance Activity Category (*A, B, C, D*) from Table 1 to determine the minimum Level of Infection Prevention and Control Precautions (*I, II, III, or IV*) using Table 4 below.

Level of Precautions determined from Table 4 (*I, II, III, or IV*): ☐

Patient Risk Category	**Activity Category**			
	A	**B**	**C**	**D**
Low Risk	I	II	II	III
Medium Risk	I	II	III	IV
High Risk	I	II	IV	IV
Highest Risk	II	III	IV	IV

An infection prevention and control permit is required for Level III and Level IV. Consult with Infection Prevention and Control for Level I and Level II.

Table 5 - Required Infection Prevention and Control Measures, by Level of Precautions

Controls defined below for the Level of Precautions identified for the activity must be in place before the activity begins and maintained until work is completed and the area is activated. Control measures for each Precaution Level must also include the control measures in the preceding Level(s).

As the activity progresses, a full re-evaluation of remaining activity type and patient risk is required prior to downgrading the Level of Precautions.

Level of Precautions	**Control Measures**
Level I	1. Perform work activity in a manner that does not create dust. 2. Immediately replace any ceiling tile, close access panels, etc., upon completion of work. 3. Any materials and equipment being brought into the facility must be free of contaminants and loose material.
Level II	**All control measures in Level I and the following:** 1. Provide active means to control airborne dust from dispersing into occupied areas and/or water mist surface to control dust (e.g., Mobile Dust Containment Cart or some other system). 2. Ensure worker clothing is clean and free of visible dust before leaving the work area. 3. Remove or isolate air diffusers (supply and return) to protect the HVAC system from dust and reduce air turbulence. Rebalance system to address diffuser isolation.

	4. When the work involves or impacts potable water systems including stagnation due to reduced usage, the piping shall be flushed twice a week or isolated from the main system. 5. Seal doors to prevent dust migration. 6. Contain all trash and debris in the work area. Perform daily cleaning and disposal of trash (covered) from work area using an identified exit route. 7. Any equipment, tools, or materials removed from the work area must be in sealed containers and/or cleaned of dust and debris prior to removal from the area. 8. Nonporous/smooth and cleanable containers (with a hard lid) must be used to transport trash and debris from the construction areas. These containers must be damp-wiped cleaned and free of visible dust/debris before leaving the contained work area. 9. Install a sticky (dust collection) mat at entrance of contained work area based on facility policy. Sticky mats must be changed routinely and when visibly soiled. 10. Maintain clean surroundings when area is not contained by damp mopping or HEPA vacuuming surfaces at least daily.
Level III	**<u>All control measures in Levels I and II</u> and the following:** 1. Ensure availability of equipment for cleaning hands. 2. Construct and complete critical barriers meeting NFPA 241 requirements. Barriers must extend to the ceiling or if ceiling tile is removed, to the deck above. 3. All (plastic or hard) barrier construction activities must be completed in a manner that prevents dust release. Plastic barriers must be effectively affixed to floor and ceiling (or floor/roof deck above) and secure from movement or damage. 4. Seal all penetrations in containment barriers, including floors and ceiling, using approved materials (UL schedule firestop if applicable for barrier type). 5. Maintain .01 inches /water gauge negative pressurization of the entire workspace by use of HEPA exhaust air systems directed outdoors, or comply with the alternative method outlined in Appendix A of this document. These control measures must be maintained continuously 24/7 for the duration of the project. HEPA filtered exhaust if discharged directly to the outdoors must be at a distance of 25 feet or greater from entrances, air intakes and operable windows. Exhausting discharged air into shared or recirculating HVAC systems, or other shared exhaust systems (e.g., bathroom exhaust) is <u>prohibited</u>. 6. Install a differential pressure sensing device (e.g., magnehelic, manometer, or digital monitoring) on exterior of work containment to continually monitor and document negative pressurization. The “ball in the wall” or similar apparatus are <u>not acceptable</u>.
Level IV	**<u>All control measures in Levels I, II and III</u> and the following:** 1. Barriers must be hard barriers unless temporary to install final barrier. 2. Containment must include an anteroom to ensure pressure control. Anteroom must be large enough for equipment staging, cart cleaning, workers’ PPE and cleaning. 3. Worker clothing and/or PPE must be removed or clean and free of visible dust before leaving the work area anteroom. HEPA vacuuming of clothing or use of cover suits is acceptable. 4. Workers must wear shoe covers or have a method to clean shoes in anteroom. Shoe covers must be removed prior to exiting the anteroom to the occupied space (non-work area). Damaged shoe covers must be changed immediately.

Table 6 - Minimum Infection Prevention and Control Measures Required Upon Completion of the Activity

Controls defined below shall be completed upon completion of the activity and inspected prior to terminating measures defined in Table 5.

Level of Precautions	Measures
Levels I - II	**Cleaning:** 1. Clean work areas including all environmental surfaces, high horizontal surfaces and flooring materials. 2. Check all supply and return air registers for dust accumulation on upper surfaces as well as air diffuser surfaces. **HVAC Systems:** 1. Remove isolation of HVAC system in areas where work is being performed. Verify that HVAC systems are clean and operational. 2. Verify the HVAC systems meet original airflow and air exchange design specifications. **Water systems:** 1. Until the potable water system is activated and in use, flushing shall continue at least twice per week in accordance with VHA Directive 1061.
Levels III - IV	Construction areas must be inspected by an infection preventionist and engineering representative (and others as determined by the facility) for final activity/project close out and removal of infection prevention and control measures. **Work Area Cleaning:** 1. Clean work areas including all environmental surfaces, high horizontal surfaces and flooring materials. 2. Check all supply and return air registers for dust accumulation on upper surfaces as well as air diffuser surfaces. **Removal of Critical Barriers:** 1. Critical barriers must remain in place during all work involving drywall removal, creation of dust and activities beyond simple touch-up work. The barrier may NOT be removed until a work area cleaning has been performed. Additional cleaning may be needed after removal of barrier. 2. All (plastic or hard) barrier removal activities must be completed in a manner that prevents dust release. Use the following precautions when removing hard barriers: i. Carefully remove screws and painter tape. ii. If dust will be generated during screw removal, use hand-held HEPA vacuum. iii. Drywall cutting is prohibited during removal process. iv. Clean all stud tracks with HEPA vacuum before removing outer hard barrier. v. Use a plastic barrier to enclose area if dust could be generated. **Negative Air Requirements:** 1. The use of negative air must be designed to remove contaminants from the work area. 2. Negative air devices (fans, filters, monitoring and documentation equipment) must remain operational at all times and in place for a period after completion of dust creating activities to remove contaminants from the work area and before removal of critical barriers. **HVAC systems:** 1. Upon removal of critical barriers, remove isolation of HVAC system in areas where work is being performed. 2. Verify that HVAC systems are clean and operational. 3. Verify and document through a TAB the HVAC systems meets original airflow and air exchange design specifications. **Water systems:** 1. Until the potable water system is activated and in use, flushing shall continue at least twice per week in accordance with VHA Directive 1061.

Infection Prevention and Control Construction/Renovation/Maintenance Permit

This page must be posted at the entrance to the project area for Level III and Level IV activities.

Unique permit number:			
Location of construction/renovation/maintenance			
Project manager		Project start date	
Contact phone number		Completion date	
Contractor		Permit expiration date	

Activity Category (*A, B, C, or D*)		Overall Patient Risk Category (*Low, Medium, High, or Highest*)		Level of Infection Prevention and Control Precautions (*I, II, III, or IV*)	

Level of Precautions	**Control measures to be in place for the duration of the activity** *(Check the box for the activity's Level of Precautions to indicate the Control Measures)*
Level I ☐	1. Perform work activity in a manner that does not create dust. 2. Immediately replace any ceiling tile, close access panels, etc., upon completion of work. 3. Any materials and equipment being brought into the facility must be free of contaminants and loose material.
Level II ☐	**All control measures in Level I and the following:** 1. Provide active means to control airborne dust from dispersing into occupied areas and/or water mist surface to control dust (e.g., Mobile Dust Containment Cart or some other system). 2. Ensure worker clothing is clean and free of visible dust before leaving the work area. 3. Remove or isolate air diffusers (supply and return) to protect the HVAC system from dust and reduce air turbulence. Rebalance system to address diffuser isolation. 4. When the work involves or impacts potable water systems including stagnation due to reduced usage, the piping shall be flushed twice a week or isolated from the main system 5. Seal doors, to prevent dust migration. 6. Contain all trash and debris in the work area. Perform daily cleaning and disposal of trash (covered) from work area using an identified exit route. 7. Any equipment, tools, or materials removed from the work area must be in sealed containers and/or cleaned of dust and debris prior to removal from the area. 8. Nonporous/smooth and cleanable containers (with a hard lid) must be used to transport trash and debris from the construction areas. These containers must be damp-wiped cleaned and free of visible dust/debris before leaving the contained work area. 9. Install a sticky (dust collection) mat at entrance of contained work area based on facility policy. Sticky mats must be changed routinely and when visibly soiled. 10. Maintain clean surroundings when area is not contained by damp mopping or HEPA vacuuming surfaces at least daily.
Level III ☐	**All control measures in Levels I and II and the following:** 1. Ensure availability of equipment for cleaning hands. 2. Construct and complete critical barriers meeting NFPA 241 requirements. Barriers must extend to the ceiling or if ceiling tile is removed, to the deck above. 3. All (plastic or hard) barrier construction activities must be completed in a manner that prevents dust release. Plastic barriers must be effectively affixed to floor and ceiling (or floor/roof deck above) and secure from movement or damage. 4. Seal all penetrations in containment barriers, including floors and ceiling, using approved materials (UL schedule firestop if applicable for barrier type). 5. Maintain .01 inches /water gauge negative pressurization of the entire workspace by use of HEPA exhaust air systems directed outdoors, or comply with the alternative method outline in Appendix A of the VHA ICRA template. These control measures must be maintained continuously 24/7 for the duration of the project. Exhausting discharged air into shared or recirculating HVAC systems, or other shared exhaust systems (e.g., bathroom exhaust) is prohibited. **Check box to indicate exhaust method:** Exterior ☐ Alternative Interior Method ☐ 6. Install a differential pressure sensing device (e.g., magnehelic, manometer, or digital monitoring) on exterior of work containment to continually monitor and document negative pressurization. The "ball in the wall" or similar apparatus are not acceptable.
Level IV ☐	**All control measures in Levels I, II and III and the following:** 1. Barriers must be hard barriers unless temporary to install final barrier. 2. Containment must include an anteroom to ensure pressure control, Anteroom must be large enough for equipment staging, cart cleaning, workers' PPE and cleaning. 3. Worker clothing and/or PPE must be removed or clean and free of visible dust before leaving the work area anteroom. HEPA vacuuming of clothing or use of cover suits is acceptable. 4. Workers must wear shoe covers or have a method to clean shoes in anteroom Shoe covers must be removed prior to exiting the anteroom to the occupied space (non-work area). Damaged shoe covers must be changed immediately.

Additional requirements:			
Project Manager signature		Date	
Infection Preventionist signature		Date	

Appendix A: Alternative To Outdoor Exhaust Requirements

This Appendix provides an equivalent ICRA control measure to requirements detailed in this VHA ICRA template (Table 5 Level III, item 5) that would allow interior construction space exhaust.

Interior Construction Space Exhaust:

If the facility is not able to exhaust to the building exterior, the Healthcare Environment and Facilities program office has identified an alternate industry-recognized standard interior exhaust procedure that is accepted as providing an equivalent level of infection prevention and control (IPC), and safety. The alternate interior exhaust procedure is implemented by completing the following:

a. If exhaust is directed indoors, then the system must be HEPA filtered. Prior to start of work, including assembly of the ICRA barriers, initial baseline air sampling measurements for particulate levels must be taken in the planned area of discharge. Once containment is erected and completed, HEPA filtration must then be verified by particulate measurement, using a particle counter with multi-channel capabilities to measure down to 0.3 microns, to confirm that the discharge of the HEPA unit does not exceed the baseline particulate count of the area to which the exhaust is directed. Verification must continue at least three times per day (once every 8 hours), 7 days per week, during the use of the negative air machine and HEPA filter. Any exceedance must trigger a work stoppage and an immediate response and resolution. All particulate measurements, including the baseline measurement, must be documented and retrievable.
b. To accommodate the sampling, the negative air pressure machine must be fitted with a 2 ft section of rigid ductwork at the discharge. The sample port for monitoring must be in the rigid ductwork section.
c. Vapor generating processes must be assessed and appropriate filtration must be installed to mitigate transmission to the facility.
d. Engineering must do a complete flow and pressure analysis and document the area to which the air is being discharged to ensure the flow and pressure relationships in that area are not being adversely impacted by the additional flow. Ideally, this is done as part of the construction package to ensure the design is implementable and no additional HVAC changes are required to accommodate the exhaust from the negative air equipment.
e. Install device on exterior of work containment to continually monitor negative pressurization. To ensure proper pressure is continuously maintained, the device(s) shall have a visual pressure indicator, data collection and alarm.
f. Exhaust must be directed to Low Risk areas as defined in Table 3 in this VHA ICRA template. Ideally this discharge must be located so as not to impinge on high traffic areas or create a nuisance with noise or excessive airflow.
   NOTE: *Exhaust into shared or recirculating HVAC systems, or other shared exhaust systems (e.g., bathroom exhaust) is not acceptable.*

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VHA Pre-Construction Risk Assessment (PCRA)

PCRA Introductory Information and Instructions

Use this template as a baseline for performing facility Pre-Construction Risk Assessments (PCRA) for Construction, Renovation, and Maintenance work (referred to as the "activity" in this document). The template provides minimum requirements for categorizing activity type(s) and safety risk to determine the level of precautions needed to prevent impact related to Construction, Renovation and Maintenance on patients, employees, and contractors.

Ensure that the activity statement of work and any drawings available are used for the PCRA assessment and included in the project file with the completed PCRA.

Communication and coordination of all types of activity with affected areas are to be included among the control measures. The development of communication and coordination plans must begin during the activity planning phase.

Facilities may customize this template to incorporate site-specific information and requirements.

NOTE: *This VHA PCRA template pertains specifically to non-infection-related safety for Construction, Renovation, and Maintenance activities. It must be used in conjunction with the VHA Infection Control Risk Assessment (ICRA) for the activity, if required, which specifically addresses infection risks outside the scope of this PCRA.*

PERMIT: See the last page of this document for a fillable permit form to be used for posting at the activity site.

Activity Location:

Activity Name, Number, and/or Brief Description:

Table 1 - Construction, Renovation, and/or Maintenance Activity Type and Control Measures

NOTE: *If any of the bulleted criteria in a higher activity type pertains to the work that will be done (even if the other criteria are in a lower type), use the higher activity type for the VHA PCRA.*

Controls defined in Table 1 for the activity must be in place before the activity begins and maintained until work is completed and the area is activated. Control measures for each activity must also include the control measures in the preceding row(s).

As the activity progresses, a full re-evaluation of remaining activity type and risk is required prior to changing the level of control measures.

Activity Type determined from Table 1:

Activity Type and Description	Control Measures
Inspection/upkeep generally defined as follows: • Work can be completed in a single shift, not to exceed 10 hours. • Patients, employees and/or visitors may be in the area depending on the activity. • Work that does not create dust or debris. • Work that does not create vapors or fumes. • Removal of ceiling tile or access to mechanical or electrical chase for visual inspection that will not impair fire safety systems and are limited to 1 tile per 50 square feet with limited	1. Immediately replace any ceiling tile, close access panels, etc., upon completion of work. 2. Site visits of construction area are required weekly by member of multi-disciplinary team. Site visits will be documented on standard checklist. 3. Site specific safety plan, task hazard analysis, and hazard communication required to be provided by the contractor and approved where a contact is in place. For internal work the

exposure time (not to exceed an hour for each tile) within the shift. • Minor interior updates (e.g., replacing floor or ceiling tiles, carpentry work to include hanging signage, and painting with hand tools) that do not create vibration or noise. • Limited building system maintenance that does not require Lock Out Tag Out (LOTO) such as plumbing on potable systems limited to faucet replacement, steam trap replacement etc. and electrical work such as replacement of bulbs, receptacles, or switches.	shop involved must work with Safety to ensure proper precautions are in place. 4. Must address identified hazards and controls that will be implemented to ensure minimal impact to patients, employees, contractors and facility. 5. Communication and coordination plan for all affected areas

Small scale Construction, Renovation and general maintenance/repair work, generally defined as follows:
• Prolonged work that may take longer than a single shift but not exceeding six months.
• Patients and employees are not to be in the area until activity is completed.
• Work that creates some noise and vibration due to power tool use.
• Selective demolition/removal of preexisting floor covering, casework, lay-in ceiling, or other architectural elements that may
  o disturb asbestos, lead or silica
  o create the potential for falling objects
  o create vibration and/or noise in excess of 80 dB(A) in surrounding areas.
  o cause penetrations in fire or smoke barrier
• Plumbing work such as the installation of new sinks, showers and toilets and associated plumbing that requires utility outages or work on the steam system that may require:
  o LOTO
  o The use of compressed gas cylinders
• Electrical work such as installation of conduit and wire for lighting, receptacles and switches for an area, the installation of conduit and wire for new devices such as terminal units, fans etc. Electrical work such as installation of cabling/wiring/conduit for a single device, installation of new device such as a light fixture that require LOTO.
• Air Handler and/or fan shutdown/startup and HVAC work such as replacement of a single diffuser, single terminal unit, a single device and the installation of ductwork, diffusers, and terminal units for an area that may require:
  o Work on ladders
  o Rigging, hoisting or lifting of equipment or materials overhead
• Modification of existing fire alarm and suppression systems requiring system outages and ILSMs or obstruction of exits and or impact on corridors.
• Architectural, structural, or any other work that may cause vapors or fumes such as:
  o Roofing work
  o Flooring work
  o Painting or other large-scale use of such substances.
	All control measures in the row above and the following:
	1. Hazard communication chemical inventory required to be provided by the contractor and approved.
	2. Where construction, Renovation and maintenance are done in an accredited facility, and ILSM assessment is required to be done and ILSMs put into place in accordance with TJC LS.01.02.01 and the local facility policy including Fire watch if necessary. Staff is trained and the ILSM is verified regularly
	3. Hot Work or burn permits in place and staff trained
	4. LOTO procedures in place and staff trained on their use
	5. Site visits will be reviewed using the criteria in standardized guide.
	6. Daily inspections of the site are to be conducted by the General Contractor or shop supervisor and documented on their daily log.

Large-scale construction, renovation, or maintenance generally defined as follows: • Work exceeding 6 months in duration. • Patients and employees are not to be in the area until activity is completed.	**All control measures in the two rows above and the following Activity Hazard Analyses and Control Plans (check all that apply):** 1. Excavation safety plan in place ☐ 2. Dust control plan in place ☐

• Excavation or heavy equipment use taking place
  ○ Dig safe required utility location
  ○ Trench safety
  ○ Dust control plan
  ○ Equipment exhaust, Noise, Vibration
• Confined space entry required (permit required or not)
• Requires crane work
  ○ General crane work
  ○ Lift over buildings
• Includes elevated work
  ○ Roof work, fall protection
  ○ Window work, scaffolding and fall protection
  ○ Odor control
• Welding, cutting or use of torches requiring burn permits
• Demolition of building components and infrastructure including removal of multiple doors, walls, framing, ceilings, flooring, piping, electrical and HVAC that may
  ○ require asbestos, lead or silica abatement
  ○ create the potential for falling objects
  ○ create vibration and/or noise in excess of 90 dB(A) in surrounding areas.
  ○ cause breaches to fire or smoke barrier
• The installation building components such as new walls, ceilings and doors including framing, drywall and associated plaster work that requires transport of significant materials through building and up elevators i.e., weight limits of floors and elevators
• Plumbing work requiring LOTO and system shutdown and startup such as the installation of:
  ○ new medical gas systems,
  ○ steam/heating hot water, condensate systems,
  ○ Potable water and sanitary drainage, multiple sinks, showers and toilets including associated plumbing.
• Electrical work such as installation of electrical feeders, distribution panels, conduit and wire for lighting, receptacles and switches for an area, the installation of conduit and wire for new devices such as terminal units, fans etc. requiring LOTO and system isolation.
• Installation of fire alarm and suppression systems requiring outages of those systems and ILSMs or closure of exits/corridors
• Mechanical work such as the installation of air handling equipment, associated ductwork, diffusers, heat exchangers, terminal units and controls requiring lifting and support of equipment and systems.
	3. Pollution prevention plan in place ☐
	4. Dig safe paper work in place ☐
	5. Crane lift plan in place ☐
	  a. Crane placement
	  b. Crane swing
	  c. Crane load evaluation
	6. Fall protection plan in place and staff trained ☐
	7. Confined entry plan in place and staff trained ☐

Table 2. Affected Adjacent Area Assessment

In addition to the minimum precautions noted above for the Activity Type, it is critical that the activity be coordinated with the areas adjacent to the activity to ensure operations in those areas are not disrupted or impacted. List the adjacent areas in Table 2 below and develop activity-specific coordination plans and associated communication plans with each area to address activity work that could impact or disrupt the operation of the areas, in general as follows:

- If adjacent area is **vacant** (e.g., work outside, construction of new building, etc.):
  - Coordination is typically not necessary other than potentially traffic flow and pedestrian access.

VHA Pre-Construction Risk Assessment (PCRA)

- If adjacent area is **non-continuously occupied** (e.g., areas where outpatient care is provided, employee health, etc.):
  - Develop a list of activities that will potentially impact or disrupt the operation of the area (e.g., work involving noise, vibration or exit obstruction) and meet with POC to coordinate execution of work in a way that mitigates the impact (e.g., conduct work after hours).
- If adjacent area is **occupied continuously** (e.g., areas where inpatient care is provided, residential areas such as Community Living Centers, etc.):
  - Develop a list of activities that will potentially impact or disrupt the operation of the area (e.g., work involving noise, vibration or exit obstruction) and meet with POC to coordinate execution of work in a way that mitigates the impact (e.g., move affected party temporarily).

Area	**Service(s)/Type(s) of Area(s)** *(e.g., OR, Unit/Ward, Sterile Processing, Administrative, etc)**	**Point of Contact (POC)**	**POC Contact Information**	**Construction plan communicated to POC?**
Activity Area**				
Area Above				
Area Below				
Adjacent Area 1				
Adjacent Area 2				
Adjacent Area 3				
Adjacent Area 4				

* There may be more than one Service/type of area for each row. List all. The information entered on this table must be used in the ICRA if required.

** List the area(s) in which the construction/renovation/maintenance activity will occur.

Infection Control Risk Assessment (ICRA)

Consult with Infection Prevention and Control regarding the assessment of potential patient infection risks associated with the activity and the need for control measures. For example, activities such as a boiler plant project and/or facility steam shutdown, if properly planned, should have minimal to no patient infection risk impacts and likely not to require an ICRA. See VHA Directive 7715 and the VHA ICRA Template for more information.

Is an ICRA required for the Activity? Yes ☐ No ☐

Pre-Construction Risk Assessment (PCRA) Permit

This page must be posted at the entrance to the project area, or other designated area

Unique permit number:			
Location and brief description of construction/renovation/maintenance			
Project manager		Project start date	
Contact phone number		Completion date	
Contractor or lead shop		Permit expiration date	

Activity Type *Inspection/Upkeep, Small-scale, or Large-scale)*	

Activity Type	**Control measures to be in place for the duration of the activity** *(Check the box for the Activity Type to indicate the Control Measures)*
Inspection/Upkeep ☐	1. Immediately replace any ceiling tile, close access panels, etc., upon completion of work. 2. Site visits of construction area are required weekly by member of multi-disciplinary team. Site visits will be documented on standard checklist. 3. Site specific safety plan, task hazard analysis, and hazard communication required to be provided by the contractor and approved. 4. Must address identified hazards and controls that will be implemented to ensure minimal impact patients, employees, contractors and facility. 5. Communication and coordination plan for all affected areas
Small-scale ☐	**All control measures in the row above and the following:** 1. Hazard communication chemical inventory required to be provided by the contractor and approved. 2. ILSMs in place and staff trained on situation 3. Hot Work or burn permits in place and staff trained 4. LOTO procedures in place and staff trained on their use 5. Site visits will be reviewed using the criteria in standardized guide. 6. Daily inspections of the site are to be conducted by the General Contractor and documented on their daily log.
Large-scale ☐	**All control measures in both rows above and the following Activity Hazard Analyses and Control Plans as applicable (check all that apply):** 1. Excavation safety plan in place ☐ 2. Dust control plan in place ☐ 3. Pollution prevention plan in place ☐ 4. Dig safe paperwork in place ☐ 5. Crane lift plan in place ☐ a. Crane placement b. Crane swing c. Crane load evaluation 6. Fall protection plan in place and staff trained ☐ 7. Confined entry plan in place and staff trained ☐

Additional requirements:			
Is an Infection Control Risk Assessment (ICRA) required for the Activity? Yes ☐ No ☐ Infection Prevention and Control signature: Date:			
Project Manager signature		Date	
Safety Officer signature		Date	
Chair, Construction Safety Committee signature		Date	

*The location of all Activity Hazard Analyses and Control Plans (excavation, dust, pollution, etc.) as applicable shall be identified on this permit and shall be made available to all workers on the job.

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SAFETY AND HEALTH DURING CONSTRUCTION

1. SUMMARY OF MAJOR CHANGES: Major changes are as follows:

a. Amendment dated September 5, 2023: Updates the Training paragraph to remove the general mention of "staff that have responsibilities related to construction" from the roles requiring training.

b. Paragraph 2: Delineates responsibilities for the Contracting Officer and the Department of Veterans Affairs (VA) medical facility Construction Safety Officer (CSO) who serves as a Contracting Officer's Representative for enforcement of construction contract safety requirements; establishes responsibility for the VA medical facility CSO to identify and assess high-hazard risks and provides a link to information on applicable high-hazard risks on construction sites.

c. Paragraph 2.e.(5): Provides for the development and administration of a Construction Safety Management Tool for tracking Veterans Health Administration (VHA) contractors' deficiencies in implementing contract safety requirements.

d. Paragraph 2.k.: Removes the requirement to create a local policy for the VA medical facility Construction Safety Committee (CSC), reduces the number of required members of the VA medical facility CSC and further delineates that the VA medical facility CSC must be chaired by a member of the VA medical facility Executive Leadership Team and co-chaired by the VA medical facility's Safety Manager.

e. Paragraph 2.l. and paragraph 3: Establishes requirements for use of the VHA-Pre-Construction Risk Assessment (PCRA) and the VHA-Infection Control Risk Assessment (ICRA) forms for assessing construction-associated hazards throughout the construction project lifecycle; provides links for the VHA-PCRA and VHA-ICRA forms.

f. Paragraph 2.l.(7): Reduces daily inspection requirements by VHA in its oversight role of construction activities capable of causing fatalities or permanently disabling injuries or illnesses as that responsibility resides with the construction contractors.

g. Paragraph 4: Removes the requirement to complete the Occupational Safety and Health Administration or VHA 10-hour Construction Safety training for the Green Environmental Management System, Patient Safety and Contracting staff; local union representatives and VA Police.

2. RELATED ISSUES: VA Directive 7700, Occupational Safety and Health, dated February 11, 2009; VHA Directive 7701, Comprehensive Occupational Safety and Health Program, dated December 12, 2022; VHA Directive 7712, Fire Protection Code Reviews of Delegated Construction Projects, dated May 19, 2022.

3. POLICY OWNER: The Assistant Under Secretary for Health for Support (19) is responsible for the content of this directive. Questions may be referred to the Director, Occupational Safety and Health Office, Office of Healthcare Environment and Facilities Programs (19HEF) at VHAOccSafetyandHealthAction@va.gov.

4. RESCISSIONS: VHA Directive 7715, Safety and Health During Construction, dated April 6, 2017, is rescinded.

5. RECERTIFICATION: This VHA directive is scheduled for recertification on or before the last working day of June 2028. This VHA directive will continue to serve as national VHA policy until it is recertified or rescinded.

6. IMPLEMENTATION SCHEDULE: This directive is effective 3 months from publication.

BY DIRECTION OF THE OFFICE OF THE UNDER SECRETARY FOR HEALTH:

/s/ Alfred A. Montoya Jr., MHA, FACHE
Acting Assistant Under Secretary for Health for Support

NOTE: *All references herein to VA and VHA documents incorporate by reference subsequent VA and VHA documents on the same or similar subject matter.*

DISTRIBUTION: Emailed to the VHA Publications Distribution List on July 5, 2023.

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SAFETY AND HEALTH DURING CONSTRUCTION

1. POLICY

It is Veterans Health Administration (VHA) policy to maintain a safe and healthful environment and ensure compliance with occupational safety and health (OSH) requirements during construction to reduce risk to patients, staff, residents, volunteers, visitors, contractors and the general public at Department of Veterans Affairs (VA) medical facilities, and to reduce risk of disruption of patient care, treatment and mission-essential services. This directive applies to all construction activities as defined by the Occupational Safety and Health Administration (OSHA) that are performed on VHA-owned or VHA-leased properties managed by VHA or where VHA has an oversight role of contractors. **AUTHORITY:** 38 U.S.C. § 7301(b); 29 C.F.R. §§ 1960.6, 1960.8.

2. RESPONSIBILITIES

a. **Under Secretary for Health.** The Under Secretary for Health is responsible for ensuring overall VHA compliance with this directive.

b. **Assistant Under Secretary for Health for Support.** The Assistant Under Secretary for Health for Support is responsible for establishing policy and providing guidance and oversight as necessary to ensure the timely and successful implementation of this directive.

c. **Assistant Under Secretary for Health for Operations.** The Assistant Under Secretary for Health for Operations is responsible for:

(1) Communicating the contents of this directive to each of the Veterans Integrated Services Networks (VISNs).

(2) Assisting VISN Directors to resolve implementation and compliance challenges in all VA medical facilities within that VISN.

(3) Providing oversight of VISNs to ensure compliance with this directive and its effectiveness.

d. **Executive Director, VHA Healthcare Environment and Facilities Program.** The Executive Director, Healthcare Environment and Facilities Program is responsible for:

(1) Overseeing the VHA OSH program.

(2) Providing advisory support to h the Assistant Under Secretary for Health for Operations, VISN Directors and VA medical facility Directors for the establishment and sustainment of their construction safety and health programs performance in a manner that meets the requirements of applicable Federal, State and local statutes and regulations; Executive Orders; and VA and VHA directives.

e. **Director, Occupational Safety and Health Office.** The Director, OSH is responsible for:

(1) Ensuring that guidance is provided in the recognition, evaluation and control of construction hazards, to comply with OSHA and other applicable regulations, health care accreditation standards, VA standards and this directive. For further information, see the Construction Safety Guidebook available at: http://vaww.hefp.va.gov/guidebooks/construction-safety-guidebook. ***NOTE:*** *This is an internal VA website that is not available to the public.*

(2) Ensuring that guidance is provided on the effective implementation of a construction safety and health program to comply with OSHA regulations, health care accreditation standards and this directive.

(3) Ensuring that consultation occurs with the Director, Office of Healthcare Engineering (OHE) on the development and implementation of this directive.

(4) Ensuring the development of metrics to identify trends in construction safety and health risks and providing guidance to reduce construction-related injuries and illnesses.

(5) Ensuring the development and maintenance of a Construction Safety Management Tool for the documentation and tracking of abatement of contractor safety deficiencies.

(6) Assisting with development and maintenance of VHA-Preconstruction Risk Assessment (PCRA) and VHA-Infection Control Risk Assessment (ICRA) forms along with instructions for use. For details, see paragraph 3.

(7) Assisting the Institute for Learning, Education and Development with the development and delivery of construction safety training materials for VHA staff.

(8) Conducting incident-related site investigations when warranted.

f. **Director, Office of Healthcare Engineering.** The Director, OHE is responsible for:

(1) Providing advisory support to the Director, OSH on the development and implementation of this directive.

(2) Communicating hazard alerts to VHA healthcare engineers at VA-owned and VA-leased properties.

(3) Assisting with incident-related site investigations at the request of the Director, OSH.

g. **Director, National Infectious Disease Service.** The Director, National Infectious Disease Service is responsible for advising on exposure mitigation and protective practices to be employed during construction that reduce the risk of infection and

providing information and advice on infectious diseases associated with construction.

h. **Veterans Integrated Service Network Director.** The VISN Director is responsible for:

(1) Ensuring that VA medical facilities within the VISN are provided adequate staffing, funding, training, support and resources for implementing their construction safety and health programs.

(2) Ensuring that all VA medical facilities within the VISN comply with this directive and informing the Assistant Under Secretary for Health for Operations when barriers to compliance are identified.

(3) Establishing construction safety and health program performance standards for VA medical facility Directors and incorporating them in the overall OSH performance standards.

(4) Ensuring that the VISN Safety and Occupational Health (SOH) Manager audits VA medical facility construction safety and health programs as part of the Annual Workplace Evaluations (AWE) and that the audit's findings are included in the AWE report. ***NOTE:*** *AWEs are required by VHA Directive 7701, Comprehensive Occupational Safety and Health Program, dated December 12, 2022.*

(5) Facilitating communication between VHA Central Office and VA medical facility staff regarding construction safety actions, policies, guidance and incidents.

i. **Veterans Integrated Service Network Safety and Occupational Health Manager.** The VISN SOH Manager (sometimes referred to as the VISN OSH Manager) is responsible for:

(1) Being knowledgeable of VHA policies and guidance concerning construction safety.

(2) Ensuring completion of AWEs that include identification of deficiencies in the implementation of each VA medical facility's construction safety and health program and drafting a report of those findings to be reviewed and approved by the VISN Director.

(3) Tracking identified deficiencies (from AWEs, employee complaints, OSHA inspections and other means) to abatement within specified timeframes.

(4) Collecting, analyzing and validating data associated with nationally established construction safety metrics and consulting with VA medical facilities to improve performance.

(5) Coordinating communication between VHA Central Office, VISN and VA medical facility staff regarding construction safety actions, policies, guidance and incidents.

(6) Completing and documenting training in accordance with paragraph 4.

j. **Contracting Officer.** The Contracting Officer (CO) is responsible for:

(1) Ensuring the appropriate Federal Acquisition Regulation (FAR), Veterans Affairs Acquisition Regulation (VAAR) and Veterans Affairs Acquisition Manual clauses have been included in the solicitation for construction contracts when appropriate and taking contracting actions, including "stop work" orders, to remedy contracting situations when necessary.

(2) Ensuring the delegation of Contracting Officer Representatives (CORs) as requested by VA medical facility Directors.

k. **VA Medical Facility Director.** The VA medical facility Director is responsible for:

(1) Ensuring the establishment, resourcing and monitoring of the VA medical facility's construction safety and health program using a Construction Safety Committee (CSC) and appointing a member of the VA medical facility Executive Leadership Team (ELT) as the chair and the VA medical facility Safety Manager as co-chair. ***NOTE:*** *The VA medical facility CSC must be a multi-disciplinary team composed of representatives from the following program areas: Infection Prevention and Control, Patient Safety, SOH, Healthcare Engineering as well as Construction Safety Officers (CSOs). Contracting, Green Environmental Management System, VA Police, Emergency Planning, Safe Patient Handling and Mobility, Pharmacy, Sterile Processing, Employee Occupational Health; other program areas that may be affected by a construction project may be asked to participate on an ad hoc basis as deemed appropriate by the VA medical facility CSC chair. Local unions are notified of meetings and may choose to attend.*

(2) Ensuring that the VA medical facility CSC complies with this directive.

(3) Submitting a formal nomination to the CO for a COR to serve as the CSO based on recommendations from the VA medical facility CSC.

(4) Ensuring that VA medical facility personnel complete and document construction safety training in accordance with paragraph 4.

(5) Ensuring that other VHA personnel who need limited access to the construction area(s) complete a local safety orientation on the hazards and safety measures that may be encountered on the construction jobsite.

l. **VA Medical Facility Construction Safety Committee Chair.** ***NOTE:*** *The VA medical facility CSC chair is a member of the ELT and appointed by the VA medical facility Director.* The VA medical facility CSC chair is responsible for:

(1) Determining the scope and depth of safety, industrial hygiene, infection prevention and control, emergency management and security responsibilities as appropriate for all construction activities.

(2) Recommending a CSO to the VA medical facility Director for nomination as a COR to the CO. ***NOTE:*** *The nomination recommendation must give due consideration to OSH qualifications, experience on the project and the identified or potential hazards. The nomination recommendation must be documented within the VA medical facility CSC minutes with the COR nomination memorandum kept on file by the CO.*

(3) Ensuring that a VHA-PCRA is completed and documented in accordance with this directive (see paragraph 3) and VA-recognized health care accreditation standards. ***NOTE:*** *The VA medical facility CSC chair designates who will complete the VHA-PCRA (e.g., the CSO).*

(4) Coordinating with the VA medical facility CSO to ensure any VA or VHA programs and initiatives for preventing the spread of infectious diseases (e.g., tuberculosis screening or testing, influenza immunization, COVID-19 immunization) are considered in those circumstances where contracted construction personnel meet the definition of persons covered by each respective policy. ***NOTE:*** *Questions about covered persons can be directed to VHA OSH Office.*

(5) Ensuring that the CSC members participate in all phases of construction projects from planning through completion. ***NOTE:*** *This includes reviewing and making recommendations regarding construction plans, contract specifications, contract submittals related to construction safety and health and any other documents that may assist in the implementation of an effective construction safety and health program. The full membership of the VA medical facility CSC must be involved early in the process and continue to actively participate on a regular basis.*

(6) Ensuring that an Interim Life Safety Measures assessment is conducted and implementing life safety measures as necessary.

(7) Ensuring that the construction safety and health program includes periodic work site hazard surveillance activities with appropriate membership (minimally the CSO), scope and frequency (minimum weekly) for each construction project as determined by the CSO and the VHA-PCRA. Hazard surveillance activities must be documented and tracked to completion in the designated OSH reporting system. ***NOTE:*** *Documentation must include date, time and members of the inspection team, as well as deficiencies, type of corrective action, time and date of correction and monthly tabulation of the contractors' OSHA recordables and hours worked.*

(8) Ensuring that each construction area or site has a security plan in place to restrict access to unauthorized persons and that the plan is fully implemented.

(9) Ensuring that the VA medical facility CSC meets at least once per month; signing CSC minutes.

(10) Documenting and communicating VA medical facility-specific construction safety requirements and standards to appropriate VA medical facility personnel.

(11) Ensuring participation of SMEs in a final walk-through inspection and approval

of the site prior to opening of the area for use, patient care or provision of services as appropriate.

m. **VA Medical Facility Safety Manager.** The VA medical facility Safety Manager is responsible for providing construction safety consultations and serving as the co-chair of the VA medical facility CSC.

n. **VA Medical Facility Chief Healthcare Engineer.** The VA medical facility Chief Healthcare Engineer is responsible for:

(1) Ensuring that the Healthcare Engineering Program complies with the applicable requirements of this directive.

(2) Ensuring each VHA construction work crew performing non-contracted (in-house) construction work/activities managed by Healthcare Engineering has a leader (VHA Construction Lead Person (CLP)) with authority to take corrective measures if hazards are observed during their work operations.

(3) Ensuring the VHA CLP is designated as the OSHA-defined Competent Person (CP) in accordance with 29 C.F.R. § 1926.20(b)(2). Documentation of CP designation(s) is provided to the VA medical facility CSC.

(4) Ensuring VHA CLPs and VHA shop staff performing construction work receive training in the recognition and avoidance of unsafe conditions and the regulations applicable to their work environment to control or eliminate any hazards or other exposure to illness or injury.

(5) Completing and documenting training in accordance with paragraph 4.

(6) Serving on the VA medical facility CSC, provide counsel on construction and engineering questions and issues.

o. **VA Medical Facility Construction Safety Officer.** The VA medical facility CSO is responsible for:

(1) Serving on the VA medical facility CSC.

(2) Advising the CO, in accordance with FAR Clause 36.513, Accident Prevention, subparagraph (b), to include FAR Clause 52.236-13, Accident Prevention, in all solicitations and construction contracts as special precautions are appropriate due to the hazardous nature of construction work and potential to disrupt VA medical facility operations and cause harm.

(3) Advising the CO as to whether subparagraph (f) of the Clause 52.236-13 which requires development of a written Accident Prevention Plan (APP) and Activity Hazard Analyses (AHAs), must be included in a solicitation and construction contract. ***NOTE:*** *Typically, all construction work is considered work of long(er) duration, hazardous nature or involves hazardous materials or operations that might endanger the safety of*

the public and government personnel or property. Only short duration, smaller scale and lower complexity construction projects should be considered for not including subparagraph (f).

(4) Editing the VA Master Construction Specifications, Division 1 - General Requirements, Section 01 35 26, to make it specific for the associated construction project and provide to the CO for inclusion in each construction solicitation and contract.

(5) Reviewing project safety-related submittals for all assigned construction projects, specifically including the contractor project APP and AHAs.

(6) Providing oversight of construction safety. The CSO must be knowledgeable in the general inspection of typical worksites during construction activities performed by contract staff and in the review of contractor construction safety and health program submittals. ***NOTE:*** *CSOs do not take the place of the contractor's CP or act on their behalf.*

(7) Conducting hazard surveillance activities weekly at a minimum to identify deficiencies in the construction contractor's implementation of contract safety requirements and tracking the abatement of those deficiencies to completion.

(8) Ensuring that high-hazard risks on construction sites have a focused attention during hazard surveillance activities for compliance contract safety requirements. The list of high-hazard risks can be found at http://vaww.hefp.va.gov/occupational-safety-health/high-hazards-items-construction-sites. ***NOTE:*** *This is an internal VA website that is not available to the public.*

(9) Collecting information related to contractor injury, illness and hours worked on a monthly basis and review the data for trends identifying non-compliance with contract safety requirements.

(10) Reporting risks, deficiencies, trends and improvements for each construction project to the VA medical facility CSC during at least monthly meetings.

(11) Communicating to the contractor, COR for overall construction contract administration and CO any identified non-compliance with OSHA regulations, VA contract safety specifications or any condition which poses a serious or imminent danger with a verbal warning and a request for immediate corrective action and following up with written confirmation (email or letter of concern) provided to the contractor of the deficiencies identified. ***NOTE:*** *Corrective action includes stopping or removal of personnel from exposure to the hazardous activity but continuing work operations with abatement of the hazardous activity. A formal "stop work" order can only be provided by the CO. No one else has the authority to make any commitments or changes that affect price, quality, quantity, delivery or other terms and conditions of the contract nor in any way to direct the contractor or its subcontractors to operate in conflict with the contract terms and conditions.*

(12) Advising the CO of repeated offenses of the same or substantially similar hazards and instances in which the contractor has failed to take the necessary corrective action to abate the safety non-compliance and requesting that either all or part of the work be stopped.

(13) Ensuring compliance, via documentation of certification from the contractor, with VA or VHA programs or initiatives for preventing the spread of infectious diseases (e.g., tuberculosis screening/testing, influenza immunization, COVID-19 immunization) in those circumstances where contracted construction personnel meet the definition of persons covered by each respective VHA policy. ***NOTE:*** *Questions about covered persons can be directed to the VHA OSH Office.*

p. **VHA Construction Lead Person.**. The VHA CLP is assigned to manage construction safety on non-contracted (in-house) construction work activities managed by the VA medical facility Healthcare Engineering Program and is responsible for:

(1) Acting as the VA medical facility OSHA-defined CP on assigned healthcare engineering in-house projects.

(2) Being knowledgeable of the hazards that may be encountered during their construction work operations and completing relevant formal training (e.g., scaffold safety training if using scaffolds).

(3) Conducting daily safety inspections on all active construction worksites, when construction-related work is being performed, to identify existing and predictable hazards in the surroundings and working conditions which are unsanitary, hazardous or dangerous to VHA construction staff and taking prompt corrective measures to eliminate identified hazards.

3. PRE-CONSTRUCTION RISK ASSESSMENTS

a. The VHA-PCRA form must be used to assess and document all construction-associated hazards that affect VA medical facilities, their occupants, services and mission-essential functions and capabilities. VHA-PCRAs are intended to eliminate or minimize construction-associated risks.

(1) At least one VHA-PCRA must be completed for each construction project or activity. Project or construction activity scope and complexity determine the need for multiple VHA-PCRAs. Determinants include, but are not limited to duration, number and size of areas or locations, work phases, types and number of individuals (e.g., patients, residents, staff, public), changes in means and methods and changes in mitigation strategies.

(2) Initial VHA-PCRAs must be completed and included in construction contract solicitations to assure bidder awareness of VA assessed risks and required mitigation(s) that may impact contractor work activities (e.g. means and methods, labor, scheduling, safety precautions, safety training of workers, pricing).

(3) VHA-PCRAs must be re-validated and updated as needed based on but not limited to changes from original designs, affected individuals, area(s)/location(s), scope, contractor means and methods, safety requirements, phasing, contractor competencies and capabilities.

(4) The VHA-PCRA form, use instructions and other guidance are available at: http://vaww.hefp.va.gov/resources/vha-pre-construction-risk-assessment-pcra. ***NOTE:*** *This is an internal VA website that is not available to the public.*

(5) VHA-PCRA includes an initial general assessment of potential risks of transmission of infectious disease(s) related to all construction activity in addition to the primary review of construction safety and associated impacts.

(a) This initial assessment of transmission risks of airborne, surface contact and waterborne or water-related infectious diseases conducted within the VHA-PCRA must be performed with input from a member of the VA medical facility Infection Prevention and Control staff and with the VA medical facility Water Safety Committee, as needed. See VHA Directive 1061(1), Prevention of Health Care-Associated Legionella Disease and Scald Injury from Water Systems, dated February 16, 2021.

1. The assessment is to determine if any infection control measures may be required in addition to those already implemented in the VHA-PCRA to prevent or reduce exposure to infectious agents to VA medical facility occupants.

2. An assessment of the risks of the construction or renovation activity on exposure to infectious diseases must not be limited to the exposure potential during the activity but also include assessment of exposure potential and necessary mitigations after completion or substantial completion prior to occupancy or use.

(b) For those construction activities where the initial infection control review within the VHA-PCRA identifies potential risks of infectious disease transmission affecting the care, treatment or services of patients or residents, a detailed analysis must be conducted using the VHA-ICRA form to document an in-depth infection risk assessment(s) and identification of mitigation actions/activities. The VHA-ICRA form, use instructions and other guidance are available at: http://vaww.hefp.va.gov/resources/vha-infection-control-risk-assessment-icra. ***NOTE:*** *This is an internal VA website that is not available to the public.*

1. VHA-ICRAs that have been completed must be included with VHA-PCRAs in construction contract solicitations to assure bidder awareness of VA-assessed risks and required mitigation(s) that may impact contractor work activities such as means and methods, labor, scheduling, safety precautions, special training of workers and pricing.

2. VHA-ICRAs must be re-validated and updated as needed based on changes in original designs, affected individuals, area(s) or location(s), scope, contractor means and methods, infection prevention and control requirements, differing site conditions, phasing, contractor competencies and capabilities, disease outbreaks.

3. Additional infection prevention and control guidance and resources related to construction safety can be found at: http://vaww.va.gov/InfectiousDiseases/IPC.asp. ***NOTE:*** *This is an internal VA website that is not available to the public.*

4. TRAINING

a. The following training is ***required*** for VA medical facility Chief Healthcare Engineers, VHA CLPs, all VISN SOH Managers that have responsibilities related to construction, CSOs, Project Engineers and VA medical facility Safety Program Managers:

(1) Talent Management System (TMS) VHA-PROG-150 or the OSHA 30-hour Construction Safety training course. ***NOTE:*** *The VA TMS PCRA training (VA # 42431) is added if the OSHA 30-hour course is used.*

(2) Minimum of 10 hours of construction safety-related training every 2 years.

b. The following training is ***required*** for VHA Infection Prevention and Control staff: VA TMS PCRA training (VA # 42431).

c. VHA CLPs and VHA shop staff performing construction work must complete training in the recognition and avoidance of unsafe conditions and the regulations applicable to their work environment to control or eliminate any hazards or other exposure to illness or injury in accordance with 29 C.F.R. § 1926.21(b)(2). This training is not standardized, varies based upon potential hazards in their work environment and can be found through such sources as: VA TMS, OSHA Training Education Centers, private sector trainers and locally by trainers with the requisite construction occupational safety and health knowledge.

5. RECORDS MANAGEMENT

All records regardless of format (e.g., paper, electronic, electronic systems) created by this directive must be managed as required by the National Archives and Records Administration (NARA) approved records schedules found in VHA Records Control Schedule 10-1. Questions regarding any aspect of records management should be addressed to the appropriate Records Officer.

6. BACKGROUND

a. OSHA amended 29 C.F.R. part 1960 to implement its Multi-Employer Worksite Policy (OSHA Directive CPL 2-0.124) in the Federal sector. As a result, controlling employers such as VHA are required to provide “reasonable care,” which OSHA explains as having the following components:

(1) Periodic inspections of appropriate frequency;

(2) Implementation of an effective system for promptly correcting hazards; and

(3) Enforcement of the other employer's compliance with safety and health requirements, with an effective, graduated system of enforcement and follow-up inspections.

b. FAR, 48 C.F.R. §§ 9.104-1(f) and 52.236-13; VAAR, 48 C.F.R. § 852.223-71(a) and (b)(1); OSHA, 29 C.F.R. part 1926; The Joint Commission accreditation standards; National Fire Protection Association standards; and VA Fire Protection Design Manual identify requirements for safe construction practices.

c. The implementation of a proactive and comprehensive construction safety and health program reduces the potential for injury and illness from unsafe and unhealthy construction activities and liability.

7. DEFINITIONS

a. **Competent Person.** For purposes of this directive, a CP is an individual who is capable of identifying existing and predictable hazards in the surroundings and working conditions which are unsanitary, hazardous or dangerous to employees and who has the authorization to take prompt corrective measures to eliminate them (see 29 C.F.R. § 1926.32(f)).

b. **Construction Work.** For purposes of this directive, construction work is the process of building, altering, repairing, remodeling, improving or demolishing an infrastructure facility, including any structure, building or other improvements of any kind to real property. It does not include the routine operation, routine repair or routine maintenance of an existing infrastructure facility, including structures, buildings or real property.

c. **VHA-Infection Control Risk Assessment.** A VHA-ICRA is a systematic process, conducted as part of the VHA-PCRA, that determines the level of potential infection risks to patients or residents due to the physical environment throughout the construction and commissioning process and defines controls to reduce these infection-related risks.

d. **VHA-Pre-Construction Risk Assessment.** A VHA-PCRA is a formal assessment protocol required to identify potential safety risks in the health care facility environment and create mitigation strategies to prevent, reduce or eliminate them prior to the initiation of any construction-related activities. The assessment includes an assessment of potential risks to occupants for air quality, infection prevention and control, utility requirements, noise, vibration and any other hazards applicable to the work. The VHA-PCRA may also include a detailed VHA-ICRA to assess infection-related risks to patients and residents.

8. REFERENCES

a. 29 C.F.R. §§ 1910.12, 1926.20, 1926.21 and 1926.32.

b. FAR, 48 C.F.R. subparts 9.1, 36 and 52.

c. VAAR, 48 C.F.R. part 852.

d. VHA Directive 1061(1), Prevention of Health Care-Associated Legionella Disease and Scald Injury from Water Systems, dated February 16, 2021.

e. VHA Directive 7701, Comprehensive Occupational Safety and Health Program, dated December 12, 2022.

f. VHA Construction Safety Guidebook. http://vaww.hefp.va.gov/guidebooks/construction-safety-guidebook. ***NOTE:*** *This is an internal VA website that is not available to the public.*

g. VHA-PCRA Guidance. http://vaww.hefp.va.gov/resources/vha-pre-construction-risk-assessment-pcra. ***NOTE:*** *This is an internal VA website that is not available to the public.*

h. VHA-ICRA Guidance. http://vaww.hefp.va.gov/resources/vha-infection-control-risk-assessment-icra. ***NOTE:*** *This is an internal VA website that is not available to the public.*

i. Infection Prevention and Control Resources. http://vaww.va.gov/InfectiousDiseases/IPC.asp. ***NOTE:*** *This is an internal VA website that is not available to the public.*

j. VHA High Hazard Items on Construction Sites. http://vaww.hefp.va.gov/occupational-safety-health/high-hazards-items-construction-sites. ***NOTE:*** *This is an internal VA website that is not available to the public.*

k. VA Master Construction Specifications, Division 1, General Requirements, Section 01 35 26 - Safety Requirements. https://www.cfm.va.gov/til/spec.asp#01.

l. OSHA Directive CPL 2-0.124, Multi-Employer Citation Policy. https://www.osha.gov/enforcement/directives/cpl-02-00-124.

m. The Joint Commission Comprehensive Accreditation and Certification Manual. http://vaww.hefp.va.gov/resources/joint-commission-tjc. ***NOTE:*** *This is an internal VA website that is not available to the public.*

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Notice of Identification Card Process and Required Contractor Documentation

Project 620-20-105 Renovate 14AB for Homeless Program Phase 1

Procurement Instrument Identifier (PIID) [enter assigned eCMS number]

After award of the contract but prior to commencing work, each contract employee, including any subcontract employees, must work with their Program Office Representative/Program Manager identified in the contract to complete the following within five (5) business days of receiving these instructions.

STEP 1. The contractor point of contact (POC) shall submit completed Contractor Request Form, OF-306, and Self-Certification for each contractor employee listed on the contract to the Program Office representative/Program Manager. Please note, due to the personal information contained in the form, the information must be sent in a secure manner. Please do NOT e-mail a document containing social security numbers unless the e-mail is encrypted or the form is password protected.

STEP 2. Each contractor employee listed on the Contractor Request Form must take the Fingerprinting Request Form and two forms of ID to their nearest VA facility to have their fingerprints submitted and the form completed and submitted in accordance with the instructions on the form. **It is imperative for each applicant to take a copy of the Fingerprinting Request Form to the fingerprinting facility as it determines which facility is billed for the fingerprint submission and where the results are sent**. Contractors can contact the local Program Office Representative/Program Manager for assistance in scheduling an appointment.

WMC HROO PerSec Contractor Team VHAWMCPerSecContractor@va.gov screens all documents as well as the fingerprint results and provides the points of contact with a favorable or unfavorable screening decision for each contractor using the National Criminal History Check (NCHC) form.

Please Note: As contract personnel are substituted and/or added to the contract each individual must complete required documentation and receive a favorable screening decision prior to commencing work.

Effective Date: 03/14/2025
Revision: 04

Department of Veterans Affairs
VHA 106A WMC HROO PerSec Contractor Team

CONTRACTOR REQUEST

(Email to: **VHAWMCPerSecContractor@va.gov**)(Make sure to encrypt only or password protect)

CONTRACT INFORMATION

VA Contracting Officer Name & Email: _____

COR Name & Email: _____

Contract End Date (**Including Options**): _____

VISN & Station#: _____

Purchase/Task Order or Contract Number: _____

Contractor Position Description: _____

Investigation Level (SAC/Tier 1/Tier 2/Tier 4): Select One ...

Contract Company Name (Subcontractor): _____

Contract Company Address: _____

Contractor POC Name & Phone: _____

Contractor POC Email: _____

Contracting Officer/COR Signature:

*****This signature verifies that an official contract is in place prior to processing the applicants for badging*****

Contractor Personal Identifiable Information

SSN

Last Name

First Name

Middle Name

Date of Birth

Marital Status Select One...

Gender Select One

City of Birth

State of Birth

Country of Birth

Country of Citizenship

Dual Citizenship

Permanent Resident

Foreign National

lived in US for 3 consecutive years YES NO

Email Address

Additional Notes

Department of Veterans Affairs
VHA 106A WMC HROO PerSec Contractor Team
VHAWMCPerSecContractor@va.gov

VHA 106A WMC HROO PerSec Contractor Team SERVICES OVERVIEW

The VHA 106A WMC HROO PerSec Contractor Team offers comprehensive services which ensures that contractor security requirements are met in accordance with OPM and federal regulations from initiation to completion.

Communication is maintained between the team POC, the contracting officer, the contracting officer representative (COR) and the Contracting company point-of-contact at all times during the process. Due to PII concerns, personnel not listed on the Contractor Request Form will be sent statuses from the Team POC. If another entity requires this information, they must work through the CO, COR or Company POC. This service provided includes the below:

- Fingerprint adjudication:
  - This involves a thorough background screening and adjudication of fingerprint along with any self- declared information. The National Criminal History Check (NCHC) Form will be sent to all contacts via email once the investigation is scheduled with the Defense Counterintelligence and Security Agency (DCSA).

- Existing investigations:
  - Verifying existing investigation information and collecting the required documents for reciprocity. The required documentation would include the OF306 Form and Self-Certification Form. These documents would be provided upon confirmation of investigation through DCSA's Portal.
- New investigations:
  - Upon receipt of the Contract Security Services Request Packet and all required documents our office will enter required applicants into the eApp system, review, return or release, and monitor the investigation progress through completion.
- PIV Badges:
  - Our office can only adjudicate PIV badges at this time. The COR on the contract or local personnel must sponsor the contractor/s in the PIV portal prior to adjudication by this office.

To begin the process, please follow the below guidelines:

1. Upon notification of contract award, COR/local sponsor must ensure to pre-sponsor applicant fin USAccess for fingerprints. Applicant must take 2 forms of ID to their print appointment.
2. Contracting officers / CORs complete and digitally sign the Contractor Request Form in its **entirety**. All information is required. The packet will be rejected if this form is not complete or does not contain the CO/COR signature.
3. Have employees complete all required documentation based on their risk level.
4. Submit complete packet to VHAWMCPerSecContractor@va.gov encrypted. Incomplete packets will be rejected and returned. Complete packets will be assigned to a team member within 5 to 10 business days dependent on workload. Subject line for the request submission email should be formatted as shown below.
   a. **New Request Packet** - Contracted Company 36C00000D0000 / 999-C202222
   b. **Status Request** – Contracted Company 36C00000D0000 / 999-C20222 submitted on 00/00/0000

5. Do not submit new requests and additions more than once as this will result in duplicate assignments and wasted time. If you have not received a response to your request within 5-10 business days, send a status request to the mailbox using the above format.
6. If there is a change in the contracted personnel (resignation, declined appointment, etc.) immediately notify the team member handling your request. The cancellation must be submitted via email.
7. Send any additions to our team member that is assigned the contract. We cc the sender of this packet on that assignment so that you can work directly with that team member on all associated actions to include re-issuances, turnover, questions, concerns, statuses, etc. If the packet is already assigned and was not forwarded to the assigned member, we will reject that packet. This is so that we can assign the new contracts as fast as possible for you.

Department of Veterans Affairs
VHA 106A WMC HROO PerSecContractor Team

CONTRACT SECURITY SERVICES REQUEST - INSTRUCTIONS

Purpose: The Contract Security Services Request is submitted to VHA 106A WMC HROO PerSecContractor Team to initiate the contract security verification process. By submitting this form, our office will ensure that everyone listed have been fingerprinted, the fingerprints are adjudicated, if necessary, background investigations are initiated or existing background investigations are current and PIV badges are adjudicated. This form should be completed and signed by the contracting officer. Please refer to the instructions below when completing the Contract Security Services Request Form #1.

Contract Information Section

Contracting Officer Name & Email: Please provide the post-award contracting officer handling this contract and their email.

COR Name & Email: Please list the Contracting Officer Representative (previously the Contracting Officer Technical Representative) and email. The COR is the liaison between the contracting officer and contracted company.

Contract End Date: Please list the date in which the contract ends including all options to extend (for PIV badge expiration).

VISN & Station Number: Please indicate the VISN and facility station number where the work is being performed/facility to be billed.

Purchase Order, Task Order and Contract Numbers: Please list the purchase order number, task order and the contract numbers. Our database is based on tracking contracts by station. Should the task order number change at fiscal year-end, please indicate on any future requests by including any/all related numbers in parenthesis next to the new numbers.

Contractor Position Description: Please provide a position title for all individuals (ex: physician, consultant, electrician).

Investigation Level: Please indicate the background security requirements as provided by the PDT (Position Designation Tool) https://pdt.nbis.mil This would include background screening or Fingerprint Only (SAC), low-level investigation (Tier 1), moderate-level investigation (Tier 2) and high-level investigation (Tier 4). Please note that PIV-I badges (contract under 180-days) require at minimum a SAC, full PIV badges (over 180-days) require a minimum a T1. If it is Tier 2 or 4, please provide a copy of the PDT to justify a higher-level investigation.

Contract Company Name: Please provide the name of the contracting company that will be providing the work under the task order. Please provide subcontractors in parenthesis.

Contractor Address: Please provide the contracting company address.

Contractor POC Name & Phone: Please provide the main point-of-contact for the contracting company and contact information.This person may be contacted to provide additional information or documents in the process. All communication with this individual will include the contracting officer and COR.

Contractor POC Email: Please provide the email address for the company point-of-contact. This email will be included in all correspondence regarding investigation and PIV processing.

Contracting Officer Signature: All contracts must be signed by the contract officer or the contracting officer representative (COR). This signature verifies that an official contract is in place prior to processing the applicants for investigation and badging.

Contractor Employee Information Section

All information must be completed in the Contractor Personal Identifiable Information Section

N O T E : For foreign-born individuals, Please Check if you are a permanent resident or foreign national.

For investigations to be conducted and eligiblity for a PIV credential, individuals must have lived in the United States for 3 consecutive years.

All background investigation request forms and supporting documents must be .pdf files and the below naming convention used:

Station #_last name last four of SSN_form name
Example:
573_Jones1234_REQ
573_Jones1234_306
573_jones1234_SC

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DEPARTMENT OF VETERANS AFFAIRS

PERSONNEL SECURITY ADJUDICATION CENTER

Self Certification of Continuous Service

I hereby certify my break in service from my last federal employment is indicated by the block checked below.

Federal employment is defined as any branch of the United States military (Active, Guard or Reserve), federal government civilian employee (any federal government agency), or a contractor working for the federal government.

(Check One)

- ☐ I have NOT had a break in service.
- ☐ My break in service was less than 60 days.
- ☐ My break in service was greater than 60 days, but less than two (2) years. (You are required to submit the OF 306, Declaration for Federal Employment, with this form.)
- ☐ My break in service is greater than two (2) years; or I have never had federal employment as defined above.

Print Name: _____ Social Security Number: _____

Signature: _____ Date: _____

VA Personnel Security/HR Use Only:

Current Investigation in PIPS: _____ Date: _____

Risk level of current position: _____ Verified by: _____

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Declaration for Federal Employment*

(*This form may also be used to assess fitness for federal contract employment)

Form Approved:
OMB No. 3206-0182

Instructions

The information collected on this form is used to determine your acceptability for Federal and Federal contract employment and your enrollment status in the Government's Life Insurance program. Most applicants are asked to complete this form after a tentative offer of employment has been made; however, depending on your position, you may be asked to complete this form earlier during the hiring process. Follow instructions that the agency provides. Before you are appointed you will be asked to update your responses on this form and on other materials submitted during the application process and then to recertify that your answers are true.

All your answers must be truthful and complete. **A false statement on any part of this declaration or attached forms or sheets may be grounds for not hiring you, or for firing you after you begin work. Also, you may be punished by a fine or imprisonment (U.S. Code, title 18, section 1001).**

Either type your responses on this form or print clearly in dark ink. If you need additional space, attach letter-size sheets (8.5" X 11"). Include your name, Social Security Number, and item number on each sheet. We recommend that you keep a photocopy of your completed form for your records.

Privacy Act Statement

The Office of Personnel Management is authorized to request this information under sections 1302, 3301, 3304, 3328, and 8716 of title 5, U. S. Code. Section 1104 of title 5 allows the Office of Personnel Management to delegate personnel management functions to other Federal agencies. If necessary, and usually in conjunction with another form or forms, this form may be used in conducting an investigation to determine your suitability or your ability to hold a security clearance, and it may be disclosed to authorized officials making similar, subsequent determinations.

Your Social Security Number (SSN) is needed to keep our records accurate, because other people may have the same name and birth date. Public Law 104-134 (April 26, 1996) asks Federal agencies to use this number to help identify individuals in agency records. Giving us your SSN or any other information is voluntary. However, if you do not give us your SSN or any other information requested, we cannot process your application. Incomplete addresses and ZIP Codes may also slow processing.

ROUTINE USES: Any disclosure of this record or information in this record is in accordance with routine uses found in System Notice OPM/GOVT-1, General Personnel Records. This system allows disclosure of information to: training facilities; organizations deciding claims for retirement, insurance, unemployment, or health benefits; officials in litigation or administrative proceedings where the Government is a party; law enforcement agencies concerning a violation of law or regulation; Federal agencies for statistical reports and studies; officials of labor organizations recognized by law in connection with representation of employees; Federal agencies or other sources requesting information for Federal agencies in connection with hiring or retaining, security clearance, security or suitability investigations, classifying jobs, contracting, or issuing licenses, grants, or other benefits; public and private organizations, including news media, which grant or publicize employee recognitions and awards; the Merit Systems Protection Board, the Office of Special Counsel, the Equal Employment Opportunity Commission, the Federal Labor Relations Authority, the National Archives and Records Administration, and Congressional offices in connection with their official functions; prospective non-Federal employers concerning tenure of employment, civil service status, length of service, and the date and nature of action for separation as shown on the SF 50 (or authorized exception) of a specifically identified individual; requesting organizations or individuals concerning the home address and other relevant information on those who might have contracted an illness or been exposed to a health hazard; authorized Federal and non-Federal agencies for use in computer matching; spouses or dependent children asking whether the employee has changed from a self-and-family to a self-only health benefits enrollment; individuals working on a contract, service, grant, cooperative agreement, or job for the Federal government; non-agency members of an agency's performance or other panel; and agency-appointed representatives of employees concerning information issued to the employees about fitness-for-duty or agency-filed disability retirement procedures.

Public Burden Statement

Public burden reporting for this collection of information is estimated to vary from 5 to 30 minutes with an average of 15 minutes per response, including time for reviewing instructions, searching existing data sources, gathering the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of the collection of information, including suggestions for reducing this burden, to the U.S. Office of Personnel Management, Reports and Forms Manager (3206-0182), Washington, DC 20415-7900. The OMB number, 3206-0182, is valid. OPM may not collect this information, and you are not required to respond, unless this number is displayed.

Declaration for Federal Employment*

Form Approved:
OMB No. 3206-0182

(*This form may also be used to assess fitness for federal contract employment)

General Information

1. FULL NAME (Provide your full name. If you have only initials in your name, provide them and indicate "Initial only". If you do not have a middle name, indicate "No Middle Name". If you are a "Jr.," "Sr.," etc. enter this under Suffix. First, Middle, Last, Suffix)

♦

2. SOCIAL SECURITY NUMBER

♦

3a. PLACE OF BIRTH (Include city and state or country)

♦

3b. ARE YOU A U.S. CITIZEN?

☐ YES ☐ NO (If "NO", provide country of citizenship) ♦

4. DATE OF BIRTH (MM / DD / YYYY)

♦

5. OTHER NAMES EVER USED (For example, maiden name, nickname, etc.)

♦

♦

6. PHONE NUMBERS (Include area codes)

Day ♦

Night ♦

Selective Service Registration

If you are a male born after December 31, 1959, and are at least 18 years of age, civil service employment law (5 U.S.C. 3328) requires that you must register with the Selective Service System, unless you meet certain exemptions.

7a. Were you born a male after December 31, 1959? ☐ YES ☐ NO (If "NO", proceed to 8.)

7b. Have you registered with the Selective Service System? ☐ YES (If "YES", proceed to 8.) ☐ NO (If "NO", proceed to 7c.)

7c. If "NO," describe your reason(s) in item 16.

Military Service

8. Have you ever served in the United States military? ☐ YES (If "YES", provide information below) ☐ NO

If your only active duty was training in the Reserves or National Guard, answer "NO."

If you answered "YES," list the branch, dates, and type of discharge for all active duty.

Branch	From (MM/DD/YYYY)	To (MM/DD/YYYY)	Type of Discharge

Background Information

For all questions, provide all additional requested information under item 16 or on attached sheets. The circumstances of each event you list will be considered. However, in most cases you can still be considered for Federal jobs.

For questions 9,10, and 11, your answers should include convictions resulting from a plea of *nolo contendere* (no contest), but omit (1) traffic fines of $300 or less, (2) any violation of law committed before your 16th birthday, (3) any violation of law committed before your 18th birthday if finally decided in juvenile court or under a Youth Offender law, (4) any conviction set aside under the Federal Youth Corrections Act or similar state law, and (5) any conviction for which the record was expunged under Federal or state law **.**

9. During the last 7 years, have you been convicted, been imprisoned, been on probation, or been on parole? (Includes felonies, firearms or explosives violations, misdemeanors, and all other offenses.) *If "YES," use item 16 to provide the date, explanation of the violation, place of occurrence, and the name and address of the police department or court involved.* ☐ YES ☐ NO

10. Have you been convicted by a military court-martial in the past 7 years? *(If no military service, answer "NO.") If "YES," use item 16 to provide the date, explanation of the violation, place of occurrence, and the name and address of the military authority or court involved.* ☐ YES ☐ NO

11. Are you currently under charges for any violation of law? *If "YES," use item 16 to provide the date, explanation of the charges, place of occurrence, and the name and address of the police department or court involved.* ☐ YES ☐ NO

12. During the last 5 years, have you been fired from any job for any reason, did you quit after being told that you would be fired, did you leave any job by mutual agreement because of specific problems, or were you debarred from Federal employment by the Office of Personnel Management or any other Federal agency? *If "YES," use item 16 to provide the date, an explanation of the problem, reason for leaving, and the employer's name and address.* ☐ YES ☐ NO

13. Are you delinquent on any Federal debt? (Includes delinquencies arising from Federal taxes, loans, overpayment of benefits, and other debts to the U.S. Government, plus defaults of Federally guaranteed or insured loans such as student and home mortgage loans.) *If "YES," use item 16 to provide the type, length, and amount of the delinquency or default, and steps that you are taking to correct the error or repay the debt.* ☐ YES ☐ NO

Declaration for Federal Employment*

Form Approved:
OMB No. 3206-0182

(*This form may also be used to assess fitness for federal contract employment)

Additional Questions

14. Do any of your relatives work for the agency or government organization to which you are submitting this form? (Include: father, mother, husband, wife, son, daughter, brother, sister, uncle, aunt, first cousin, nephew, niece, father-in-law, mother-in-law, son-in-law, daughter-in-law, brother-in-law, sister-in-law, stepfather, stepmother, stepson, stepdaughter, stepbrother, stepsister, half-brother, and half-sister.) *If "YES," use item 16 to provide the relative's name, relationship, and the department, agency, or branch of the Armed Forces for which your relativeworks.* ☐ YES ☐ NO

15. Do you receive, or have you ever applied for, retirement pay, pension, or other retired pay based on military, Federal civilian, or District of Columbia Government service? ☐ YES ☐ NO

Continuation Space / Agency Optional Questions

16. Provide details requested in items 7 through 15 and 18c in the space below or on attached sheets. Be sure to identify attached sheets with your name, Social Security Number, and item number, and to include ZIP Codes in all addresses. If any questions are printed below, please answer as instructed *(these questions are specific to your position and your agency is authorized to ask them).*

Certifications / Additional Questions

APPLICANT: If you are applying for a position and received a tentative/conditional job offer or have not yet been selected, carefully review your answers on this form and any attached sheets.

APPOINTEE: If you are being appointed, carefully review your answers on this form and any attached sheets, including any other application materials that your agency has attached to this form. If any information requires correction to be accurate as of the date you are signing, make changes on this form or the attachments and/or provide updated information on additional sheets, initialing and dating all changes and additions. When this form and all attached materials are accurate, read item 17, complete 17b, read 18, and answer 18a, 18b, and 18c as appropriate.

17. **I certify** that, to the best of my knowledge and belief, all of the information on and attached to this Declaration for Federal Employment, including any attached application materials, is true, correct, complete, and made in good faith. **I understand that a false or fraudulent answer to any question or item on any part of this declaration or its attachments may be grounds for not hiring me, or for firing me after I begin work, and may be punishable by fine or imprisonment. I understand** that any information I give may be investigated for purposes of determining eligibility for Federal employment as allowed by law or Presidential order. **I consent** to the release of information about my ability and fitness for Federal employment by employers, schools, law enforcement agencies, and other individuals and organizations to investigators, personnel specialists, and other authorized employees or representatives of the Federal Government. **I understand** that for financial or lending institutions, medical institutions, hospitals, health care professionals, and some other sources of information, a separate specific release may be needed, and I may be contacted for such a release at a later date.

17a. Applicant's Signature:_____ Date: _____ (MM / DD / YYYY)

17b. Appointee's Signature:_____ Date: _____ (MM / DD / YYYY)

Appointing Officer:
Enter Date of Appointment or Conversion
MM / DD / YYYY

18. **Appointee (Only respond if you have been employed by the Federal Government before):** Your elections of life insurance during previous Federal employment may affect your eligibility for life insurance during your new appointment. These questions are asked to help your personnel office make a correct determination.

18a. When did you leave your last Federal job? Date: (MM / DD / YYYY)

18b. When you worked for the Federal Government the last time, did you waive Basic Life Insurance or any type of optional life insurance? ☐ YES ☐ NO ☐ DO NOT KNOW

18c. If you answered "YES" to item 18b, did you later cancel the waiver(s)? If your answer to item 18c is "NO," use item 16 to identify the type(s) of insurance for which waivers were not canceled. ☐ YES ☐ NO ☐ DO NOT KNOW

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FINGERPRINT REQUEST FORM

Bring with you two (2) original IDs (Identity Source Documents) from the list below
https://www.oit.va.gov/programs/piv/_media/docs/IDMatrix.pdf
Complete all fields on this form to the best of your ability

Applicant Category: Check One

☐	**EMPLOYEE**	☐	**CONTRACTOR**	☐	**HEALTH PROFESSONS TRAINEE (VHA intern, resident, fellow, student)**
☐	**AFFILIATE**	☐	**VOLUNTEER**	☐	**OTHER:**

ENTER YOUR NAME EXACTLY AS IT APPEARS ON IDs

Name: (Last, First, Middle)		Other Last Names Used
SSN (use of pseudo number is not permitted)	Position Title	Telephone #
Date of Birth: (mm/dd/yyyy)	City/State and Country of Birth	
E-Mail Address (long-term, sustained E-Mail)	Country of Citizenship	Dual Citizen? (Yes/No)
VA Work Location	POC/COTR/Sponsor/Supervisor	POC Phone #
Contractors Only: Company Name	Company Address	Contract End Date
Health Professions Trainees Only: School/Affiliate Name	Training Program	Program End Date

FINGERPRINT LOCATION		FINGERPRINT DATE (mm/dd/yyyy)		PREVIOUS PIV CARD HOLDER (Yes/No)	
GENDER (M/F)	HEIGHT (inches)	WEIGHT (US pounds)	HAIR COLOR	EYE COLOR	RACE/ETHNICITY

Courtesy Prints for another Facility

Facility Name/Location:	**Facility SOI#**	**Facility SON#**

Personnel Security Specialist USE ONLY

Date Cleared	**Signature**
Comments	

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SECTION 01 32 00
CONSTRUCTION DOCUMENTATION

PART 1 - GENERAL

1.1 DESCRIPTION:

A. Construction contractors and A/E design firms, selected by award to perform work at VISN 2 VA facilities, are required to utilize VISN 2 Autodesk Build Construction management platform, also called Autodesk Construction Cloud (ACC). Access to the platform and training portal will be provided by VISN 2 through project Contracting Officer Representative (COR) at no cost for the duration of the project. Autodesk Build is the management and collaborative environment that VISN 2 uses for all its Non-Recurring Maintenance (NRM), Minor Program projects, Feasibility Studies, Commissioning and Retro-Commissioning contracts. There is no user, license, or subscription fee to the contractor for using this cloud-based platform.

1.2 REQUIREMENTS:

A. Contractor shall accomplish and complete the following tasks upon award of contract:
   1. Request access to ACC platform and ProductivityNOW eLearning Site to project VA COR NLT 14 days from contract award.
   2. Only staff that shall utilize the platform to be granted access. Examples: Project manager, sub-contractors POC, Site manager, Safety officer, etc.
   3. The access request shall be in writing and include a list of staff. The list shall include the following information:
      a. Full Name
      b. Company Name
      c. Email Address
      d. Role/Position on the project (i.e., Project manager, site super)
   4. Upon granting access, staff shall complete required ACC training through ProductivityNOW platform within 12 Calendar days.
   5. Upon successful completion of training, contractor shall submit certificates of completion to COR NLT 2 Business days.

B. Access to ProductivityNOW eLearning will expire after 12 Calendar days after online access is granted. Contractor shall complete ACC training within that period.

C. Additional Staff and Subcontractors can be added at any time with a request submission to the project COR as described above.

D. The contractor shall only use the ACC platform for all contract required submissions, official project correspondence to be acknowledged, reviewed, and actioned by the responsible party. No additional time shall be added to the contract, nor an increase in contract amount be provided for the contractor's failure to utilize the ACC platform as the project's official communication and collaboration system. Any correspondence out of platform shall not be the governing authority contradicting direction and will be at the contractor's expense. Official project correspondence and collaboration includes but not limited to: RFIs, submittals, schedules, shutdown requests, actionable tasks, reports, testing, safety inspections, photos, and site surveys.

E. Contractor must inform the COR of any staff changes NLT 2 business days from the change. Staff changes pertains to staff who was granted access to the ACC platform. Contractor shall request termination of access, replacement of personnel and/or any other action that might impact the contractor ability to maintain required utilization of the platform.

F. Contractor submission requirements cannot be accepted for work to begin without meeting all ACC Platform requirements outlined herein, including completing required ACC platform training.

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SECTION 01 32 16.13

NETWORK ANALYSIS SCHEDULES - MAJOR CONSTRUCTION PROJECT

DESIGN-BID-BUILD

PART 1 - GENERAL:

1.1 DESCRIPTION:

A. The Contractor shall develop a fully Resource loaded (cost and manpower) Network Analysis System (NAS) plan and computer generated schedule demonstrating fulfillment of the entire contract requirements, shall keep the plan and computer generated schedule up-to-date in accordance with the specification requirements of this section and shall utilize the plan for scheduling, coordinating, mitigating and monitoring work under this contract (including all activities of subcontractors, equipment vendors and suppliers) and verification of every Periodic Progress updates and Payment Submittals of the work under this contract. The Contractor's initial NAS Diagram submission will be the basis for their initial project schedule and will be designated as a Day 1 submission. After review and approval by VA, this schedule will be designated as the approved Baseline Schedule.

B. Conventional Critical Path Method (CPM) Precedence Diagramming Method (PDM) technique shall be utilized to satisfy both time and cost applications. All schedule data and reports required under this specification section shall be based upon total float, not free float schedules. The approved baseline NAS diagram and the schedule becomes the official project schedule of record governing schedule management, oversight and actions on the corresponding contract.

1.2 CONTRACTOR'S REPRESENTATIVE:

A. The contractor shall designate a representative on the site (Usually the Project Executive or Manager) who will be responsible for the preparation, timeliness, quality and the accuracy of the network diagram, review and report progress of the project with and to the Contracting Officer's representative.

B. The Contractor's representative shall have direct project control and complete authority to act on behalf of the Contractor in fulfilling the requirements of this specification section and such authority shall not be interrupted throughout the duration of the project.

1.3 CONTRACTOR'S CONSULTANT:

A. To fulfill all the requirements of this specification section, the Contractor shall engage an independent CPM consultant who is skilled in the time and cost application of scheduling using (PDM) network techniques for similar sized construction projects. The cost of which is included in the Contractor's bid proposal price. This consultant shall not have any financial ties, business ties, affiliation with or a subsidiary company of the Contractor. The consultant is expected to provide unbiased professional services to the contractor and to VA's representatives in developing and maintaining the project schedule.

B. Prior to engaging a consultant, and within 10 calendar days after award of the contract, the Contractor shall submit to the Contracting Officer:
   1. The name and address of the proposed consultant and Company.
   2. Sufficient information to show that the proposed consultant has the qualifications to meet the requirements specified in this specification section.
   3. A list of at least three similar prior construction projects, along with selected PDM network diagram samples on current projects which the proposed consultant has performed complete project scheduling services. These network diagram and schedule samples

must show complete project planning for a project of similar size and scope as covered under this contract.

C. The Contracting Officer has the right to approve or disapprove employment of the proposed consultant and will notify the Contractor of the VA decision within seven calendar days from receipt of information. In case of disapproval, the Contractor shall resubmit another consultant within 10 calendar days for renewed consideration. The contractor must have their CPM Consultant approved prior to Notice to Proceed (NTP).

1.4 PRIOR TO BASELINE SCHEDULE ACCEPTANCE:

A. At the time of the Pre-Construction Conference, prior to the issuance of the project Notice to Proceed, the Contractor and the Contractor's Scheduling Consultant shall arrange a separate meeting with the Contracting Officer and/or his representative to discuss the requirements of this specification in detail. The Contractor and the Contractor's CPM Consultant shall acknowledge, in writing, their understanding and compliance with the requirements of this specification.

B. With exception of bonds, insurance, and limited mobilization cost associated with preparatory work such as site trailers, staging areas, haul roads etc., the approval of the baseline NAS schedule is a condition precedent to:
   1. Processing of contractor's pay request(s) for any construction activities/items of work.
   2. Review of any schedule updates.

C. Government review comments on the contractor's schedule shall not relieve the contractor from compliance with requirements of this specification section and the remaining contract documents.

PART 2 - SCHEDULE CRITERIA / DATA REQUIREMENTS:

2.1 COMPUTER PRODUCED SCHEDULE DEVELOPMENT CRITERIA:

A. The computer produced schedule shall be prepared and maintained using Primavera P6 software.

B. Work activity/event relationships shall be restricted to Finish-to-Start (FS) and Start-to-Start (SS) only without lead or lag constraints. Note: Some exception may be allowed for lag in SS relationship but must be approved by the VA's contracting officer on case by case basis prior to inclusion in the schedule.

C. Subsequent schedule updates work activity/event relationships shall reflect planned sequence of work, with actual status of completed or for in-progress work.

D. Activity/event date constraints, not required by the contract, will not be accepted unless submitted to and approved by the Contracting Officer. The contractor shall make a separate written detailed request to the Contracting Officer identifying these date constraints and secure the Contracting Officer's written approval before incorporating them into the network diagram. The Contracting Officer's separate approval of the network diagram shall not excuse the contractor of this requirement.

E. Logic events (non-work) will be permitted where necessary to reflect proper logic among work events but must have zero duration. The complete computer schedule shall reflect the Contractor's approach to pursuing the entire project.

F. Intermediate Phasing milestones contained in the contract documents shall be clearly shown in the schedule.

G. The Contractor's initial Day 1 submission, prior to VA review and approval, in its original form shall reflect the original contract scope of work.

H. Early Project Completion or "Short Schedule" – VA will not approve any baseline schedule which shows completion date prior to the contract completion date. Also, there should not be

any “filler or “contingency” type of activities to fill the entire contract duration. VA has no obligation to accelerate activities to support a proposed early contract completion. However, if the subsequent updates show that early handover is feasible due to “ahead of schedule” situation, VA may accept the facility earlier at no additional cost to the government.

I. The Baseline Schedule Critical Path of the project shall be limited to:
   1. No more than 20% of the work activities shall be on the critical and near-critical path(s). Critical path is defined as activities with zero (0) day total float. Near-Critical path(s) is defined as activities with one (1) to twenty (20) days of total float.
   2. Multiple Critical paths will not be allowed.

J. The Contractor shall show activities/events for:
   1. Contractor's time required for submittal of shop drawings, templates, fabrication, delivery and similar pre-construction work.
   2. Contracting Officer's and Architect-Engineer's review and approval of shop drawings, equipment schedules samples, template, or similar items with time duration of no less than 20 workdays.
   3. Shutdowns or Interruption of VA Medical Center utilities, delivery of Government furnished equipment (GFE), and rough-in drawings, project phasing and any other specification requirements.
   4. VC/VV Equipment - All significant VC (VA furnished and Contractor installed) and VV (VA furnished and VA installed) equipment shall be clearly shown in the schedule. Any smaller VC and VV Equipment shall also be logically grouped together and shown in the schedule.
   5. Test, balance and adjust various systems and pieces of equipment, maintenance and operation manuals, instructions and preventive maintenance tasks.
   6. Commissioning (Cx)Activities – Based upon the project specific Commissioning plan and project specification section 01 91 00, the contractor shall include in the Day 1 NAS Diagram all the systems commissioning activities (see systems covered in Division 7, 8, 21, 22, 23, 26, 28, 31 and others as specified) such as startup, Pre-functional check list, Pre–test, individual component and system level Functional test, Operator’s training, O.& M. Manuals etc.(including any deficiency correction and re-testing). The majority of commissioning activities should be completed as part of the normal construction schedule and finalized prior to the construction contract completion date. To this end, it is imperative that the Commissioning Agent and the Contractor collaborate to integrate commissioning activities into the Contractor’s overall construction schedule. All commissioning activities shall be cost loaded as required in the later paragraphs. e Commissioning Plan will identify critical commissioning activities and associated construction/start up tasks that must precede these activities to allow for successful execution of the commissioning activities. To coordinate these activities with the construction schedule, a Commissioning Duration Schedule should be provided by the Commissioning Agent to the VA SRE and the Contractor to provide a rational basis for integration of commissioning into the Day 1 NAS diagram and the construction schedule. The Commissioning Duration Schedule should include the following information:
      a. Description of Commissioning Activity
      b. Prerequisite Construction Tasks Required to Execute the Cx Activity
      c. Elapsed Time Duration of Each Activity
      d. Documentation Associated with Each Task/Document Responsibility
   7. Once the duration schedule is delivered to the Contractor, the Contractor will collaborate with the Commissioning Agent to integrate all commissioning activities into the fixed duration construction schedule in accordance with VA NAS requirements for scheduling the project. The Baseline Schedule, as approved by the VA at the beginning, may not have all necessary Cx details, but the contractor is required to subsequently update the commissioning activities as more detailed Commissioning Duration Schedule is being developed.

K. VA inspection and acceptance activity/event with a minimum duration of five work days at the end of each phase and immediately preceding any VA move activity/event required by the contract phasing for that phase. Schedule these activities/events so that only one phase is scheduled for completion within the same 30 consecutive calendar day period (except for those phases immediately preceding the final acceptance). Maintain this scheduling condition throughout the length of the contract unless waived by the Contracting Officer's representative in writing.

L. Work activities/events for the asbestos abatement bid item shall have a trade code of ASB.

M. Bid items other than the Base Bid (ITEM 1) and Asbestos Abatement item shall have trade codes corresponding to the appropriate bid item number (e.g., ITM 3, ITM 4 and other items).
   1. Show not only the activities/events for actual construction work for each trade category of the project, but also trade relationships to indicate the movement of trades from one area, floor, or building, to another area, floor, or building, for at least five trades who are performing major work under this contract.
   2. Break up the work into activities/events shall have:
      a. Duration no longer than 20 work days each, except as to non-construction activities/events (i.e., procurement of materials, delivery of equipment, concrete and asphalt curing) and any other activities/events for which the Contracting Officer may approve the showing of a longer duration.
      b. Submittal / Shop Drawings- The duration for VA approval of any required submittal, shop drawing, or other submittals shall not be less than 20 work days. Some long lead items and complex system shop drawings and submittal approval process will require longer than 20 workdays and should be clearly portrayed in the baseline schedule. Refer to drawing CPM-1 for some typical VA approval activities/events which will require minimum duration longer than 20 workdays. The construction time as determined by the CPM schedule from early start to late finish for any sub-phase, phase or the entire project shall not exceed the contract time(s) specified or shown.
      c. An activity/event shall only reflect the work of one entity (subcontract or craft).
      d. The activity/event once began can continue unimpeded until the activity/event is complete.
   3. Describe work activities/events clearly, so the work is readily identifiable with clear scope for assessment of completion. Activities/events labeled "start," "continue," or "completion," are not specific and will not be allowed. Lead and lag time activities will not be acceptable (Refer to item 2.1 B above for some exceptions).
   4. Uniquely number each activity/event ID with ALPHA-NUMERIC value in ascending order. The network diagram should be generally numbered in such a way to reflect trade discipline, phase or location of the work.

2.2 WORK ACTIVITY/EVENT COST AND TRADE RESOURCE DATA:

A. Cost Loading - The Contractor shall cost load all work activities/events except procurement activities. The cost loading shall reflect the appropriate level of effort of the work activities/events. The cumulative amount of all cost loaded work activities/events (including alternates) shall equal the total contract price. Prorate overhead, profit and general conditions on all work activities/events for the entire project length. The contractor shall generate from this information cash flow curves indicating graphically the total percentage of work activity/event dollar value scheduled to be in place on early finish, late finish. These cash flow curves will be used by the Contracting Officer to assist him in determining approval or disapproval of the cost loading. In the event of disapproval, the Contractor shall revise and resubmit in accordance with Article, THE INITIAL DAY ONE SCHEDULE SUBMITTAL (Item 3.1B below). Negative work activity/event cost data will not be acceptable, except on VA issued contract changes.

B. The Contractor shall cost load work activities/events for guarantee period services, test, balance and adjust various systems in accordance with the provisions in the FAR 52.232 – 5

(PAYMENTS UNDER FIXED-PRICE CONSTRUCTION), Article, and VAAR 852.236 - 83(PAYMENTS UNDER FIXED-PRICE CONSTRUCTION).

C. The Contractor shall cost load work activities/events for ASBESTOS ABATEMENT. The sum of asbestos abatement work activity/event costs shall equal the value of the asbestos bid item in the Contractors' bid.

D. The Contractor shall cost load work activities/events for all BID ITEMS. The sum of the cost loading for each bid item work activities/events shall equal the value of the item in the Contractors' bid.

E. Work activities/events for Contractor bond shall have a trade code and area code of BOND.

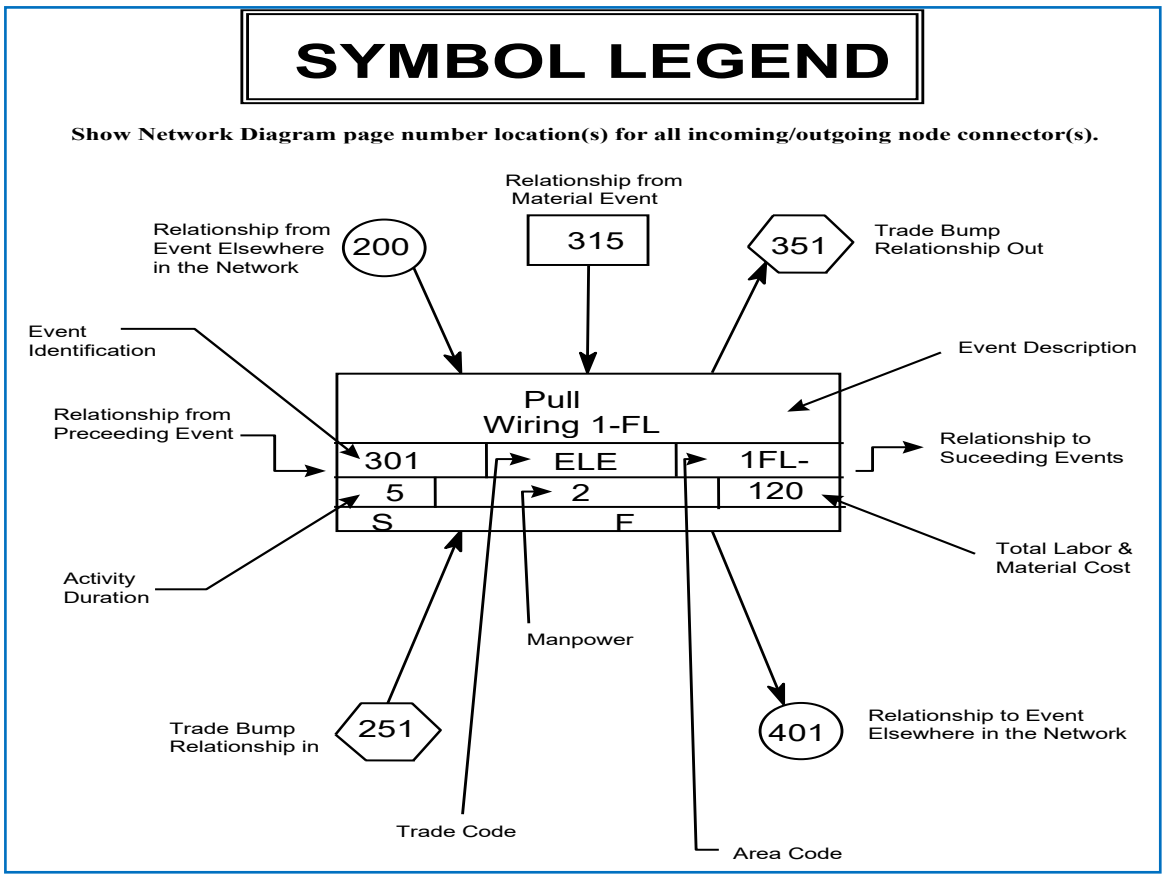
F. General contractor work requirement code – The scope of work activities that will be performed solely by the general contractor must be identified clearly and a unique code assigned to each activity so that it can be sorted and summarized in a report. The purpose is to ascertain that the general contractor is meeting his contractual share of work content (as outlined in the signed contract documents). Care must be taken to estimate individual activity costs realistically, so these are not unreasonably inflated or deflated in the schedule.

G. Manpower loading - In accordance with Article PERFORMANCE OF WORK BY THE CONTRACTOR in FAR 52.236 – 1 and VAAR 852.236 - 72, the Contractor shall submit, simultaneously with the cost per work activity/event of the construction schedule required by this Section, a responsibility code for all activities/events of the project for which the Contractor's forces will perform the work. This shall be the basis for the “Resource loading” of the schedule and the contractor shall provide “Manpower loading” reports by trades and the overall Trade manpower requirements, when requested by the contracting officer or his/her representatives.

2.3 NETWORK DIAGRAM (NAS) DATA REQUIREMENTS:

A. The Day 1 NAS diagram is the logical plan and forms the basis for contractor’s baseline schedule. Participation and input of key construction personnel from the General contractor and the major subcontractors is a mandatory requirement in the baseline schedule development. The Day 1 NAS diagram in its original form shall reflect the original contract scope of work and contain no contract changes or delays which may have been incurred during the final NAS diagram and baseline schedule development period and shall reflect the entire contract duration as defined in the bid documents. Show on the NAS diagram the sequence and interdependence of work activities/events required for complete performance of all items of work. In preparing the NAS diagram, the Contractor shall:

1. Exercise sufficient care to produce a clear, legible and accurate network diagram, in pure logical PDM format, refer to the construction document (CD) drawing, CPM-1 (Sample CPM Network). Computer plotted network diagrams shall legibly display and plot all information required by the VA CPM activity/event legend, otherwise the computer plotted network diagram will not be accepted. If the computer plotted network diagram is not found acceptable by the contracting officer’s representative, then the network diagram will need to be created through other means to meet legibility requirements. Provide a key plan on each network diagram sheet showing the project area associated with the work activities/events shown on that sheet. VA will accept electronic version of this legible NAS diagram instead of hard copy, if the contractor so choses.
2. Show the following on each work activity/event:
   a. Activity/Event ID number, driven by WBS coding structure.
   b. Concise description of the work represented by the location and activity/event.
   c. Activity coding – Provide activity coding (five alpha characters or less) for Trades (GEN, MECH, ELEC, CARP, PLAST, or other acceptable abbreviations), Area, Phasing etc. Provide a dictionary of all coding in the front page of the NAS Diagram.
   d. Duration (in work days.)
   e. Cost (in accordance with Article, ACTIVITY/EVENT COST DATA of this section and less than $9,999,999 per activity).



f. Manpower required (average number of workers per day). Load manpower for each and every activity with proper trade codes in the “resource” field of P6 for ease of generating individual Trade and overall manpower profile required to plan and complete the project.

g. No open-ended activities will be accepted, except for Notice to Proceed and the Final Completion activities.

h. The SYMBOL LEGEND format shown below and, on the drawing, CPM-1 (Sample CPM Network) is mandatory and shall be followed in preparing final network diagrams.

1)

B. To the extent that the network diagram or any revised network diagram shows anything not jointly agreed upon, it shall not be deemed to have been approved by the Contracting Officer. Failure to include any element of work required for the performance of this contract shall not excuse the Contractor from completing all work required within any applicable completion date of each phase regardless of the Contracting Officer's approval of the network diagram.

C. Compact Disk Requirements and CPM Activity/Event Record Specifications: Submit to the VA (Senior Resident Engineer and CPM Schedule Analyst) an electronic file(s) containing one file of the data required to produce a Primavera (P6), (PDM) produced schedule, reflecting all the activities/events of the complete project network diagram being submitted.

2.4 CONSTRUCTION SCHEDULE RISK ANALYSIS / MITIGATION PLAN:

A. Schedule Risk Analysis – The contractor shall conduct the statistical schedule risk analysis based on the above detailed construction activities in the Day 1 approved diagram, identifying major schedule risk areas and recommended risk mitigation plans as outlined below.

B. The risk analysis shall be conducted by a person or firm skilled in the statistical method of schedule risk analysis based on the (PDM) network techniques for major construction projects,

preferably in the major health care related projects. The cost of this service shall be included in the Contractor's proposal.

C. The Contracting Officer has the right to approve or disapprove the

D. Person or firm designated to perform the risk analysis.

2.5 RISK ANALYSIS FORMAT / DATA REQUIREMENTS:

A. Conduct Risk Analysis - Based on the approved software / format, the consultant shall perform statistical risk analysis on the detailed approved Day 1 diagram and the baseline schedule. The contractor shall review and utilize any previous Risk analysis performed by the A/E of record based on the “semi-detailed” (yet at an overall level) construction logic and schedule to ensure the continuity of previous schedule risk analysis. The contractor’s project manager and Superintendent shall identify the major schedule risk areas and possible risk mitigation strategy/plan and record it in a narrative format, with electronic file submission to the VA as directed by the VA Contracting officer.

B. The submittal shall include three copies of a computer-produced risk analysis results, predicting the various meaningful probability curves of achieving the contract schedules. It shall also include a detailed narrative list of all major and minor potential and specific schedule and cost risk areas and impact of them on the overall project, and a contractor’s recommendations of mitigating the identified risks which must be addressed by the VA Project and Resident engineer teams to maintain the contract schedule.

C. The contractor shall, as a part of Risk monitoring, prepare a detailed Project Risk Register (PRR), identifying each risk items, risk assessment and its response plan. This PRR, at the discretion of VA SRE and CO, shall be discussed in a monthly risk management meeting for mitigation.

PART 3 - SUBMITTALS, DELIVERABLES, AND UPDATE PROCESS:

3.1 SUBMITTALS:

A. The independent cpm consultant Submittal: Within 10 calendar days after award of the contract, the Contractor shall submit to the Contracting Officer for review and approval the qualifications of their proposed independent CPM consultant. The submittal information shall be in accordance with PART 1 GENERAL, ARTICLE 1.3 CONTRACTOR'S CONSULTANT of this Specification.

B. THE INITIAL Day 1 SCHEDULE SUBMITTAL: Within 30 calendar days (45 calendar days on projects over $50,000,000) after receipt of Notice to Proceed, the Contractor shall submit the initial Day 1 schedule submittal package, including schedule narrative that describes, not limited to, phasing, work breakdown structure, overall sequence of work, activity calendars, updates process, project start/finish/total duration, deliverables, and milestones, for the Contracting Officer's review and approval. This Day 1 schedule submittal shall consist of:

1. Two hard copies of the complete Day One network (NAS) diagram on sheets of paper 765 x 1070 mm (30 x 42 inches) activities sorted by physical work area. Submit also an electronic version of the NAS diagram.
2. Computerized Schedule;
   a. An electronic file in a compressed Primavera (P6) computerized schedule, (PDM) format.
   b. Three hard copies of a computer-produced activity/event ID schedule showing all requirements project duration; phase completion dates; and other data, including event manpower and cost. Each activity/event on the computer-produced schedule shall contain as a minimum, but not limited to, activity/event ID, description, duration, predecessor and successor relationships, trade code, area code, budget amount, manpower, early start date, early finish date, late start date, late finish

date and total float. The Contracting Officer's separate approval of the network diagram shall not excuse the contractor of this requirement.

3. Supporting Data include the following data:
   a. The proposed number of working days per week.
   b. The holidays to be observed during the life of the contract (by day, month, and year).
   c. The planned number of shifts per day.
   d. The number of hours per shift. List the major construction equipment to be used on the site, describing how each piece relates to and will be used in support of the submitted network diagram work activities/events.
   e. Provide a typed, doubled spaced description, at least one page in length, of the sequencing plan and contractor's approach to constructing the project.
   f. Failure of the Contractor to include this data will delay the review of the submittal until the Contracting Officer is in receipt of the missing data.

C. VA RESPONSE TO INITIAL SCHEDULE SUBMITTAL – BASELINE SCHEDULE: Within 30 calendar days after receipt of the complete INITIAL Day 1 SCHEDULE SUBMITTAL Package (3.1.B), the Contracting Officer or his representative will do one or both of the following:
   1. Notify the Contractor concerning the acceptability of the Day 1 Schedule Submittal Package and any additional actions, opinions, and objections to the package.
   2. A meeting with the Contractor at or near the job site for joint review, correction or adjustment of the proposed plan will be scheduled if required. Within 14 calendar days after the joint review, the Contractor shall revise and shall submit three hard copies of the revised network diagram, three copies of the revised computer-produced activity/event ID schedule and a revised electronic P6 file as specified by the Contracting Officer. The revised submission will be reviewed by the Contracting Officer and, if found to be as previously agreed upon, will be approved.
   3. The contractor submitted NAS diagram, the corresponding computer-produced schedule(s) and the submitted supporting data, when approved, shall constitute the official Baseline Schedule until subsequently revised in accordance with the requirements of this section.

D. COMPUTER PRODUCED SCHEDULES submittals:
   1. Within 7 calendar days of periodic (monthly) update meeting, the contractor shall submit to the VA Senior Resident Engineer (SRE) and CPM Schedule Analyst (simultaneously), computer-produced time/cost schedules and reports generated from monthly project updates. This monthly computer service will include: electronic file copies of up to five different reports (inclusive of all pages), available within the user defined reports of Primavera (P6), to the contracting officer's representatives; a hard copy listing of all project schedule changes, and associated data, made at the update; an electronic file of this data in Primavera (P6) format; and the resulting monthly updated schedule reports in a compressed electronic file in Primavera (P6), (PDM) format. These schedule reports must be submitted along with the modified Look ahead report (with % complete progress) made at the periodic (Monthly) update meeting signed by the contractor and VA); and substantively support the contractor's monthly payment request. The SRE shall identify the five different report formats that the contractor shall provide based upon the monthly schedule updates.
   2. The contractor is responsible for the correctness and timeliness of the computer-produced reports. The Contractor is also responsible for the accurate and timely submittal (within 7 calendar days as noted above) of the updated project schedule and all CPM data necessary to produce the computer reports and payment request that is specified.

E. VA RESPONSES TO COMPUTER PRODUCED SCHEDULE submittals: The VA may report errors in computer-produced reports to the Contractor's representative within ten calendar days from receipt of reports, indicating approval or disapproval. In case of disapproval, the Contractor will reprocess the computer-produced reports and associated compact disk(s), when requested

by the Contracting Officer's representative, to correct errors which affect the payment and schedule for the project. In certain large and complex project, as determined by the Contracting Officer, this periodic (monthly) reporting shall be formal submittal and approval process. The next periodic (month) update shall not proceed without timely submittal and approval of the previous periodic update.

F. FIRST UPDATE SCHEDULE SUBMITTAL: Within 30 calendar days of VA acceptance of the project baseline schedule, the Contractor shall submit the first update of the schedule. This update shall contain any progress of the work the contractor wishes to receive payment for from contract notice to proceed. Any changes/delays shall be entered at the first update after the final network diagram has been approved. The Contractor should provide their requests for time and supporting time extension analysis for contract time because of contract changes/delays, after this update, and in accordance with Article, ADJUSTMENT OF CONTRACT COMPLETION. These changes/delays shall be analyzed (entered) at the first update after the final network diagram and baseline schedule have been approved. The Contractor should provide their requests for time and supporting time extension analysis for contract time because of contract changes/delays, after this update, and in accordance with Article, ADJUSTMENT OF CONTRACT COMPLETION.

G. Periodic Progress and payment Submittals: The Contractor is entitled to a periodic (not less than monthly) progress payment upon approval of the resource loaded project schedule.
   1. The contractor shall submit the AIA application and certificate for payment documents G702 & G703 reflecting updated schedule activities and cost data in accordance with the provisions of the following Article 3.2, PAYMENT AND PROGRESS REPORTING, as the basis upon which progress payments will be made pursuant to Article FAR 52.232 – 5 (PAYMENTS UNDER FIXED-PRICE CONSTRUCTION), and VAAR 852.236 - 83(PAYMENTS UNDER FIXED-PRICE CONSTRUCTION).
   2. If the Contractor fails or refuses to furnish to the Contracting Officer the information and the associated updated Primavera (P6), (PDM) schedule in electronic format, which, in the sole judgment of the Contracting Officer, is necessary for processing the monthly progress payment, the Contractor shall not be deemed to have provided an estimate and supporting schedule data upon which progress payment may be made.

H. RISK ANALYSIS PROCEDURE SUBMITTAL: Within 45 calendar days (60 calendar days on projects over $50,000,000) after receipt of Notice to Proceed, the Contractor shall submit for the Contracting Officer's review and approval:
   1. The qualifications of a consultant or representative who will be conducting the Risk Analysis.
   2. The software to be utilized.
   3. The methodology of performing the analysis.
   4. The format of presenting the data.
   5. A sample of the reports to be given to VA.

I. RISK ANALYSIS REPORT SUBMITTAL: Quarterly a risk analysis exercise shall be performed and/or updated and submitted to the VA Contracting Officer. The VA Contracting Officer can request additional risk analysis.
   1. The submittal shall include three copies of a computer-produced risk analysis results, predicting the various meaningful probability curves of achieving the contract schedules. It shall also include a detailed narrative list of all major and minor potential and specific schedule and cost risk areas and impact of them on the overall project, and a contractor's recommendations of mitigating the identified risks which must be addressed by the VA Project and Resident engineer teams to maintain the contract schedule.
   2. The Contractor shall, as a part of Risk Analysis Submittal, prepare a detailed Project Risk Register (PRR), identifying each risk items, risk assessment and its response plan. This PRR, at the discretion of the SRE and the CO, shall be discussed in a monthly risk management meeting for mitigation.

3.2 PAYMENT AND PROGRESS REPORTING – SCHEDULE UPDATES:

A. Schedule update meeting - Monthly job site schedule update meeting shall be held on dates mutually agreed to by the Contracting Officer (or Contracting Officer's representative) and the Contractor. Contractor and his CPM consultant will be required to attend all monthly update meetings. Presence of Subcontractors during update meeting is optional unless required by the Contracting Officer (or Contracting Officer's representative). The Contractor shall update the project schedule and all other data required by this section shall be accurately filled in and completed draft (Pencil copy) prior to the monthly update meeting. The Contractor shall provide this information to the Contracting Officer or the VA representative in completed form three work days in advance of the update meeting. The contractor shall use only approved previous month's schedule to report progress (% complete) in "pencil copy" and shall not change this in any shape or form. Logic or duration changes for future incomplete activities should be entered later and shown in the resulting reports. Job progress will be reviewed to verify:

1. Actual start and/or finish dates for updated/completed activities/events.
2. Remaining duration, required to complete each activity/event started, or scheduled to start, but not completed.
3. Logic, time and cost data for change orders (CO), and supplemental agreements (SA) that are to be incorporated into the network diagram and computer-produced schedule. Submit "Fragnets" for each CO and SA for VA approval prior to monthly parallel run. Changes in activity/event sequence and duration should be made pursuant to the provisions of following Article, ADJUSTMENT OF CONTRACT COMPLETION.
4. Percentage for completed and partially completed activities/events.
5. Logic and duration revisions required by this section of the specifications, particularly if the Day 1 logic / sequence have changed significantly, which could potentially alter or impact the critical path of the schedule. Highlight and request VA approval prior to making any logic, durations, manpower and cost loading changes.
6. Activity/event duration and percent complete shall be updated independently, meaning that the Remaining Durations (RD) shall be reviewed for all "in-progress" activities and entered manually based on realistic remaining work content, and shall not be left to "auto-calculate" by the software.
7. Out of sequence progress – Activities that have progressed before all preceding logic has been satisfied (Out-of-Sequence progress) are not allowed except on a rare case by case basis, subject to approval by the contracting officer. Propose logic corrections to eliminate out of sequence progress or justify not changing the sequencing for approval prior to submitting updated monthly schedule. Correct out of sequence progress that continues for more than two update cycles by logic revision, as approved by the contracting officer. Also, submit complete revised schedule when more than 5% of the remaining activities are out of sequence. Calculate multiple float paths option is not allowed.
8. Logic changes – Specifically identify and discuss all logic changes pertaining to change orders (see section item 3.2.E below), contractor proposed changes in work plan or sequence, correction to schedule logic for out-of-sequence progress etc. that have been made pursuant to contract provisions. VA will only approve logic revisions to keep the schedule valid in terms of its usefulness in calculating a realistic completion date, correcting erroneous logic ties, and accurately sequencing the work.

B. Schedule Narrative - The Contractor, in addition to the 5 schedule reports noted earlier, shall submit a narrative report as a part of his monthly update reporting prepared after the update meeting, in a form agreed upon by the Contractor and the Contracting Officer. The narrative report shall be prepared by the contractor's authorized representatives (Project manager, Superintendent or other responsible official, and not by the CPM consultant); shall include, at a minimum, a description of major construction problem areas; current and anticipated delaying factors and their estimated impact on performance of other activities/events and completion dates; and an explanation of corrective action being taken or proposed. This narrative shall also include:

1. Any forward Logic Revisions; 2) any added or deleted activities; 3) Any cost loading or budget changes; 4) any missed major milestones. This monthly schedule narrative should also briefly discuss the potential schedule risks / mitigation effort, as required by the item 3.1.G above. This report is in addition to the daily reports pursuant to the provisions of Article, DAILY REPORT OF WORKERS AND MATERIALS in the GENERAL CONDITIONS.

C. Cash Flow S-curve or Schedule Variance Control (SVC) Diagram – With each schedule submission, provide an SVC diagram showing Scheduled and Actual (earned value) Project cost curve (both incremental and cumulative) based on both projected early and late activity finish dates. Also, revise the Cash Flow S-curve when the contract is modified, or as directed by the Contracting Officer.

D. After completion of the joint review and the Contracting Officer's approval of all entries, the contractor will generate an updated computer-produced calendar-dated schedule and submit to the contracting Officer's representative with reports in accordance with the Article, COMPUTER PRODUCED SCHEDULES, specified. These reports shall be submitted within 7 calendar days after the monthly update meeting to the SRE and the VA CPM Schedule analyst simultaneously via electronic media, as noted earlier.

E. Parallel Runs / Time Impact Analysis (TIA) - After completing the monthly schedule update, the contractor's CPM consultant shall rerun all current period contract change(s) as a batch against the previous month's approved monthly project schedule with the approved "Fragnet" (Fragments of network or sub-network) logic and durations. The Change Order Fragnet should be driven by the pure logical ties; and there should not be any "Plug in" date ahead of the data date or at the time of impact. The analysis shall only include original workday durations and schedule logic previously agreed upon during the update meeting by the contractor and the SRE for the contract change(s), and preferably shall be submitted as a part of the C.O. proposal and before any physical C.O. work is performed. Fragnet logic shall include only relevant procurement and physical C.O. work activities and shall not include any RFI (Request for Information) or non-work activities time. Note: If timely resolution of the RFI is potentially impacting the contract schedule, in contractor's opinion, the contractor must provide tangible proof with CPM data and immediately submit in writing to the Contracting Officer's review. Only selective RFIs for the CO or SA shall be allowed in the schedule of record only when approved by the contracting officer or his representative.

F. When there is a disagreement on Fragnet logic and/or durations, the contractor shall use the Fragnet provided and approved by the SRE. The contractor must also allocate cost and average manpower loading to each CO or SA Fragnet activities as required by the section 2.3 – Network Diagram Requirements above. Note: Insertion of any CO or SA activities into the CPM database (as a placeholder for cost only) with faulty logic ties like NTP (predecessor) and Project complete (successor) and zero (0) duration will not be accepted. The proper "Fragnet" logic and durations must be used as approved by the SRE, tied to the related physical work area of the schedule. After each rerun update, the resulting electronic project schedule data file shall be appropriately identified and submitted to the VA SRE and the CPM Analyst in accordance to the requirements listed in articles 3.2.D. This electronic submission is separate from the regular monthly project schedule reports requirements and shall be submitted to the SRE within fourteen (14) calendar days of completing the regular schedule update meeting. Before inserting the contract changes durations, care must be taken to ensure that only the original durations of the change will be used for the analysis, not the reported durations (as-built) after the progress. In addition, once the final network diagram is approved, the contractor must recreate all manual progress payment updates on this approved network diagram and associated reruns for contract changes in each of these update periods as outlined above for regular update periods. This will require detailed record keeping for each of the manual progress payment updates.

G. RFI activities not allowed – RFIs are only contractor inquiries and not legitimate work activities; and VA does not allow indiscriminate inclusion of any RFIs in any project schedule updates.

The contractor must provide, in advance and in writing, to the contracting officer the valid justification for including any RFIs, on an exception basis, in the project schedule updates; and must obtain VA approval prior to its inclusion in the schedule of record.

H. Retroactive TIA - Retroactive TIA long after (generally over 3 months) the initiation of impact with “as-built” logic / duration will not be accepted as a normal practice. The contractor is required to perform TIA (as required by Item 3.2.E above) within a month of VA issued Change or other directives to proceed with additional work.

I. Concurrency in Time Extension delays – Whenever there are several delays (due to change orders impact or other Government or contractor caused delays) occurring at the same time frame (same point of initiation), the contractor is required to perform one single TIA with individual Fragnets for each change inserted in the same base schedule and determine which one is impacting the critical or longest path. Analyze and assign responsibilities to each individual changes or other delay (Government or contractor caused) with graphics and narratives to show if and how various delay impacts becoming concurrent. The VA is only responsible for granting the amount of delay caused by them (apportioned delay) in the longest or critical path, discounting effects of any contractor caused delay that has been occurring concurrently in that time frame. The contractor is required to provide justification narrative, and then submit summary results for VA approval and acceptance.

J. Revised NAS Diagram - After VA acceptance and approval of the final NAS diagram and the schedule, and after each monthly update, the contractor shall submit to the Contracting Officer electronic copies of a revised complete NAS diagram showing all completed and partially completed activities/ events, contract changes and logic changes made on the intervening updates or at the first update on the final diagram. The Contracting Officer may elect to have the contractor do this on a less frequent basis, but it shall be done when the Baseline schedule is revised, or when requested by the Contracting Officer.

K. Schedule Coordination/ Progress review meeting - Following approval of the CPM schedule updates, the VA, the General Contractor, its approved CPM Consultant, RE office representatives, and all subcontractors needed, as determined by the SRE, shall meet to discuss the monthly updated schedule. This schedule coordination meeting shall be chaired by the VA SRE and will occur after each monthly project schedule update meeting utilizing the resulting schedule reports from the previous schedule update. The main emphasis shall be to address work activities to avoid slippages of project schedule and to identify any necessary corrective actions required to maintain project schedule during the reporting period. VA representatives and the Contractor should conclude the meeting with a clear understanding of those work and administrative actions necessary to maintain project schedule status during the reporting period. If the project is behind schedule, discussions should concentrate on ways to prevent further slippage as well as ways to improve the project schedule status, as appropriate. Furthermore, the critical Change Orders that impact the contract schedule, the contractor must include a reasonable “work-around” plan or re-planning effort (submit narrative) including revised logic sequence for the downstream base contract work, durations adjustments and crew re-allocation from less critical to the new critical path areas, without adversely impacting the change order cost to the government to minimize/mitigate the impact of the time delay. This should not be implied as a direction to accelerate the schedule, rather a reasonable mitigation effort within the current work plan.

L. Ownership of Project Float – Project float is the length of time between the contractor’s predicted completion milestone and the contract completion date milestone. Project Float available in the schedule, at any time, shall not be considered for the exclusive use of either the VA or the Contractor.

3.3 3.3 RESPONSIBILITY FOR COMPLETION / PROJECT DELAY / RECOVERY:

A. Whenever it becomes apparent from the current monthly progress review meeting or the monthly schedule update that phasing or contract completion dates will not be met, the Contractor shall execute some or all of the following remedial actions:

1. Increase construction manpower in such quantities and crafts as necessary to eliminate the backlog of work.
2. Increase the number of working hours per shift, shifts per working day, working days per week, the amount of construction equipment, or any combination of the foregoing to eliminate the backlog of work.
3. Reschedule the work in conformance with the specification requirements to recover all of the delay for which the contractor is responsible.

B. Prior to proceeding with any of the above actions, the Contractor shall notify and obtain approval from the Contracting Officer for the proposed schedule changes. If such actions are approved, the contractor shall incorporate this “Recovery schedule” with all the CPM revisions into the next update, at no additional cost to the Government.

3.4 CHANGES TO NETWORK DIAGRAM AND REVISED SCHEDULE:

A. Within 30 calendar days after VA acceptance and approval of any updated computer-produced schedule, the contractor shall submit a revised network diagram and schedule, the associated compact disk(s), and a list of any activity/event changes including predecessors and successors for any of the following reasons:
1. Delay in completion of any activity/event or group of activities/events; that indicate an extension of the project completion by 20 working days or 10 percent of the remaining project duration, whichever is less. Such delays which may be involved with contract changes, strikes, unusual weather, and other delays will not relieve the Contractor from the requirements specified unless the conditions are shown on the CPM as the direct cause for delaying the project is beyond the acceptable limits.
2. Delays in submittals, or deliveries, or work stoppage are encountered which make rescheduling of the work necessary.
3. The schedule does not represent the actual prosecution and realistic progress of the project, or when more than 5% of the remaining activities are “out of sequence” as noted earlier (Ref.3.2.A.7).
4. When there is, or has been, a substantial revision to the activity/event costs of the network diagram regardless of the cause for these revisions.

B. B. CPM revisions made under this paragraph which affect the previously approved computer-produced schedules for Government furnished equipment, vacating of areas by the VA Medical Center, contract phase(s) and sub phase(s), utilities furnished by the Government to the Contractor, or any other previously contracted item, must be furnished in writing to the Contracting Officer for approval.

C. Contracting Officer's approval for the revised NAS diagram and schedule and all relevant data is contingent upon compliance with all other paragraphs of this section and any other previous agreements by the Contracting Officer or the VA representative.

D. The cost of revisions to the network diagram resulting from contract changes will be included in the proposal for changes in work as specified in Article, FAR 52.243 -4 (CHANGES), and will be based on the complexity of the revision or contract change, man hours expended in analyzing the change, and the total cost of the change.

E. The cost of revisions to the network diagram and schedule, not resulting from contract changes is the responsibility of the Contractor.

3.5 3.5 ADJUSTMENT OF CONTRACT COMPLETION DATE / TIME EXTENSION DUE TO CHANGES TO THE CONTRACT:

A. Contract Time Extension due to Changes to Contract - The contract completion time will be adjusted only for causes specified in this contract. The contractor shall submit Request for a time extension to the contract within reasonable time frame (within 1 month of the issuance of the Change order or before signing of the bilateral Supplemental Agreement) and must provide a justification, CPM data and supporting evidence as the Contracting Officer may deem necessary for determination if the Contractor is entitled to a time extension under the provisions

of the contract. Submission of proof based on approved Fragnet; i.e. revised activity/event logic, durations (in work days) and costs is obligatory to any approvals. The schedule must clearly display that the Contractor has used, in full, all the float time available for the work involved in this request. The Contracting Officer's determination as to the total number of days of contract extension will be based upon the current computer-produced calendar-dated schedule for the time period in question and all other relevant information.

B. Actual delays in activities/events which, according to the computer-produced calendar-dated schedule, do not affect the original or extended contract completion dates shown by the critical path in the network, will not be the basis for a change to the contract completion date. The Contracting Officer will within a reasonable time after receipt of such justification and supporting evidence, review the facts and advise the Contractor in writing of the Contracting Officer's decision. The burden of proof to request the time extension is the sole responsibility of the contractor, and the contractor is required to revise the Time analysis or provide further documentation when requested by the Contracting Officer.

C. The contractor shall submit each request for a change in the contract completion date to the Contracting Officer in accordance with the provisions specified under Article, FAR 52.243 -4 (CHANGES). The contractor shall include, as a part of each change order proposal, a sequence of activities showing all CPM logic revisions (Fragnets), duration (in work days) changes, and cost changes, manpower loading for work in question and its relationship to other activities on the approved network diagram (as specified above in item 3.2.E – Parallel Run /Time Impact Analysis).

3.6 3.6 ADJUSTMENT OF CONTRACT COMPLETION DATE / TIME EXTENSION DUE TO WEATHER:

A. Weather Delays - All delays due to Weather shall be analyzed on a month by month basis. The unusual weather events and its “after-effects” must impact the work activities on or near critical path work to qualify for weather delay extension. Any weather-related delays claimed by the contractor must be “above and beyond” the “normal weather” pattern (10- year average) and shall be supported by the data shown in the National Oceanic and Atmospheric Administration (NOAA) for the region of the country where the project site is located. The weather delay analysis (along with NOAA weather charts) shall be submitted to the VA within 30 calendar days after the weather event has passed. VA considers Time extension due to the weather is “non-compensable” time only.

B. ADJUSTMENT OF CONTRACT COMPLETION DATE / Non-Work activities/events:
   1. All delays due to non-work activities/events such as RFI’s, STRIKES, and similar non-work activities/events shall be analyzed on a month by month basis and must be supported with a justification, CPM data and supporting evidence as the Contracting Officer may deem necessary for determination as to whether the Contractor is entitled to an extension of time. Note: As noted earlier, RFI activities are not allowed and VA does not allow indiscriminate inclusion of any RFIs in any project schedule updates.
   2. Actual delays in activities/events which, according to the computer produced calendar dated schedule, do not affect the original or extended contract completion dates shown by the critical path in the network, will not be the basis for a change to the contract completion date. The burden of proof to request the time extension is the sole responsibility of the contractor.
   3. The Contractor shall submit each request for a change in the contract completion date to the Contracting Officer in accordance with the provisions specified under Article, FAR 52.243 -4 (CHANGES). The Contractor shall include, as a part of each change order proposal, a sequence of activities showing all CPM logic revisions (Fragnets), duration (in work days) changes, and cost changes, manpower loading for work in question and its relationship to other activities on the approved network diagram (as specified above in item 3.2.E – Parallel Run /Time Impact Analysis).

4. The cost of revisions to the network diagram not resulting from VA actions or inactions is the responsibility of the contractor.

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SECTION 01 33 23
SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This specification defines the general requirements and procedures for submittals. A submittal is information submitted for VA review to establish compliance with the contract documents.

B. Detailed submittal requirements are found in the technical sections of the contract specifications. The Contracting Officer may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective technical specifications at no additional cost to the government.

C. VA approval of a submittal does not relieve the Contractor of the responsibility for any error which may exist. The Contractor is responsible for fully complying with all contract requirements and the satisfactory construction of all work, including the need to check, confirm, and coordinate the work of all subcontractors for the project. Non-compliant material incorporated in the work will be removed and replaced at the Contractor's expense.

1.2 DEFINITIONS

A. Preconstruction Submittals: Submittals which are required prior to issuing contract notice to proceed or starting construction. For example, Certificates of insurance; Surety bonds; Site-specific safety plan; Construction progress schedule; Schedule of values; Submittal register; List of proposed subcontractors, OSHA Construction Safety training certificates, VA Security Management program PIV approval

a. OSHA Construction Safety:
   1) All employees of general contractor or subcontractors shall have the 10-hour OSHA certified Construction Safety course and other relevant competency training.
   2) Submit training records of all such employees for approval before the start of work.

b. VA Security Management Program – Personal Identity Verification (PIV):
   1) Refer to 01 00 00 1.5 C for Montrose VAMC Badging Process.
   2) The Contractor and subcontractors are responsible to furnish the names of all employees scheduled to work to the COR within tens days of the Notice to Proceed. Special Access Check Form SAC to be used.
   3) All employees of the general contractor, all subcontractors and all sub-subcontractors will be required to be made available to Police Service at the FDR, Montrose Campus to apply for photo identification badge and fingerprinting following badge production the employee shall return in person to receive issue of the badge. VA Form 07111 to be used.

B. The contractor shall identify on the construction schedule of work the date for start of work of short term (greater than 10 days) specialty subcontractors and two weeks prior to start of work process identification badge verification for employee issue prior to starting of work (Employees not issued identification badges will have to leave the site at no addition cost to the government.)

C. Shop Drawings: Drawings, diagrams, and schedules specifically prepared to illustrate some portion of the work. Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be integrated and coordinated.

D. Coordination Drawings: Reproducible overlay drawings showing work with horizontal and vertical dimensions to avoid interference with structural framing, ceilings, partitions, equipment, lights, mechanical, electrical, conveying systems, and other services:

1. In and above ceilings.

2. Within walls.
3. Within chases and shafts.
4. Under concrete floors on grade.
5. In mechanical spaces.
6. In electrical spaces.
7. Below grade.

E. Product Data: Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions, and brochures, which describe and illustrate size, physical appearance, and other characteristics of materials, systems, or equipment for some portion of the work. Samples of warranty language when the contract requires extended product warranties.
1. Include index if multiple items under specification section are included in submittal.
2. Mark each copy to show exact item, model, and options submitted for review.
3. Show compliance with specified reference standards, performance characteristics, and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions; and required clearances; notation of coordination requirements.
4. Mark through items on manufacturer's standard sheets which are not being proposed. Submittals without indications and deletions will be returned without review.
5. Include scale details, sizes, dimensions, performance characteristics, capacities, wiring diagrams, controls and other pertinent data.
6. Mark through items on manufacturer's standard sheets which are not being proposed. Submittals without indications and deletions will be returned without review.

F. Samples: Physical examples of materials, equipment, or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged. Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project. Field samples and mock-ups constructed to establish standards by which the ensuing work can be judged.
1. Identify samples with manufacturer’s name, item, use, type, Project designation, specification section or drawing, detail reference, color, range, texture, finish and other pertinent data.
2. Samples shall have a label affixed or attached thereto of sufficient size to accommodate Contractor’s approval stamp.
3. Submit two samples of each.
4. When specific colors, textures, or patterns are not specified, submit samples from full range of manufacturer's standards for selection. When custom or standard finishes are specified, submit samples of specified colors, textures or patterns.

G. Design Data: Calculations, mix designs, analyses, or other data pertaining to a part of work.

H. Test Reports: Report which includes findings of a test required to be performed by the Contractor on an actual portion of the work. Report which includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.

I. Certificates: Document required of Contractor, or of a manufacturer, supplier, installer, or subcontractor through Contractor. The purpose is to document procedures, acceptability of methods, or personnel qualifications for a portion of the work.

J. Manufacturer's Instructions: Pre-printed material describing installation of a product, system, or material, including special notices and MSDS concerning impedances, hazards, and safety precautions.

K. Manufacturer's Field Reports: Documentation of the testing and verification actions taken by manufacturer's representative at the job site on a portion of the work, during or after installation, to confirm compliance with manufacturer's standards or instructions. The documentation must indicate whether the material, product, or system has passed or failed the test.

L. Operation and Maintenance Data: Manufacturer data that is required to operate, maintain, troubleshoot, and repair equipment, including manufacturer's help, parts list, and product line documentation. This data shall be incorporated in an operations and maintenance manual.

O&M manual shall also include recommended Lock Out-Tag Out (LOTO) procedure for all equipment requiring isolation of potential energy sources.

M. Closeout Submittals: Documentation necessary to properly close out a construction contract. For example, Record Drawings and as-built drawings. Also, submittal requirements necessary to properly close out a phase of construction on a multi-phase contract.

1.3 RELATED WORK

A. Section 01 33 24; ELECTRONIC SUBMITTAL PROCEDURES.

1.4 SUBMITTAL REGISTER

A. The submittal register will serve as a scheduling document for submittals and will be used to control submittal actions throughout the contract period.- See the Example Submittal register at general conditions appendix B.

B. The VA will provide a blank submittal register in electronic format. Thereafter, the Contractor shall fill in the blank register with the required submittals as documented in the project spec. The Contractor shall track all submittals by maintaining a complete list, including completion of all data columns, including dates on which submittals are received and returned by the VA.

C. Preconstruction Submittals: Per the appended submittal register, all preconstruction submittals shall be reviewed and approved prior to Construction kick-off.

D. Contractor is to identify Critical submittals based on items requiring long lead times and give these priority.

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E. The Contractor shall update the submittal register as submittal actions occur and maintain the submittal register at the project site until final acceptance of all work by Contracting Officer.

F. The Contractor shall submit formal monthly updates to the submittal register in electronic format. Each monthly update shall document actual submission and approval dates for each submittal.

1.5 SUBMITTAL SCHEDULING

A. Submittals are to be scheduled, submitted, reviewed, and approved prior to the acquisition of the material or equipment.

B. Coordinate scheduling, sequencing, preparing, and processing of submittals with performance of work so that work will not be delayed by submittal processing. Allow time for potential resubmittal.

C. No delay costs or time extensions will be allowed for time lost in late submittals or resubmittals.

D. All submittals are required to be approved prior to the start of the specified work activity.

1.6 SUBMITTAL PREPARATION

A. Each submittal is to be complete and in sufficient detail to allow ready determination of compliance with contract requirements.

B. Collect required data for each specific material, product, unit of work, or system into a single submittal. Prominently mark choices, options, and portions applicable to the submittal. Partial submittals will not be accepted for expedition of construction effort. Submittal will be returned without review if incomplete.

C. If available product data is incomplete, provide Contractor-prepared documentation to supplement product data and satisfy submittal requirements.

D. All irrelevant or unnecessary data shall be removed from the submittal to facilitate accuracy and timely processing. Submittals that contain the excessive amount of irrelevant or unnecessary data will be returned without review.

E. Provide a transmittal form for each submittal with the following information:
   1. Project title, location and number.
   2. Construction contract number.
   3. Date of the drawings and revisions.
   4. Name, address, and telephone number of subcontractor, supplier, manufacturer, and any other subcontractor associated with the submittal.
   5. List paragraph number of the specification section and sheet number of the contract drawings by which the submittal is required.
   6. Do not include or submit items not required to be submitted by Contract Documents.
   7. When a resubmission, add alphabetic suffix on submittal description. For example, submittal 18 would become 18A, to indicate resubmission.
   8. Product identification and location in project.
   9. Arrange submittals by specification section:
      a. Submittals shall include items from one specification section only.
      b. Submit Shop Drawings, Product Data, and Project Information (except for Field Test Reports) items specified in a section at same time for a complete review.
         1) Shop Drawings: Individual submittal item. Subparagraphs represent description of items to include.
            a) Indicate additional submittals that will be generated as result of dividing required submittal by building, floor, area of a floor, or other subdivision.
         2) Product Data: Individual submittal item. Subparagraphs represent description of items to include as part of single submittal.
         3) Sample and Information submittals: Each subparagraph represents an individual submittal item
   10. Indicate submittal number in space provided on Submittal Transmittal form. Following submittal numbering system shall be used:
      a. Identify each submittal using applicable 6 digit specification section number from Contract Documents.
      b. After section number, indicate sequence number. First submittal of section series would be numbered “## ## ##-1, next would be “## ## ##-2, etc.
      c. If returned for re-submission, add a designation character. Second submission would be “## ## ##-1A”, third would be “## ## ##-1B”, etc
   11. Submit all submittals required by a section at same time which are needed for a complete review, except Contract Closeout Information Submittals, and Shop Drawing submittals divided by building area, such as; structural steel, reinforcing steel, HVAC ductwork, etc.
   12. Do not submit large quantities of submittals at one time.
   13. Schedule Contract Closeout Information submittals during last quarter of construction period and prior to Substantial Completion

F. The Contractor is responsible for reviewing and certifying that all submittals are in compliance with contract requirements before submitting for VA review. Proposed deviations from the contract requirements are to be clearly identified. All deviations submitted must include a side by side comparison of item being proposed against item specified. Failure to point out deviations will result in the VA requiring removal and replacement of such work at the Contractor's expense.

G. Stamp, sign, and date each submittal transmittal form indicating action taken.

H. Stamp used by the Contractor on the submittal transmittal form to certify that the submittal meets contract requirements is to be similar to the following:

CONTRACTOR
(Firm Name)
_____Approved
_____Approved with corrections as noted on submittal data and/or attached sheets(s)
SIGNATURE: _____
TITLE: _____
DATE: _____

1.7 SUBMITTAL FORMAT AND TRANSMISSION

A. Provide submittals in electronic format, with the exception of material samples. Use PDF as the electronic format, unless otherwise specified or directed by the Contracting Officer.

B. Compile the electronic submittal file as a single, complete document. Name the electronic submittal file specifically according to its contents.

C. Electronic files must be of sufficient quality that all information is legible. Generate PDF files from original documents so that the text included in the PDF file is both searchable and can be copied. If documents are scanned, Optical Character Resolution (OCR) routines are required.

D. All documents (submittals and RFI) shall be sent through an electronic FTP file sharing system. Confirm that the electronic submittal file sharing system can be accessed from the VA computer network. The Contractor is responsible for setting up, providing, and maintaining the electronic submittal file sharing system for the construction contract period of performance.

E. Autodesk build shall be provided by VHA. It shall be used as the project management tool for this project. All RFIs, Specs, DWGs, Submittal reviews, etc shall be performed on this platform.

F. Provide hard copies of submittals when requested by the Contracting Officer. Up to 3 additional hard copies of any submittal may be requested at the discretion of the Contracting Officer, at no additional cost to the VA.

1.8 RFI PREPARATION AND SUBMISSION

A. Review of Contract Documents and Field Conditions:
   1. Before starting each portion of Work, Contractor shall carefully study and compare various Drawings, Specifications and other Contract Documents, coordination drawings, shop drawings, prior correspondence or documentation relative to that portion of Work, as well as information furnished by COR.
   2. Contractor and Subcontractors shall evaluate and take field measurements of conditions related to that portion of Work and shall observe any conditions at site affecting it.
   3. These obligations are for purpose of facilitating coordination and construction by Contractor and are not for purpose of discovering errors, omissions, or inconsistencies in Contract Documents.
   4. Contractor and subcontractors acknowledge that all documents pertaining to Work has been examined, have examined character of site and any existing conditions, and are satisfied with nature of Work, and other matters which can affect Work.
   5. In event of inconsistency between portions of Contract Documents or within Contract Documents; provide better quality or greater quantity of Work, and comply with more stringent requirement, either or both in accordance with COR's interpretation.
   6. Report errors, inconsistencies or omissions discovered in Contract Documents promptly to COR as a properly prepared and timely RFI.
   7. Contractor and Subcontractors are not required to ascertain Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, and rules and regulations, unless they bear upon construction means, methods, techniques or safety and health precautions, but the Contractor shall promptly report to COR any nonconformity discovered by or made known to Contractor as a RFI.
   8. On condition that Contractor or Subcontractor fail to give such notice, and knowingly proceeds with Work affected by errors or omissions in Contract Documents, Contractor shall correct any such errors, inconsistencies, or omissions at no additional cost.
   9. Prior to bid, Contractor shall review existing facilities related to this contract and shall be familiar with utility requirements and construction.
      a. Existing facility documents may be available through COR for review.
      b. Perform preliminary investigations as required to ascertain extent of Work.
      c. Conditions which would be apparent by such investigation will not be allowed as cause for claims for extra costs.

B. Contractor's and Subcontractor's Responsibilities:
   1. Process request through Contractor when interpretation, clarification or explanation of portion of Construction Documents is needed by Contractor, Subcontractor, Vendor or Supplier.
      a. Review request for completeness, quality, proper referencing to drawing or specification section and reason submitted.
      b. In event request is not acceptable return to submitter with comments regarding reason for being returned.
      c. Make every attempt to validate, resolve or respond to RFI by thoroughly researching and reviewing Contract Documents and field conditions.
      d. Respond to RFI accordingly if review of RFI discloses a response or is related to coordination of construction or other issue not related to Contract Documents.
      e. If request is unclear, rewrite and state in clear, concise, correct, complete and easily understood manner.
         1) Include additional information if necessary, and submit to COR for response.
   2. Submit request for interpretation, clarification or explanation of Contract Documents to COR through Contractor.
      a. List specific Contract Documents researched when seeking information being requested.
      b. Reference applicable Contract Drawings by sheet number, section, detail, room number, door number, etc., Specifications by section and paragraph number, and reference other relevant documents.

c. The field titled "Regarding" on RFI form must be clear for future reference in reports or correspondence.
d. Clearly state request and provide Contract Document references and any additional information needed so request can be fully understood, including sketches, photos or other reference material.
e. Fully assess issues, suggest any reasonable solutions and include various factors, including potential costs, schedule impacts, if any, and recommendations which will aid in determining a solution or response.
   1) In event a reasonable solution can not be suggested, a statement to that effect should be so stated.
f. Indicate reason request is being submitted.
g. Clearly indicate critical RFI's requiring a rapid response with an explanation as to why RFI is critical.
h. Indicate priority for responses when multiple RFI's are submitted within short period of time.

3. Distribute copies of responses to RFI's to all parties affected.
4. Response to RFI shall not be considered a notice to proceed with a change that may revise the Contract Sum or Contract Time, unless authorized by the Contract Officer in writing.
5. In event response to RFI is determined incomplete, resubmit with explanation for unacceptability of response and necessary additional information within five (5) days of receipt to RFI response.

C. RFI Submittal Process:
1. Insert entire question or requested information in "Request" portion of RFI form to include costs, schedule impact and contractors recommended solution.
2. Electronic file of sketches, photos or other pertinent information shall be included with a RFI request to clarify request.
3. Assign a unique RFI number in sequential order (1, 2, 3, 4, etc.).
4. In event previously submitted RFI request requires revision to provide additional information, initiate a new RFI.
5. New RFI shall be renumbered with previous submitted RFI proceeded by ".1 IN to indicate revision one of RFI (i.e.: RFI No. 34.1 for revision 1 to RFI No. 34).

1.9 COORDINATION DRAWINGS

A. Prepare coordination drawings where careful coordination is needed for installation of products and materials fabricated by separate entities.

B. Prepare coordination drawings where limited space availability necessitates maximum utilization of space for efficient installation of different components.

C. Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.

D. Work out all "tight" conditions involving Work of various Sections in advance of installation.

E. Sleeve, core drill and block out layout drawings:
1. Drawings showing proposed locations and sizes of sleeves, core drills block outs, and embedded items in concrete walls, columns, floors and beams.

F. Prior to start of work in any given area, each Subcontractor approve, in writing, coordination drawings affecting Subcontractor's work in that area.

G. Modifications required as result of failure to resolve interferences, provide correct coordination drawings, or call attention to changes required in other work as result of modifications shall be paid for by responsible Subcontractor.

H. Coordination meetings scheduled by Contractor, with all affected Subcontractors.

I. Production of Coordination Drawings:

1. Contractor provide minimum 1:50 1/4 IN scale plan, elevation and section drawings unless noted otherwise, showing:
   a. Partitions.
   b. Fire/smoke rated barriers.
   c. Ceiling heights.
   d. Structural framing locations and elevations.
   e. Column lines.
   f. Support systems.
   g. Other work.
   h. Existing obstructions.
2. Subcontractors produce combined coordination layout drawings plan and sections of HVAC ductwork, hydronic, steam, condensate, fuel oil, fire protection piping, plumbing, special water systems, natural gas and medical gas systems electrical cable tray, conduit, conveying systems, equipment, and other work.
3. Resolve major interferences at initial coordination meeting prior to production of any drawings.
4. Produce initial coordination drawings within 30 days after initial meeting.
5. Contractor arrange for production of said drawings not provided by that time.
6. Meet as required to resolve interferences and correct drawings.

J. After Approval:
1. After Subcontractors' written approval of coordination drawings, Contractor determine method used to resolve interferences not previously identified.
2. Contractor give written approval of changes to coordination drawings prior to start of work in affected area.
3. Maintain one copy of current approved Coordination Drawings at project site.

K. Precedence Of Services For Coordination Drawings:
1. In event of conflicts involving location and layout of work; use following priority to resolve disputes:
   a. Structure and partitions have highest priority.
   b. Equipment location and access.
   c. Support systems
   d. Ceiling system and recessed light fixtures.
   e. Gravity drainage lines.
   f. High pressure ductwork and devices.
   g. Large pipe mains, valves and devices.
   h. Pneumatic tube and material conveying systems.
   i. Low pressure ductwork, diffusers, registers, grilles, HVAC equipment.
   j. Fire protection piping, devices and heads.
   k. Small piping, tubing, electrical conduit, and devices.
      1) Conduits installed in corridors shall be maintained at least 9 IN above finished ceiling. Conduits shall be grouped within a 12 IN width.
      2) The space utilized for conduit shall be selected to allow access to all devices which normally require adjustment, repair, resetting, etc.
   l. Sleeves through rated partitions.
   m. Access panels.

1.10 SAMPLES

A. Submit two sets of physical samples showing range of variation, for each required item.

B. Where samples are specified for selection of color, finish, pattern, or texture, submit the full set of available choices for the material or product specified.

C. When color, texture, or pattern is specified by naming a particular manufacturer and style, include one sample of that manufacturer and style, for comparison.

D. Before submitting samples, the Contractor is to ensure that the materials or equipment will be available in quantities required in the project. No change or substitution will be permitted after a sample has been approved.

E. The VA reserves the right to disapprove any material or equipment which previously has proven unsatisfactory in service.

F. Physical samples supplied maybe requested back for use in the project after reviewed and approved.

1.11 OPERATION AND MAINTENANCE DATA

A. Submit data specified for a given item within 30 calendar days after the item is delivered to the contract site.

B. In the event the Contractor fails to deliver O&M Data within the time limits specified, the Contracting Officer may withhold from progress payments 50 percent of the price of the item with which such O&M Data are applicable.

1.12 TEST REPORTS

A. COR may require specific test after work has been installed or completed which could require contractor to repair test area at no additional cost to contract.

1.13 VA REVIEW OF SUBMITTALS AND RFIS

A. The VA will review all submittals for compliance with the technical requirements of the contract documents. The Architect-Engineer for this project will assist the VA in reviewing all submittals and determining contractual compliance. Review will be only for conformance with the applicable codes, standards and contract requirements.

B. Period of review for submittals begins when the VA COR receives submittal from the Contractor.

C. Period of review for each resubmittal is the same as for initial submittal.

D. VA review period is 21 calendar days for submittals.

E. VA review period is 21 calendar days for RFIs.

F. The VA will return submittals to the Contractor with the following notations:
1. "Approved": authorizes the Contractor to proceed with the work covered.
2. "Approved as noted": authorizes the Contractor to proceed with the work covered provided the Contractor incorporates the noted comments and makes the noted corrections.
3. "Disapproved, revise and resubmit": indicates noncompliance with the contract requirements or that submittal is incomplete. Resubmit with appropriate changes and corrections. No work shall proceed for this item until resubmittal is approved.
4. "Not reviewed": indicates submittal does not have evidence of being reviewed and approved by Contractor or is not complete. A submittal marked "not reviewed" will be returned with an explanation of the reason it is not reviewed. Resubmit submittals after taking appropriate action.

1.14 APPROVED SUBMITTALS

A. The VA approval of submittals is not to be construed as a complete check, and indicates only that the general method of construction, materials, detailing, and other information are satisfactory.

B. VA approval of a submittal does not relieve the Contractor of the responsibility for any error which may exist. The Contractor is responsible for fully complying with all contract requirements and the satisfactory construction of all work, including the need to check, confirm, and coordinate the work of all subcontractors for the project. Non-compliant material incorporated in the work will be removed and replaced at the Contractor's expense.

C. After submittals have been approved, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

D. Retain a copy of all approved submittals at project site, including approved samples.

1.15 WITHHOLDING OF PAYMENT

A. Payment for materials incorporated in the work will not be made if required approvals have not been obtained.

1.16 PROJECT MANAGEMENT TOOL

- - - E N D - - -

SECTION 01 33 24

ELECTRONIC SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies requirements for provision and use of an electronic, web-based service for submittal and tracking of construction submittals for the Project.

1.2 RELATED WORK

A. Additional submittal requirements: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

1.3 SUMMARY

A. The intent of electronic submittals is to expedite the construction process by reducing paperwork, improving information flow, and decreasing turnaround time.

B. Shop drawing and product data submittals shall be transmitted to COR in electronic (PDF) format using a web-based service designed specifically for transmitting and tracking submittals between construction team members.

C. The electronic submittal process is not intended for color samples, color charts, or physical material samples.

1.4 GENERAL DESCRIPTION OF PROCEDURES

A. Submittal Preparation - Contractor may use any or all of the following options:
   1. Subcontractors and Suppliers provide electronic (PDF) submittals to Contractor via the electronic submittal website.
   2. Subcontractors and Suppliers provide paper submittals to General Contractor who electronically scans and converts to PDF format.
      a. General Contractor shall perform Optical Character Resolution (OCR) routines as required by Section 01 33 23 1.6 C.
   3. Subcontractors and Suppliers provide paper submittals to Scanning Service which electronically scans and converts to PDF format.
      a. Scanning Service shall perform Optical Character Resolution (OCR) routines as required by Section 01 33 23 1.6 C.

B. Contractor shall review, comment, and apply electronic stamp certifying that the submittal (as noted) complies with the requirements of the Contract Documents including verification of manufacturer / product, dimensions and coordination of information with other parts of the work.

C. Contractor shall transmit each submittal to Architect and COR (simultaneously) using the web-based electronic submittal service.

D. Architect / Engineer review comments will be made available on web-based electronic submittal service. COR shall receive email notice of completed review.

E. COR review comments will be made available on web-based electronic submittal service. Contractor shall receive email notice of completed review.

F. Distribution of reviewed submittals to subcontractors and suppliers is the responsibility of the Contractor.

1.5 REQUIREMENTS AND RESPONSIBILITIES

A. Electronic Submittal Service shall provide:

1. Web-based tracking and approval system.
2. Automated email notice for new submittals and reminders for submittals approaching the review deadline.
3. Tracking and exchange of ITC/RFI/CO's and other similar document as well as product and equipment submittals.
4. Means for tracking of the status such documents including whether they have been approved and released by the Owner.
5. Organized storage of submittals that is accessible for review by the designated construction team members at any time.
6. Submit a complete set of submittal on CD to the Owner at the end of the Project. Include all submittals included product submittals, shop drawings, ITC/RFI/CO's and other similar submittals.

B. Contractor responsibilities:
1. Training in the use of the service by the team members shall be at the option of the Contractor and, if chosen, shall be paid by the Contractor.
2. Contractor shall have or obtain required hardware and software: Internet Service and Equipment Requirements:
3. Email address and Internet access at Contractor's main office.
4. Adobe Acrobat (www.adobe.com), Bluebeam PDF Revu (www.bluebeam.com), or other similar PDF review software for applying electronic stamps and comments.
5. Contractor shall prepare or have prepared all required submittals in the PDF format required.
6. PDF files must be readable. As a general rule, a resolution of 300 dpi should be used.
7. If the Architect can download more readable product data directly from the manufacturer's website than was submitted by the Contractor, the Architect shall reserve the right to reject the submittal.
8. Other responsibilities for submittals shall be as described in Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
9. Color samples, color charts, or physical material samples shall be submitted as described in Section 01 33 23.

PART 2 - PRODUCTS

2.1 ACCEPTABLE SERVICES

A. Submittal Exchange®, Autodesk Build® and/or ProCore® or approved equal for the duration of the contract.

B. Substitutions must be submitted with Contractor Bid.

PART 3 - NOT USED

- - - END - - -

SECTION 01 35 26
SAFETY REQUIREMENTS

1.1 APPLICABLE PUBLICATIONS:

A. Latest publications listed below form part of this Article to extent referenced. Publications are referenced in text by basic designations only.

B. American Society of Safety Professionals (ASSP):
A10.1-2011 ..... Pre-Project & Pre-Task Safety and Health Planning

A10.34-2012 ..... Protection of the Public on or Adjacent to Construction Sites

A10.38-2013 ..... Basic Elements of an Employer's Program to Provide a Safe and Healthful Work Environment American National Standard Construction and Demolition Operations

Z359.0-2012 ..... Definitions and Nomenclature Used for Fall Protection and Fall Arrest

Z359.1-2016 ..... The Fall Protection Code

C. American Society for Testing and Materials (ASTM):
E84-2013 ..... Surface Burning Characteristics of Building Materials

D. The Facilities Guidelines Institute (FGI):
FGI Guidelines-2010Guidelines for Design and Construction of Healthcare Facilities

E. National Fire Protection Association (NFPA):
10-2018 ..... Standard for Portable Fire Extinguishers

30-2018 ..... Flammable and Combustible Liquids Code

51B-2019 ..... Standard for Fire Prevention During Welding, Cutting and Other Hot Work

70-2020 ..... National Electrical Code

70B-2019 ..... Recommended Practice for Electrical Equipment Maintenance

70E-2018 ..... Standard for Electrical Safety in the Workplace

241-2019 ..... Standard for Safeguarding Construction, Alteration, and Demolition Operations

703-2024 ..... Standard for Fire Retardant–Treated Wood and Fire-Retardant Coatings for Building Materials

F. The Joint Commission (TJC)
TJC Manual ..... Comprehensive Accreditation and Certification Manual

G. U.S. Nuclear Regulatory Commission
10 CFR 20 ..... Standards for Protection Against Radiation

H. U.S. Occupational Safety and Health Administration (OSHA):
29 CFR 1904 ..... Reporting and Recording Injuries & Illnesses

29 CFR 1910 ..... Safety and Health Regulations for General Industry

29 CFR 1926 ..... Safety and Health Regulations for Construction Industry

CPL 2-0.124 ..... Multi-Employer Citation Policy

I. US Army Corps of Engineers Safety and Occupational Health (SOH) Requirements Publication No. EM 385-1-1, 2024 edition

1.2 DEFINITIONS:

A. Critical Lift. A lift with the hoisted load exceeding 75% of the crane's maximum capacity; lifts made out of the view of the operator (blind picks); lifts involving two or more cranes; personnel being hoisted; and special hazards such as lifts over occupied facilities, loads lifted close to power-lines, and lifts in high winds or where other adverse environmental conditions exist; and any lift which the crane operator believes is critical.

B. OSHA "Competent Person" (CP). One who is capable of identifying existing and predictable hazards in the surroundings and working conditions which are unsanitary, hazardous or dangerous to employees, and who has the authorization to take prompt corrective measures to eliminate them (see 29 CFR 1926.32(f)).

C. Competent Person, Confined Space

The CP, Confined Space, is a person meeting the competent person requirements as defined EM 385-1-1 Appendix Q, with thorough knowledge of OSHA's Confined Space Standard, 29 CFR 1910.146, and designated in writing to be responsible for the immediate supervision, implementation and monitoring of the confined space program, who through training, knowledge and experience in confined space entry is capable of identifying, evaluating and addressing existing and potential confined space hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

D. Competent Person, Cranes and Rigging.

The CP, Cranes and Rigging, as defined in EM 385-1-1 Appendix Q, is a person meeting the competent person, who has been designated in writing to be responsible for the immediate supervision, implementation and monitoring of the Crane and Rigging Program, who through training, knowledge and experience in crane and rigging is capable of identifying, evaluating and addressing existing and potential hazards and, who has the authority to take prompt corrective measures regarding such hazards.

E. Competent Person, Excavation/Trenching.

A CP, Excavation/Trenching, is a person meeting the competent person requirements as defined in EM 385-1-1 Appendix Q and 29 CFR 1926, who has been designated in writing to be responsible for the immediate supervision, implementation and monitoring of the excavation/trenching program, who through training, knowledge and experience in excavation/trenching is capable of identifying, evaluating and addressing existing and potential hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

F. Competent Person, Fall Protection

The CP, Fall Protection, is a person meeting the competent person requirements as defined in EM 385-1-1 Appendix Q and in accordance with ASSE/SAFE Z359.0, who has been designated in writing by the employer to be responsible for immediate supervising, implementing and monitoring of the fall protection program, who through training, knowledge and experience in fall protection and rescue systems and equipment, is capable of identifying, evaluating and addressing existing and potential fall hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

G. Competent Person, Scaffolding

The CP, Scaffolding is a person meeting the competent person requirements in EM 385-1-1 Appendix Q and designated in writing by the employer to be responsible for immediate supervising, implementing and monitoring of the scaffolding program. The CP for Scaffolding has enough training, knowledge and experience in scaffolding to correctly identify, evaluate and address existing and potential hazards and has the authority to take prompt corrective measures with regard to these hazards. CP qualifications must be documented and include experience on the specific scaffolding systems/types being used, assessment of the base material that the scaffold will be erected upon, load calculations for materials and personnel,

and erection and dismantling. The CP for scaffolding must have a documented, minimum of 8-hours of scaffold training to include training on the specific type of scaffold being used (e.g. mast-climbing, adjustable, tubular frame), in accordance with EM 385-1-1 Section 22.B.02.

H. Competent Person (CP) Trainer

A competent person trainer as defined in EM 385-1-1 Appendix Q, who is qualified in the material presented, and who possesses a working knowledge of applicable technical regulations, standards, equipment and systems related to the subject matter on which they are training Competent Persons. A competent person trainer must be familiar with the typical hazards and the equipment used in the industry they are instructing. The training provided by the competent person trainer must be appropriate to that specific industry. The competent person trainer must evaluate the knowledge and skills of the competent persons as part of the training process.

I. High Risk Activities

High Risk Activities are activities that involve work at heights, crane and rigging, excavations and trenching, scaffolding, electrical work, and confined space entry.

J. "Qualified Person" means one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training and experience, has successfully demonstrated his ability to solve or resolve problems relating to the subject matter, the work, or the project.

K. Qualified Person, Fall Protection (QP for FP)

A QP for FP is a person meeting the requirements of EM 385-1-1 Appendix Q, and ASSE/SAFE Z359.0, with a recognized degree or professional certificate and with extensive knowledge, training and experience in the fall protection and rescue field who is capable of designing, analyzing, and evaluating and specifying fall protection and rescue systems.

L. USACE Property and Equipment

Interpret "USACE" property and equipment specified in USACE EM 385-1-1 as Government property and equipment.

M. High Visibility Accident. Any mishap which may generate publicity or high visibility.

N. Mishap: Mishap in this specification is defined according to the EM 385-1-1. A mishap is any unplanned, undesired event that occurs during the course of work being performed. This includes accidents, incidents, and near misses.

O. Mishap Criticality Categories
1. No impact/Near-Miss – near miss incidents that shall be investigated and reported to the VA within 24 hours.
2. Minor incident/impact – incidents that require first aid or result in minor equipment damage (less than $5000). These incidents must be investigated and reported to the VA within 24 hours.
3. Moderate incident/impact – Any work-related injury or illness that results in any of the following. These incidents must be investigated and are required to be reported to the VA within 2 hours.
   a. Days away from work (any time lost after day of injury/illness onset);
   b. Restricted work;
   c. Transfer to another job;
   d. Medical treatment beyond first aid;
   e. Loss of consciousness;
   f. A significant injury or illness diagnosed by a physician or other licensed health care professional, even if it did not result in (1) through (5) above or,
   g. any incident that leads to major equipment damage (greater than $5000).
4. Major incident/impact – Any mishap that leads to fatalities, hospitalizations, amputations, and losses of an eye as a result of contractors' activities. Or any incident which leads to

major property damage (greater than $20,000) and/or may generate publicity or high visibility. These incidents must be investigated and are required to be reported to the VA as soon as practical, but not later than 2 hours after the incident.

P. Load Handling Equipment (LHE)

LHE is a term used to describe cranes, hoists and all other hoisting equipment (hoisting equipment means equipment, including crane, derricks, hoists and power operated equipment used with rigging to raise, lower or horizontally move a load).

Q. Medical Treatment. Treatment administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment even through provided by physician or registered personnel.

1.3 SUBMITTAL REQUIRMENTS:

A. Government approval or concurrence is required for submittals with a "G" designation; submittals not having a "G" designation are submitted for information only.

B. Preconstruction Submittals
1. Accident Prevention Plan (APP); G

C. Reports
1. Monthly Contractor Health Safety and Environmental (HS&E) Performance Report; G
2. Notifications and Reports;
3. Mishap Reports;
4. Near-Miss Reports;
5. LHE Inspection Reports
6. Monthly Exposure Hour Reports;

D. Work Plans
1. Standard Lift Plan; G
2. Critical Lift Plan; G
3. Activity Hazard Analysis (AHA); G
4. Confined Space Entry Permit
5. Hot Work Permit
6. Radiography Operation Planning Work Sheet; G
7. Portable Gauge Operations Planning Worksheet; G

E. Certificates
1. Contractor Safety Self-Evaluation Checklist
2. Crane Operators/Riggers Certifications; G
3. Certificate of Compliance
4. Mobile Cranes Inspection Certificate
5. License Certificates
6. Machinery & Mechanized Equipment Certification Form

1.4 REGULATORY REQUIREMENTS:

A. In addition to the detailed requirements included in the provisions of this contract, comply with the most recent edition of USACE EM 385-1-1, comply with 29 CFR 1926, comply with 29 CFR 1910 as incorporated by reference within 29 CFR 1926, comply with ASSP A10.34, and all applicable federal, state, and local laws, ordinances, criteria, rules and regulations. Submit matters of interpretation of standards for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements govern except with specific approval and acceptance by the Contracting Officer Representative.

1.5 ACCIDENT PREVENTION PLAN (APP):

A. The APP (aka Construction Safety & Health Plan) shall interface with the Contractor's overall safety and health program. Include any portions of the Contractor's overall safety and health

program referenced in the APP in the applicable APP element and ensure it is site-specific. The Government considers the Prime Contractor to be the "controlling authority" for all worksite safety and health of each subcontractor(s). Contractors are responsible for informing their subcontractors of the safety provisions under the terms of the contract and the penalties for noncompliance, coordinating the work to prevent one craft from interfering with or creating hazardous working conditions for other crafts, and inspecting subcontractor operations to ensure that Mishap prevention responsibilities are being carried out.

B. The APP shall be prepared as follows:
   1. Written in English by a qualified person who is employed by the Prime Contractor articulating the specific work and hazards pertaining to the contract. Specifically articulating the safety requirements found within these VA contract safety specifications and the latest version of the United States Army Corps of Engineers – Safety and Occupational Health (SOH) Requirements - EM 385-1-1 Manual. Model language and format can be found in Appendix A of the EM 385-1-1 Manual
   2. Address both the Prime Contractors and the subcontractors work operations.
   3. State measures to be taken to control hazards associated with materials, services, or equipment provided by suppliers.
   4. Address all the elements/sub-elements and in order as follows:
      a. SIGNATURE SHEET. Title, signature, and phone number of the following:
         1) 1) Plan preparer (Qualified Person such as corporate safety staff person or contracted Certified Safety Professional with construction safety experience);
         2) 2) Plan approver (company/corporate officers authorized to obligate the company);
         3) 3) Plan concurrence (e.g., Chief of Operations, Corporate Chief of Safety, Corporate Industrial Hygienist, project manager or superintendent, project safety professional). Provide concurrence of other applicable corporate and project personnel (Contractor).
      b. **BACKGROUND INFORMATION**. List the following:
         1) Contractor;
         2) Contract number;
         3) Project name;
         4) Brief project description, description of work to be performed, and location; phases of work anticipated (these will require an AHA).
      c. **STATEMENT OF SAFETY AND HEALTH POLICY**. Provide a copy of current corporate/company Safety and Health Policy Statement, detailing commitment to providing a safe and healthful workplace for all employees. The Contractor's written safety program goals, objectives, and accident experience goals for this contract should be provided. The Statement of Safety and Health Policy must be signed by a company executive.
      d. **RESPONSIBILITIES AND LINES OF AUTHORITIES**. Provide the following:
         1) A statement of the employer's ultimate responsibility for the implementation of his SOH program;
         2) Identification and accountability of personnel responsible for safety at both corporate and project level. Contracts specifically requiring safety or industrial hygiene personnel shall include a copy of their resumes.
         3) The names of Competent and/or Qualified Person(s) and proof of competency/qualification to meet specific OSHA or EM 385-1-1 Competent/Qualified Person(s) requirements must be attached.;
         4) Requirements that no work shall be performed unless a designated competent person is present on the job site;
         5) Requirements for pre-task Activity Hazard Analysis (AHAs);
         6) Lines of authority;

7) Policies and procedures regarding noncompliance with safety requirements (to include disciplinary actions for violation of safety requirements) should be identified;

e. **SUBCONTRACTORS AND SUPPLIERS.** If applicable, provide procedures for coordinating SOH activities with other employers on the job site:
1) Identification of subcontractors and suppliers (if known);
2) Safety responsibilities of subcontractors and suppliers.

f. **TRAINING.**
1) Site-specific SOH orientation training at the time of initial hire or assignment to the project for every employee before working on the project site is required.
2) Mandatory training and certifications that are applicable to this project (e.g., explosive actuated tools, crane operator, rigger, crane signal person, fall protection, electrical lockout/NFPA 70E, machine/equipment lockout, confined space, etc.…) and any requirements for periodic retraining/recertification are required.
3) Procedures for ongoing safety and health training for supervisors and employees shall be established to address changes in site hazards/conditions.
4) OSHA 10-hour Construction Outreach training within the past five years is required for all workers on site and the OSHA 30-hour Construction Outreach training within the past five years is required for Trade Competent Persons (CPs)

g. SAFETY AND HEALTH INSPECTIONS.
1) Specific assignment of responsibilities for a minimum daily job site safety and health inspection during periods of work activity: Who will conduct (e.g., “Site Safety and Health CP”), proof of inspector’s training/qualifications, when inspections will be conducted, procedures for documentation, deficiency tracking system, and follow-up procedures.
2) Any external inspections/certifications that may be required (e.g., contracted CSP or CSHT)

h. MISHAP INVESTIGATION & REPORTING.
1) The APP shall include identify person(s) responsible to provide the following to the Contracting Officer Representative:
a) Monthly HS&E Performance Report (Exposure Hours Data);
b) Mishap investigation reports;
c) Project site injury and illness logs;
d) Near-Miss reports;

i. **PLANS (PROGRAMS, PROCEDURES) REQUIRED.** Based on a risk assessment of contracted activities and on mandatory OSHA and/or EM 385-1-1 compliance programs, the Contractor shall address all applicable occupational, patient, and public safety risks in site-specific compliance and accident prevention plans. These Plans shall include but are not limited to procedures for addressing the risks associated with the following:
1) Emergency response;
2) Contingency for severe weather;
3) Fire Prevention;
4) Medical Support;
5) Posting of emergency telephone numbers;
6) Prevention of alcohol and drug abuse;
7) Site sanitation (housekeeping, drinking water, toilets);
8) Night operations and lighting;
9) Hazard communication program;
10) Welding/Cutting “Hot” work;
11) Electrical Safe Work Practices (Electrical LOTO/NFPA 70E);
12) General Electrical Safety;

13) Hazardous energy control (LOTO);
14) Site-Specific Fall Protection & Prevention;
15) Excavation/trenching;
16) Asbestos abatement;
17) Lead abatement;
18) Crane Critical lift;
19) Respiratory protection;
20) Health hazard control program;
21) Radiation Safety Program;
22) Abrasive blasting;
23) Heat/Cold Stress Monitoring;
24) Crystalline Silica Monitoring (Assessment);
25) Demolition plan (to include engineering survey);
26) Formwork and shoring erection and removal;
27) Pre-Cast Concrete;
28) Public (Mandatory compliance with ANSI/ASSP A10.34-2012);
29) Sub-contractor or cross-trade coordination;

C. Submit the APP to the Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES 15 calendar days prior to the date of the preconstruction safety conference for acceptance. Work cannot proceed without an accepted APP.

D. Once accepted by the Contracting Officer Representative, the APP and attachments will be enforced as part of the contract. Disregarding the provisions of this contract or the accepted APP will be cause for stopping of work, at the discretion of the Contracting Officer in accordance with FAR Clause 52.236-13, Accident Prevention, until the matter has been rectified.

E. Once work begins, changes to the accepted APP shall be made with the knowledge and concurrence of the Resident Engineer, Contracting Officer Representative or Government Designated Authority. Should any severe hazard exposure, i.e. imminent danger, become evident, stop work in the area, secure the area, and develop a plan to remove the exposure and control the hazard. Notify the Resident Engineering Office and Contracting Officer within 2 hours of discovery. Eliminate/remove the hazard. In the interim, take all necessary action to restore and maintain safe working conditions to safeguard onsite personnel, visitors, the public and the environment.

1.6 ACTIVITY HAZARD ANALYSES (AHAS):

A. AHAs are also known as Job Hazard Analyses, Job Safety Analyses, and Activity Safety Analyses. Before beginning each work activity involving a type of work presenting hazards not experienced in previous project operations or where a new work crew or sub-contractor is to perform the work, the Contractor(s) performing that work activity shall prepare an AHA (Example electronic AHA forms can be found on the US Army Corps of Engineers web site)

B. AHAs shall define the activities being performed and identify the work sequences, the specific anticipated hazards, site conditions, equipment, materials, and the control measures to be implemented to eliminate or reduce each hazard to an acceptable level of risk.

C. Work shall not begin until the AHA for the work activity has been accepted by the Resident Engineer, Contracting Officer Representative or Government Designated Authority and discussed with all engaged in the activity, including the Contractor, subcontractor(s), and Government on-site representatives at preparatory and initial control phase meetings.

1. The names of the Competent/Qualified Person(s) required for a particular activity (for example, excavations, scaffolding, fall protection, other activities as specified by OSHA, EM 385-1-1, or other State and Local agencies) shall be identified and included in the AHA. Certification of their competency/qualification shall be submitted to the Government Designated Authority (GDA) for acceptance prior to the start of that work activity.

2. The AHA shall be reviewed and modified as necessary to address changing site conditions, operations, or change of competent/qualified person(s).
   a. If more than one Competent/Qualified Person is used on the AHA activity, a list of names shall be submitted as an attachment to the AHA. Those listed must be Competent/Qualified for the type of work involved in the AHA and familiar with current site safety issues.
   b. If a new Competent/Qualified Person (not on the original list) is added, the list shall be updated (an administrative action not requiring an updated AHA). The new person shall acknowledge in writing that he or she has reviewed the AHA and is familiar with current site safety issues.
3. Submit AHAs to the Contracting Officer Representative Government Designated Authority for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES for review at least 15 calendar days prior to the start of each phase. Subsequent AHAs as shall be formatted as amendments to the APP. The analysis should be used during daily inspections to ensure the implementation and effectiveness of the activity's safety and health controls.
4. The AHA list will be reviewed periodically (at least weekly) at the Contractor supervisory safety meeting and updated as necessary when procedures, scheduling, or hazards change.
5. Develop the activity hazard analyses using the project schedule as the basis for the activities performed. All activities listed on the project schedule will require an AHA. The AHAs will be developed by the contractor, supplier, or subcontractor and provided to the prime contractor for review and approval and then submitted to the Contracting Officer Representative or Government Designated Authority for review for compliance.

1.7 PRECONSTRUCTION SAFETY CONFERENCE:

A. Contractor representatives who have a responsibility or significant role in implementation of the accident prevention program, as required by 29 CFR 1926.20(b)(1), on the project shall attend the pre-construction safety conference to gain a mutual understanding of its implementation. This includes the project superintendent, subcontractor superintendents, and any other assigned safety and health professionals.

B. Discuss the details of the submitted APP to include incorporated plans, programs, procedures and a listing of anticipated AHAs that will be developed and implemented during the performance of the contract. This list of proposed AHAs will be reviewed at the conference and an agreement will be reached between the Contractor and the Contracting Officer's representative as to which phases will require an analysis. In addition, establish a schedule for the preparation, submittal, review, and acceptance of AHAs to preclude project delays.

1.8 SAFETY MEETINGS:

A. Conduct safety meetings to review past activities, plan for new or changed operations, review pertinent aspects of appropriate AHA (by trade), establish safe working procedures for anticipated hazards, and provide pertinent Safety and Occupational Health (SOH) training and motivation. Conduct meetings at least once a month for all supervisors on the project location. The SSHO, supervisors, foremen, or CDSOs must conduct meetings at least once a week for the trade workers. Document meeting minutes to include the date, persons in attendance, subjects discussed, and names of individual(s) who conducted the meeting. Maintain documentation on-site and furnish copies to the Contracting Officer on request. Notify the Contracting Officer of all scheduled meetings 7 calendar days in advance.

1.9 “SITE SAFETY AND HEALTH OFFICER” (SSHO) AND “COMPETENT PERSON” (CP):

A. The Prime Contractor shall provide a Safety oversight team that includes a minimum of one (1) person at each project site, for each shift, to function as the Site Safety and Health Officer (SSHO). The Prime Contractor shall provide a minimum of one “Full-Time” SSHO at each project site, for each shift (with no other duties) that holds as current, a professional safety

certification with at least 3 years of dedicated construction safety related experience. The SSHO shall ensure that the requirements of the VA and of 29 CFR 1926.16 are met for the project. The SSHO must be at the work site at all times, during construction activities, to implement and administer the Contractor's safety program and government-accepted Accident Prevention Plan. If the SSHO is off-site for a period longer than 8 hours, or one shift, and not exceeding 40 hours, or 5 shifts, a pre-approved Alternate Safety Officer shall be provided and shall fulfill the same roles and responsibilities as the primary SSHO. The Alternate Safety Officer shall have the required training, experience, and qualifications in accordance with EM 385-1-1 Section 01.A.17, and all associated sub-paragraphs. When the SSHO is temporarily (not to exceed 8 hours) off-site, a Designated Representative (DR) from the Prime Contractors' staff, as identified in the AHA may be used in lieu of an Alternate Safety Officer and shall be on the project site, at all times, when work is being performed. Note that the DR is a collateral duty safety position, with safety duties in addition to their full-time occupation. Each subcontractor shall designate a minimum of one CP in compliance with 29 CFR 1926.20 (b)(2) that will be identified as a CP to administer their individual safety programs.

B. Further, all specialized Competent Persons for the work crews will be supplied by the respective contractor as required by 29 CFR 1926 (i.e. Asbestos, Electrical, Cranes, & Derricks, Demolition, Fall Protection, Fire Safety/Life Safety, Ladder, Rigging, Scaffolds, and Trenches/Excavations).

C. These Competent Persons can have collateral duties as the subcontractor's superintendent and/or work crew lead persons as well as fill more than one specialized CP role (i.e. Asbestos, Electrical, Cranes, & Derricks, Demolition, Fall Protection, Fire Safety/Life Safety, Ladder, Rigging, Scaffolds, and Trenches/Excavations). However, the SSHO has be a separate qualified individual from the Prime Contractor's Superintendent and/or Quality Control Manager with duties only as the SSHO

D. The SSHO or an equally qualified Designated Representative/alternate will maintain a presence on the site during construction operations in accordance with FAR Clause 52.236-6: Superintendence by the Contractor. CPs will maintain presence during their construction activities in accordance with above mentioned clause. A listing of the designated SSHO and all known CPs shall be submitted prior to the start of work as part of the APP with the training documentation and/or AHA as listed in Section 1.8 below.

E. The repeated presence of uncontrolled hazards during a contractor's work operations will result in the designated CP as being deemed incompetent and result in the required removal of the employee in accordance with FAR Clause 52.236-5: Material and Workmanship, Paragraph (c).

1.10 TRAINING:

A. The designated Prime Contractor SSHO must meet the requirements of all applicable OSHA standards and be capable (through training, experience, and qualifications) of ensuring that the requirements of 29 CFR 1926.16 and other appropriate Federal, State and local requirements are met for the project.

B. As a minimum the SSHO must have completed the OSHA 30-hour Construction Safety Outreach class within the past five (5) years and:
   1. Seven (7) years of construction industry safety related experience.
   2. OR have a safety and health degree from an accredited university or college and five (5) years of construction industry safety related experience
   3. OR hold as current, a Certified Safety Professional (CSP) or a Construction Health and Safety Technician (CHST) certification and five (3) years of construction industry safety related experience.

C. The Alternate Safety Officer shall meet, at a minimum, the requirements of EM 385-1-1 Section 1 and have five (5) years of construction industry safety experience If the SSHO does not have a current certification, certification must be obtained within 90 days, maximum, of contract award.

D. All designated CPs shall have completed the OSHA 30-hour Construction Safety course and/or EM 385-1-1 40-hour training within the past 5 years. In addition, all CPs with high hazard work operations (such as operations involving asbestos, electrical, cranes, demolition, work at heights/fall protection, fire safety/life safety, ladder, rigging, scaffolds, and trenches/excavations) shall have a specialized formal course in the hazard recognition and control associated with those high hazard work operations. Documented “repeat” deficiencies in the execution of safety requirements will require retaking the requisite formal course.

E. All other construction workers shall have the OSHA 10-hour Construction Safety Outreach course within the past 5 years and any necessary safety training to be able to identify hazards within their work environment.

F. Submit training records associated with the above training requirements to Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES 15 calendar days prior to the date of the preconstruction safety conference for acceptance.

G. Prior to any worker for the contractor or subcontractors beginning work, they shall undergo a safety briefing provided by the SSHO or his/her designated representative. As a minimum, this briefing shall include information on the site-specific hazards, construction limits, VAMC safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of VAMC equipment, emergency procedures, accident reporting etc... Documentation shall be provided to the COR that individuals have undergone contractor’s safety briefing.

H. Ongoing safety training will be accomplished in the form of weekly documented safety meeting.

1.11 INSPECTIONS:

A. The SSHO shall conduct frequent and regular safety inspections (daily) of the site and each of the subcontractors CPs shall conduct frequent and regular safety inspections (daily) of their work operations as required by 29 CFR 1926.20(b)(2). Each week, the SSHO shall conduct a formal documented inspection with a written report of the entire construction areas with the subcontractors’ “Trade Safety and Health CPs” present in their work areas. Coordinate with, and report findings and corrective actions weekly to Contracting Officer Representative.

B. A Certified Safety Professional (CSP) with specialized knowledge in construction safety or a certified Construction Safety and Health Technician (CSHT) shall randomly conduct a monthly site safety inspection. The CSP or CSHT shall be one that is not a part of the immediate site project team. The individual can be a corporate safety professional or independently contracted who is not an immediate member of the construction project site team. The CSP or CSHT will provide their certificate number on the required report for verification as necessary.
   1. Results of the inspection will be documented with tracking of the identified hazards to abatement.
   2. The Contracting Officer Representative will be notified immediately prior to start of the inspection and invited to accompany the inspection.
   3. Identified hazard and controls will be discussed to come to a mutual understanding to ensure abatement and prevent future reoccurrence.
   4. A report of the inspection findings with status of abatement will be provided to the Contracting Officer Representative within one week of the onsite inspection.

1.12 MISHAPS, OSHA 300 LOGS, AND EXPOSURE-HOURS:

A. The prime contractor shall establish and maintain a Near-Miss and Mishap reporting, recordkeeping, and analysis system to track and analyze all injuries and illnesses, high visibility incidents, and accidental property damage (both government and contractor) that occur on site. Notify and provide an initial report to the Contracting Officer Representative as soon as practical, but no more than two hours after any Moderate or Major Mishap, High Visibility Incidents, or any weight handling and hoisting equipment mishap. No Impact/Near-Miss and Minor Mishaps shall be reported within 24 hours or as soon as practical. Within the notification the sender shall include contractor name; contract title; type of contract; name of activity,

installation or location where mishap occurred; date and time of accident; names of personnel injured; extent of property damage, if any; extent of injury, if known, and brief description of mishap (to include type of construction equipment used, PPE used, etc.). Preserve the conditions and evidence on the Mishap site until the Contracting Officer Representative determines whether a government investigation will be conducted.

B. Conduct a mishap investigation for all Mishaps including mishaps resulting in at least $20,000 in damages without injury, to establish the root cause(s) of the mishap. The Mishap investigation shall include images, 5 whys, the injured person's firsthand account, any witness accounts, methods of procedures, related AHA to the task, and corrective action plan signed by the president, vice president, or appropriate corporate-level leadership identified in the company's org chart for the project. Additionally, complete the VA Form 2162 (or equivalent) and provide the report to the Contracting Officer Representative within 7 calendar days of the accident. The Contracting Officer Representative will provide copies of any required or special forms.

C. A summation of all exposure-hours worked by the contractor and associated sub-contractors for each month will be reported to Contracting Officer Representative no later than the 10th day of the following month.

D. A summation of all Minor, Moderate, and Major incidents experienced on site by the contractor and associated sub-contractors for each month will be provided to the Contracting Officer Representative monthly. The contractor and associated sub-contractors' OSHA 300 logs will be made available to the Contracting Officer Representative upon request.

1.13 PERSONAL PROTECTIVE EQUIPMENT (PPE):

A. PPE is governed in all areas by the nature of the work the employee is performing. For example, specific PPE required for performing work on electrical equipment is identified in NFPA 70E, Standard for Electrical Safety in the Workplace.

B. Any PPE above and beyond the Mandatory PPE identified below and determined by the Contracting Officer or their Representative to be necessary in the performance of the Governments duties relative to this contract, shall be provided to the Government upon written notification by the Contracting Officer and at no additional expense to the Government. All PPE provided to the Government shall also be accompanied by any relevant or required training necessary to ensure its proper use.

C. Mandatory Minimum PPE includes:
   1. Hard Hats – unless written authorization is given by the Contracting Officer Representative in circumstances of work operations that have limited potential for falling object hazards such as during finishing work or minor remodeling. With authorization to relax the requirement of hard hats, if a worker becomes exposed to an overhead falling object hazard, then hard hats would be required in accordance with the OSHA and/or EM 385-1-1 regulations.
   2. Safety glasses - unless written authorization is given by the Contracting Officer Representative in circumstances of no eye hazards, appropriate safety glasses meeting the ANSI Z.87.1 standard must be worn by each person on site.
   3. Appropriate Safety Shoes – based on the hazards present, safety shoes meeting the requirements of ASTM F2413-11 shall be worn by each person on site unless written authorization is given by Contracting Officer Representative in circumstances of no foot hazards.
   4. Hearing protection - Use personal hearing protection at all times in designated noise hazardous areas or when performing noise hazardous tasks.
   5. High-visibility Safety Apparel – appropriate brightly colored clothing that feature some type of reflective material on them, such as safety vests, shall be worn by personnel or visitors on construction sites.

1.14 INFECTION CONTROL

A. Infection Control is critical in all medical center facilities. Interior construction activities causing disturbance of existing dust, or creating new dust, must be conducted within ventilation-controlled areas that minimize the flow of airborne particles into patient areas. Exterior construction activities causing disturbance of soil or creates dust in some other manner must be controlled.

B. An AHA associated with infection control will be performed by VA personnel in accordance with FGI Guidelines (i.e. Infection Control Risk Assessment (ICRA)). Refer to section 01 35 26.19 for Hudson Valley Health Care System's Infection Control Risk Assessment Procedure. Risk classifications of Class II or lower will require approval by the Safety Officer, or Contracting Officer Representative before beginning any construction work. Risk classifications of Class III or higher will require a permit before beginning any construction work. Infection Control permits will be issued by the Contracting Officer Representative The Infection Control Permits will be posted outside the appropriate construction area. More than one permit may be issued for a construction project if the work is located in separate areas requiring separate classes. The primary project scope area for this project is: Class III however, work outside the primary project scope area may vary. The required infection control precautions with each class are as follows:

1. Class I requirements:
   a. During Construction Work:
      1) Notify the Facility Safety Officer, or Contracting Officer Representative Execute work by methods to minimize raising dust from construction operations.
      2) Ceiling tiles: Immediately replace a ceiling tiles displaced for visual inspection.
   b. Upon Completion:
      1) Clean work area upon completion of task
      2) Notify the Facility Safety Officer, or Contracting Officer Representative
2. Class II requirements:
   a. During Construction Work:
      1) Notify the Facility Safety Officer, or Contracting Officer Representative
      2) Provide active means to prevent airborne dust from dispersing into atmosphere such as wet methods or tool mounted dust collectors where possible.
      3) Water mist work surfaces to control dust while cutting.
      4) Seal unused doors with duct tape.
      5) Block off and seal air vents.
      6) Remove or isolate HVAC system in areas where work is being performed.
   b. Upon Completion:
      1) Wipe work surfaces with cleaner/disinfectant.
      2) Contain construction waste before transport in tightly covered containers.
      3) Wet mop and/or vacuum with HEPA filtered vacuum before leaving work area.
      4) Upon completion, restore HVAC system where work was performed
      5) Notify the Facility Safety Officer, or Contracting Officer Representative
3. Class III requirements:
   a. During Construction Work:
      1) Obtain permit from the Facility Safety Officer, or Contracting Officer Representative
      2) Remove or Isolate HVAC system in area where work is being done to prevent contamination of duct system.
      3) Complete all critical barriers i.e. sheetrock, plywood, plastic, to seal area from non-work area or implement control cube method (cart with plastic covering and sealed connection to work site with HEPA vacuum for vacuuming prior to exit) before construction begins. Install construction barriers and ceiling protection carefully, outside of normal work hours.

4) Maintain negative air pressure, 0.03 inches of water gauge, within work site utilizing HEPA equipped air filtration units and continuously monitored with a digital display, recording and alarm instrument, which must be calibrated on installation, maintained with periodic calibration and monitored by the contractor.
5) Contain construction waste before transport in tightly covered containers.
6) Cover transport receptacles or carts. Tape covering unless solid lid.

b. Upon Completion:
1) Do not remove barriers from work area until completed project is inspected by the Facility Safety Officer, or Contracting Officer Representative and thoroughly cleaned by the VA Environmental Services Department.
2) Remove construction barriers and ceiling protection carefully to minimize spreading of dirt and debris associated with construction, outside of normal work hours.
3) Vacuum work area with HEPA filtered vacuums.
4) Wet mop area with cleaner/disinfectant.
5) Upon completion, restore HVAC system where work was performed.
6) Return permit to the Facility Safety Officer, or Contracting Officer Representative.

4. Class IV requirements:

a. During Construction Work:
1) Obtain permit from the Facility Safety Officer, or Contracting Officer Representative.
2) Isolate HVAC system in area where work is being done to prevent contamination of duct system.
3) Complete all critical barriers i.e. sheetrock, plywood, plastic, to seal area from non-work area or implement control cube method (cart with plastic covering and sealed connection to work site with HEPA vacuum for vacuuming prior to exit) before construction begins. Install construction barriers and ceiling protection carefully, outside of normal work hours.
4) Maintain negative air pressure, 0.03 inches of water gauge, within work site utilizing HEPA equipped air filtration units and continuously monitored with a digital display, recording and alarm instrument, which must be calibrated on installation, maintained with periodic calibration and monitored by the contractor.
5) Seal holes, pipes, conduits, and punctures.
6) Construct anteroom and require all personnel to pass through this room so they can be vacuumed using a HEPA vacuum cleaner before leaving work site or they can wear cloth or paper coveralls that are removed each time they leave work site.
7) All personnel entering work site are required to wear shoe covers. Shoe covers must be changed each time the worker exits the work area.

b. Upon Completion:
1) Do not remove barriers from work area until completed project is inspected by the Safety Officer, or Contracting Officer Representative with thorough cleaning by the VA Environmental Services Dept.
2) Remove construction barriers and ceiling protection carefully to minimize spreading of dirt and debris associated with construction, outside of normal work hours.
3) Contain construction waste before transport in tightly covered containers.
4) Cover transport receptacles or carts. Tape covering unless solid lid.
5) Vacuum work area with HEPA filtered vacuums.
6) Wet mop area with cleaner/disinfectant.
7) Upon completion, restore HVAC system where work was performed.
8) Return permit to the Facility Safety Officer, or Contracting Officer Representative

C. Barriers shall be erected as required based upon classification (Class III & IV requires barriers) and shall be constructed as follows:
   1. Class III and IV - closed door with masking tape applied over the frame and door is acceptable for projects that can be contained in a single room.
   2. Construction, demolition or reconstruction not capable of containment within a single room must have the following barriers erected and made presentable on hospital occupied side:
      a. Class III & IV (where dust control is the only hazard, and an agreement is reached with the Resident Engineer and Medical Center) - Airtight plastic barrier that extends from the floor to ceiling. Seams must be sealed with duct tape to prevent dust and debris from escaping
      b. Class III & IV:
         1) Drywall barrier erected with joints covered or sealed to prevent dust and debris from escaping.
         2) Telescoping modular wall panels system of gasketing aluminum frame and white aluminum panel, sound attenuating foam core, rugged galvanized steel back panels, door panels & negative air panels.
      c. Class III & IV - Seal all penetrations in existing barrier airtight
      d. Class III & IV - Barriers at penetration of ceiling envelopes, chases and ceiling spaces to stop movement air and debris
      e. Class IV only - Anteroom or double entrance openings that allow workers to remove protective clothing or vacuum off existing clothing
      f. Class III & IV - At elevators shafts or stairways within the field of construction, overlapping flap minimum of two feet wide of polyethylene enclosures for personnel access.

D. Products and Materials:
   1. Sheet Plastic: Fire retardant polystyrene, 6-mil thickness meeting local fire codes
   2. Barrier Doors: Self Closing Two-hour fire-rated solid core wood in steel frame, painted
   3. Dust proof fire-rated drywall.
   4. Telescoping modular wall panels system conforming to ASTM E-84.
   5. High Efficiency Particulate Air-Equipped filtration machine rated at 95% capture of 0.3 microns including pollen, mold spores and dust particles. HEPA filters should have ASHRAE 85 or other prefilter to extend the useful life of the HEPA. Provide both primary and secondary filtrations units. Maintenance of equipment and replacement of the HEPA filters and other filters will be in accordance with manufacturer's instructions.
   6. Exhaust Hoses: Heavy duty, flexible steel reinforced; Ventilation Blower Hose
   7. Adhesive Walk-off Mats: Provide minimum size mats of 24 inches x 36 inches
   8. Disinfectant: Hospital-approved disinfectant or equivalent product
   9. Portable Ceiling Access Module

E. Before any construction on site begins, all contractor personnel involved in the construction or renovation activity shall be educated and trained in infection prevention measures established by the medical center.

F. A dust control program will be established and maintained as part of the contractor's infection preventive measures in accordance with the FGI Guidelines for Design and Construction of Healthcare Facilities. Prior to start of work, prepare a plan detailing project-specific dust protection measures with associated product data, including periodic status reports, and submit to Facility Safety Officer and Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

G. Medical center Infection Control personnel will monitor for airborne disease (e.g. aspergillosis) during construction. A baseline of conditions will be established by the medical center prior to the start of work and periodically during the construction stage to determine impact of construction activities on indoor air quality with safe thresholds established.

H. In general, the following preventive measures shall be adopted during construction to keep down dust and prevent mold.
   1. Contractor shall verify that construction exhaust to exterior is not reintroduced to the medical center through intake vents or building openings. HEPA filtration is required where the exhaust dust may reenter the medical center.
   2. Exhaust hoses shall be exhausted so that dust is not reintroduced to the medical center.
   3. Adhesive Walk-off/Carpet Walk-off Mats shall be used at all interior transitions from the construction area to occupied medical center area. These mats shall be changed as often as required to maintain clean work areas directly outside construction area at all times.
   4. Vacuum and wet mop all transition areas from construction to the occupied medical center at the end of each workday. Vacuum shall utilize HEPA filtration. Maintain surrounding area frequently. Remove debris as it is created. Transport these outside the construction area in containers with tightly fitting lids.
   5. The contractor shall not haul debris through patient-care areas without prior approval of the Resident Engineer and the Medical Center. When, approved, debris shall be hauled in enclosed dust proof containers or wrapped in plastic and sealed with duct tape. No sharp objects should be allowed to cut through the plastic. Wipe down the exterior of the containers with a damp rag to remove dust. All equipment, tools, material, etc. transported through occupied areas shall be made free from dust and moisture by vacuuming and wipe down.
   6. There shall be no standing water during construction. This includes water in equipment drip pans and open containers within the construction areas. All accidental spills must be cleaned up and dried within 12 hours. Remove and dispose of porous materials that remain damp for more than 72 hours.
   7. At completion, remove construction barriers and ceiling protection carefully, outside of normal work hours. Vacuum and clean all surfaces free of dust after the removal.

I. Final Cleanup:
   1. Upon completion of project, or as work progresses, remove all construction debris from above ceiling, vertical shafts and utility chases that have been part of the construction.
   2. Perform HEPA vacuum cleaning of all surfaces in the construction area. This includes walls, ceilings, cabinets, furniture (built-in or free standing), partitions, flooring, etc.
   3. All new air ducts shall be cleaned prior to final inspection.

J. Exterior Construction
   1. Contractor shall verify that dust will not be introduced into the medical center through intake vents or building openings. HEPA filtration on intake vents is required where dust may be introduced.
   2. Dust created from disturbance of soil such as from vehicle movement will be wetted with use of a water truck as necessary
   3. All cutting, drilling, grinding, sanding, or disturbance of materials shall be accomplished with tools equipped with either local exhaust ventilation (i.e. vacuum systems) or wet suppression controls.

1.15 PRE-CONSTRUCTION RISK ASSESSMENT

A. Control of all construction-associated hazards that affect VA medical facilities, their occupants, services and mission-essential functions and capabilities is critical in all medical center facilities. VHA Pre-Construction Risk Assessments (PCRAs) for construction, renovation and maintenance projects are included with this contract solicitation with required mitigations of identified hazards. VHA-PCRAs will be re-validated and updated as needed based on but not limited to changes from original designs, affected individuals, areas/locations, scope, contractor means and methods, safety requirements, phasing, contractor competencies and capabilities.

B. Infection Prevention and Control is critical in all medical center facilities. Interior construction activities causing disturbance of existing dust, or creating new dust, must be conducted within ventilation-controlled areas that minimize the flow of airborne particles into patient areas. A detailed analysis of potential risks for infectious disease transmission affecting the care,

treatment or services of patients or residents has been conducted. VHA Infection Control Risk Assessments (ICRAs) are included with this contract solicitation with required mitigation actions/activities. VHA-ICRAs will be re-validated and updated as needed based on changes in original designs, affected individuals, area(s) or location(s), scope, contractor means and methods, infection prevention and control requirements, differing site conditions, phasing, contractor competencies and capabilities, and infectious disease outbreaks.

C. For work occurring at a VA medical facility, coordinate with the facility Safety Manager/Officer, as several aspects of this section directly relate to infection control risk assessments required in or adjacent to construction affecting occupied buildings accredited by The Joint Commission.

D. Products and Materials:
1. Sheet Plastic: Fire retardant polyethylene, 6-mil thickness meeting local fire codes
2. Barrier Doors: Self Closing One-hour fire-rated solid core wood in steel frame, painted
3. Dust proof one-hour fire-rated drywall
4. High Efficiency Particulate Air-Equipped filtration machine rated at 95% capture of 0.3 microns including pollen, mold spores and dust particles. HEPA filters should have ASHRAE 85 or other prefilter to extend the useful life of the HEPA. Provide both primary and secondary filtrations units. Maintenance of equipment and replacement of the HEPA filters and other filters will be in accordance with manufacturer's instructions.
5. Exhaust Hoses: Heavy duty, flexible steel reinforced; Ventilation Blower Hose
6. Adhesive Walk-off Mats: Provide minimum size mats of 24 inches x 36 inches
7. Disinfectant: EPA-registered, Hospital-approved disinfectant or equivalent product
8. Portable Ceiling Access Module

1.16 DUST CONTROL

A. Contractor shall verify that dust will not be introduced into the facility through intake vents or building openings. HEPA filtration on intake vents is required where dust may be introduced.

B. Dust created from disturbance of soil such as from vehicle movement will be wetted with use of a water truck as necessary.

C. All cutting, drilling, grinding, sanding, or disturbance of materials shall be accomplished with tools equipped with either local exhaust ventilation (i.e. vacuum systems) or wet suppression controls.

1.17 TUBERCULOSIS SCREENING

A. Contractor shall provide written certification that all contract employees assigned to the work site have had a pre-placement tuberculin screening within 90 days prior to assignment to the worksite and been found have negative TB screening reactions. Contractors shall be required to show documentation of negative TB screening reactions for any additional workers who are added after the 90-day requirement before they will be allowed to work on the work site. NOTE: This can be the Center for Disease Control (CDC) and Prevention and two-step skin testing or a Food and Drug Administration (FDA)-approved blood test.
1. Contract employees manifesting positive screening reactions to the tuberculin shall be examined according to current CDC guidelines prior to working on VHA property.
2. Subsequently, if the employee is found without evidence of active (infectious) pulmonary TB, a statement documenting examination by a physician shall be on file with the employer (construction contractor), noting that the employee with a positive tuberculin screening test is without evidence of active (infectious) pulmonary TB.
3. If the employee is found with evidence of active (infectious) pulmonary TB, the employee shall require treatment with a subsequent statement to the fact on file with the employer before being allowed to return to work on VHA property.

1.18 FIRE SAFETY

A. Fire Safety Plan: Establish and maintain a site-specific fire protection program in accordance with 29 CFR 1926. Prior to start of work, prepare a plan detailing project-specific fire safety measures, including periodic status reports, and submit to Contracting Officer Representative

for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. This plan may be an element of the Accident Prevention Plan.

B. Site and Building Access: Maintain free and unobstructed access to facility emergency services and for fire, police and other emergency response forces in accordance with NFPA 241.

C. For work occurring at a VA medical facility, coordinate with the facility Safety Manager/Officer, as several aspects of this section directly relate to interim life safety measures required in or adjacent to construction affecting occupied buildings accredited by The Joint Commission.

D. Separate temporary facilities, such as trailers, storage sheds, and dumpsters, from existing buildings and new construction by distances in accordance with NFPA 241. For small facilities with less than 6 m (20 feet) exposing overall length, separate by 3m (10 feet).

E. Temporary Construction Partitions:
   1. Install and maintain temporary construction partitions to provide smoke-tight separations between construction areas and adjoining areas. Construct partitions of gypsum board or fire-retardant treated plywood (fire-retardant treated in accordance with NFPA 703) on both sides of fire-retardant treated wood framing or metal steel studs. Extend the partitions through suspended ceilings to floor slab deck or roof. Seal joints and penetrations. At door openings, install Class C, ¾ hour fire/smoke rated doors with self-closing devices.
   2. Install one-hour fire-rated temporary construction partitions as shown on drawings to maintain integrity of existing exit stair enclosures, exit passageways, fire-rated enclosures of hazardous areas, horizontal exits, smoke barriers, vertical shafts and openings enclosures.
   3. Close openings in smoke barriers and fire-rated construction to maintain fire ratings. Seal penetrations with listed through-penetration firestop materials in accordance with Section 07 84 00, FIRESTOPPING.

F. Temporary Heating and Electrical: Install, use and maintain installations in accordance with 29 CFR 1926, NFPA 241 and NFPA 70.

G. Means of Egress: Do not block exiting for occupied buildings, including paths from exits to roads. Minimize disruptions and coordinate with Contracting Officer Representative.

H. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to Contracting Officer Representative.

I. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.

J. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.

K. Sprinklers: Install, test and activate new automatic sprinklers prior to removing existing sprinklers.

L. Existing Fire Protection: Do not impair automatic sprinklers, smoke and heat detection, and fire alarm systems, except for portions immediately under construction, and temporarily for connections. Provide fire watch for impairments more than 4 hours in a 24-hour period. Request interruptions in accordance with Article, OPERATIONS AND STORAGE AREAS, and coordinate with Contracting Officer Representative. All existing or temporary fire protection systems (fire alarms, sprinklers) located in construction areas shall be tested as coordinated with the medical center. Parameters for the testing and results of any tests performed shall be recorded by the medical center and copies provided to the Contracting Officer Representative.

M. Smoke Detectors: Prevent accidental operation. Remove temporary covers at end of work operations each day. Coordinate with Contracting Officer Representative.

N. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with Facility Safety Office . Obtain permits from facility Safety Officer at least 48 hours in advance. Designate contractor's responsible project-site fire prevention program manager to permit hot work.

O. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly. Coordinate with, and report findings and corrective actions weekly to Contracting Officer Representative.

P. Smoking: Smoking is prohibited in and adjacent to construction areas inside existing buildings and additions under construction. In separate and detached buildings under construction, smoking is prohibited except in designated smoking rest areas.

Q. Dispose of waste and debris in accordance with NFPA 241. Remove from buildings daily.

R. If required, submit documentation to the COR that personnel have been trained in the fire safety aspects of working in areas with impaired structural or compartmentalization features.

1.19 ELECTRICAL

A. All electrical work shall comply with NFPA 70 (NEC), NFPA 70B, NFPA 70E, 29 CFR Part 1910 Subpart J – General Environmental Controls, 29 CFR Part 1910 Subpart S – Electrical, and 29 CFR 1926 Subpart K in addition to other references required by contract.

B. All qualified persons performing electrical work under this contract shall be licensed journeyman or master electricians. All apprentice electricians performing under this contract shall be deemed unqualified persons unless they are working under the immediate supervision of a licensed electrician or master electrician.

C. All electrical work will be accomplished de-energized and in the Electrically Safe Work Condition (refer to NFPA 70E for Work Involving Electrical Hazards, including Exemptions to Work Permit). Any Contractor, subcontractor or temporary worker who fails to fully comply with this requirement is subject to immediate termination in accordance with FAR clause 52.236-5(c). Only in rare circumstance when achieving an electrically safe work condition prior to beginning work would increase or cause additional hazards or is infeasible due to equipment design or operational limitations is energized work permitted. Contracting Officer Representative with approval of the Medical Center Director will make the determination if the circumstances would meet the exception outlined above. An AHA and permit specific to energized work activities will be developed, reviewed, and accepted by the VA prior to the start of that activity.

1. Development of a Hazardous Electrical Energy Control Procedure is required prior to de-energization. A single Simple Lockout/Tagout Procedure for multiple work operations can only be used for work involving qualified person(s) de-energizing one set of conductors or circuit part source. Task specific Complex Lockout/Tagout Procedures are required at all other times.
2. Verification of the absence of voltage after de-energization and lockout/tagout is considered “energized electrical work” (live work) under NFPA 70E, and shall only be performed by qualified persons wearing appropriate shock protective (voltage rated) gloves and arc rate personal protective clothing and equipment, using Underwriters Laboratories (UL) tested and appropriately rated contact electrical testing instruments or equipment appropriate for the environment in which they will be used.
3. Personal Protective Equipment (PPE) and electrical testing instruments will be readily available for inspection by the Contracting Officer Representative.

D. Before beginning any electrical work, an Activity Hazard Analysis (AHA) will be conducted to include Shock Hazard and Arc Flash Hazard analyses (NFPA Tables can be used only as a last alterative and it is strongly suggested a full Arc Flash Hazard Analyses be conducted). Work shall not begin until the AHA for the work activity and permit for energized work has been reviewed and accepted by the Contracting Officer Representative and discussed with all engaged in the activity, including the Contractor, subcontractor(s), and Government on-site representatives at preparatory and initial control phase meetings.

E. Ground-fault circuit interrupters. GFCI protection shall be provided where an employee is operating or using cord- and plug-connected tools related to construction activity supplied by 125-volt, 15-, 20-, or 30- ampere circuits. Where employees operate or use equipment supplied by greater than 125-volt, 15-, 20-, or 30- ampere circuits, GFCI protection or an assured equipment grounding conductor program shall be implemented in accordance with NFPA 70E - 2015, Chapter 1, Article 110.4(C)(2).

1.20 FALL PROTECTION

A. The fall protection (FP) threshold height requirement is 4ft for ALL WORK in government occupied sites, unless the OSHA 29 CFR 1926 or EM 385-1-1 requirements are more stringent, to include steel erection activities, systems-engineered activities (prefabricated) metal buildings, residential (wood) construction and scaffolding work. For work occurring at new “greenfield” sites or sites with 24/7 Contractor controlled 100% restricted access, the fall protection (FP) threshold height may be increased to 6ft unless the OSHA 29 CFR 1926 or EM 385-1-1 requirements are more stringent.
   1. The use of a Safety Monitoring System (SMS) as a fall protection method is prohibited.
   2. The use of Controlled Access Zone (CAZ) as a fall protection method is prohibited.
   3. A Warning Line System (WLS) may ONLY be used on floors or flat or low-sloped roofs (between 0 - 18.4 degrees or 4:12 slope) and shall be erected around all sides of the work area (See 29 CFR 1926.502(f) for construction of WLS requirements). Working within the WLS does not require FP. No worker shall be allowed in the area between the roof or floor edge and the WLS without FP. FP is required when working outside the WLS.
   4. Fall protection while using a ladder will be governed by the more stringent of OSHA and EM 385-1-1 requirements.

1.21 SCAFFOLDS AND OTHER WORK PLATFORMS

A. All scaffolds and other work platforms construction activities shall comply with 29 CFR 1926 Subpart L.

B. The fall protection (FP) threshold height requirement is 4 ft as stated in Section 1.16.

C. The following hierarchy and prohibitions shall be followed in selecting appropriate work platforms.
   1. Scaffolds, platforms, or temporary floors shall be provided for all work except that can be performed safely from the ground or similar footing.
   2. Ladders less than 20 feet may be used as work platforms only when use of small hand tools or handling of light material is involved.
   3. Ladder jacks, lean-to, and prop-scaffolds are prohibited.
   4. Emergency descent devices shall not be used as working platforms.

D. Contractors shall use a scaffold tagging system in which all scaffolds are tagged by the Competent Person. Tags shall be color-coded: green indicates the scaffold has been inspected and is safe to use; red indicates the scaffold is unsafe to use. Tags shall be readily visible, made of materials that will withstand the environment in which they are used, be legible and shall include:
   1. The Competent Person’s name and signature;
   2. Dates of initial and last inspections.

E. Mast Climbing work platforms: When access ladders, including masts designed as ladders, exceed 20 ft (6 m) in height, positive fall protection shall be used.

1.22 EXCAVATION AND TRENCHES

A. All excavation and trenching work shall comply with 29 CFR 1926 Subpart P. Excavations less than 5 feet in depth require evaluation by the contractor’s “Competent Person” (CP) for determination of the necessity of an excavation protective system where kneeing, laying in, or stooping within the excavation is required.

B. All excavations and trenches 24 inches in depth or greater shall require a written trenching and excavation permit (NOTE – some States and other local jurisdictions require separate state/jurisdiction-issued excavation permits). The permit shall have two sections, one section will be completed prior to digging or drilling and the other will be completed prior to personnel entering the excavations greater than 5 feet in depth. Each section of the permit shall be provided to the Facility Safety Officer prior to proceeding with digging or drilling and prior to proceeding with entering the excavation. After completion of the work and prior to opening a new section of an excavation, the permit shall be closed out and provided to the Facility Safety Officer. The permit shall be maintained onsite, and the first section of the permit shall include the following:

1. Estimated start time & stop time
2. Specific location and nature of the work.
3. Indication of the contractor's "Competent Person" (CP) in excavation safety with qualifications and signature. Formal course in excavation safety is required by the contractor's CP.
4. Indication of whether soil or concrete removal to an offsite location is necessary.
5. Indication of whether soil samples are required to determined soil contamination.
6. Indication of coordination with local authority (i.e. "One Call") or contractor's effort to determine utility location with search and survey equipment.
7. Indication of review of site drawings for proximity of utilities to digging/drilling.

The second section of the permit for excavations greater than five feet in depth shall include the following:

8. Determination of OSHA classification of soil. Soil samples will be from freshly dug soil with samples taken from different soil type layers as necessary and placed at a safe distance from the excavation by the excavating equipment. A pocket penetrometer will be utilized in determination of the unconfined compression strength of the soil for comparison against OSHA table (Less than 0.5 Tons/FT2 – Type C, 0.5 Tons/FT2 to 1.5 Tons/FT2 – Type B, greater than 1.5 Tons/FT2 – Type A without condition to reduce to Type B).
9. Indication of selected protective system (sloping/benching, shoring, shielding). When soil classification is identified as "Type A" or "Solid Rock", only shoring or shielding or Professional Engineer designed systems can be used for protection. A Sloping/Benching system may only be used when classifying the soil as Type B or Type C. Refer to Appendix B of 29 CFR 1926, Subpart P for further information on protective systems designs.
10. Indication of the spoil pile being stored at least 2 feet from the edge of the excavation and safe access being provided within 25 feet of the workers.
11. Indication of assessment for a potential toxic, explosive, or oxygen deficient atmosphere where oxygen deficiency (atmospheres containing less than 19.5 percent oxygen) or a hazardous atmosphere exists or could reasonably be expected to exist. Internal combustion engine equipment is not allowed in an excavation without providing force air ventilation to lower the concentration to below OSHA PELs, providing sufficient oxygen levels, and atmospheric testing as necessary to ensure safe levels are maintained.

C. As required by OSHA 29 CFR 1926.651(b)(1), the estimated location of utility installations, such as sewer, telephone, fuel, electric, water lines, or any other underground installations that reasonably may be expected to be encountered during excavation work, shall be determined prior to opening an excavation.

1. The planned dig site will be outlined/marked in white prior to locating the utilities.
2. Used of the American Public Works Association Uniform Color Code is required for the marking of the proposed excavation and located utilities.
3. 811 will be called two business days before digging on all local or State lands and public Right-of Ways.
4. Digging will not commence until all known utilities are marked.
5. Utility markings will be maintained

D. Excavations will be hand dug or excavated by other similar safe and acceptable means as excavation operations approach within 3 to 5 feet of identified underground utilities. Exploratory bar or other detection equipment will be utilized as necessary to further identify the location of underground utilities.

E. Excavations greater than 20 feet in depth require a Professional Engineer designed excavation protective system.

1.23 CRANES

A. All crane work shall comply with 29 CFR 1926 Subpart CC and EM 385-1-1.

B. Prior to operating a crane, the operator must be licensed, qualified or certified to operate the crane. Thus, all the provisions contained with Subpart CC are effective and there is no “Phase In” date.

C. A detailed lift plan for all lifts shall be submitted to the Resident Engineer, COR and/or other Government Designated Authority 14 days prior to the scheduled lift complete with route for truck carrying load, crane load analysis, siting of crane and path of swing and all other elements of a critical lift plan where the lift meets the definition of a critical lift. Critical lifts require a more comprehensive lift plan to minimize the potential of crane failure and/or catastrophic loss. The plan must be reviewed and accepted by the General Contractor before being submitted to the VA for review. The lift will not be allowed to proceed without prior acceptance of this document by the Facility Safety Officer.

D. Crane operators shall not carry loads
   1. over the general public or VAMC personnel
   2. over any occupied building unless
      a. a. The top two or more floors are vacated under the lift affected area AND a Contractor provided engineering analysis, performed by a Professional Engineer, demonstrates that overhead protection provided by the roof and vacated floors is sufficient to protect against the potential loss of a load being lifted or a minimum of 300 psf of protection is provided, whichever is greater
      b. OR Overhead protection is designed by a Professional Engineer and installed over the roof by the Contractor to protect the occupants below. The installed system shall be sufficient to protect against the potential loss of a load being lifted or a minimum of 300 psf of protection is provided, whichever is greater.

E. OR A formal request may be submitted to the Contracting Officer for documentation, if available, indicating the roof of the building has been previously designed and constructed using a reinforced concrete roof slab or other means to provide overhead protection from construction activities specifically associated with the vertical or horizontal expansion of the same building AND a Contractor provided engineering analysis, performed by a Professional Engineer, demonstrates that overhead protection provided by the roof is sufficient to protect against the potential loss of a load being lifted or a minimum of 300 psf of protection is provided, whichever is greater.

1.24 CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT)

A. All installation, maintenance, and servicing of equipment or machinery shall comply with 29 CFR 1910.147 except for specifically referenced operations in 29 CFR 1926 such as concrete & masonry equipment [1926.702(j)], heavy machinery & equipment [1926.600(a)(3)(i)], and process safety management of highly hazardous chemicals (1926.64). Control of hazardous electrical energy during the installation, maintenance, or servicing of electrical equipment shall comply with Section 1.15 to include NFPA 70E and other VA specific requirements discussed in the section.

1.25 CONFINED SPACE ENTRY

A. All confined space entry shall comply with 29 CFR 1926, Subpart AA except for specifically referenced operations in 29 CFR 1926 such as excavations/trenches [1926.651(g)].

B. A site-specific Confined Space Entry Plan (including permitting process) shall be developed and submitted to the Facility Safety Officer.

1.26 WELDING AND CUTTING

A. As specified in section 1.14, Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with Facility Safety Officer. Obtain permits from Facility Safety Officer at least 48 hours in advance . Designate contractor's responsible project-site fire prevention program manager to permit hot work.

1.27 LADDERS

A. All Ladder use shall comply with 29 CFR 1926 Subpart X and EM 385-1-1.

B. All portable ladders shall be of sufficient length and shall be placed so that workers will not stretch or assume a hazardous position.

C. Manufacturer safety labels shall be in place on ladders

D. Step Ladders shall not be used in the closed position

E. Top steps or cap of step ladders shall not be used as a step

F. Portable ladders, used as temporary access, shall extend at least 3 ft (0.9 m) above the upper landing surface.
   1. When a 3 ft (0.9-m) extension is not possible, a grasping device (such as a grab rail) shall be provided to assist workers in mounting and dismounting the ladder.
   2. In no case shall the length of the ladder be such that ladder deflection under a load would, by itself, cause the ladder to slip from its support.

G. Ladders shall be inspected for visible defects on a daily basis and after any occurrence that could affect their safe use. Broken or damaged ladders shall be immediately tagged "DO NOT USE," or with similar wording, and withdrawn from service until restored to a condition meeting their original design.

1.28 FLOOR & WALL OPENINGS

A. All floor and wall openings shall comply with 29 CFR 1926 Subpart M and EM 385-1-1.

B. Floor and roof holes/openings are any that measure over 2 in (51 mm) in any direction of a walking/working surface which persons may trip or fall into or where objects may fall to the level below. Skylights located in floors or roofs are considered floor or roof hole/openings.

C. All floor, roof openings or hole into which a person can accidentally walk or fall through shall be guarded either by a railing system with toe boards along all exposed sides or a load-bearing cover. When the cover is not in place, the opening or hole shall be protected by a removable guardrail system or shall be attended when the guarding system has been removed, or other fall protection system.
   1. Covers shall be capable of supporting, without failure, at least twice the weight of the worker, equipment and material combined.
   2. Covers shall be secured when installed, clearly marked with the word “HOLE”, “COVER” or “Danger, Roof Opening-Do Not Remove” or color-coded or equivalent methods (e.g., red or orange “X”). Workers must be made aware of the meaning for color coding and equivalent methods.
   3. Roofing material, such as roofing membrane, insulation or felts, covering or partly covering openings or holes, shall be immediately cut out. No hole or opening shall be left unattended unless covered.
   4. Non-load-bearing skylights shall be guarded by a load-bearing skylight screen, cover, or railing system along all exposed sides.
   5. Workers are prohibited from standing/walking on skylights.

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VHA Infection Control Risk Assessment
for Construction, Renovation and Maintenance

Introductory Information and Instructions

Use this template as a baseline for performing facility Infection Control Risk Assessments (ICRAs) for construction, renovation, and maintenance work (referred to as the "activity" in this document). The template provides minimum requirements for categorizing activity types and patient risk to determine the level of precautions needed to prevent infection risks. Facilities may customize this template to incorporate site-specific information and/or to add more stringent criteria.

NOTE: *This VHA ICRA template pertains specifically to infection prevention. It must be used in conjunction with the required Pre-Construction Risk Assessment (PCRA) for the activity which addresses other activity-related safety concerns (e.g., vibration, noise) outside the scope of the ICRA.*

To complete the template:

1. Use **Table 1** to identify the category of the construction, renovation and/or maintenance activity.
2. Use **Table 2** to identify the areas affected by the activity.
3. Use **Table 3** to identify the overall patient risk category that will be affected by the activity.
4. Use **Table 4** to determine the level of infection prevention and control precautions needed for the activity.

Once all 4 steps above are completed: Refer to **Table 5** for the minimum required control measures for the level of infection prevention and control precautions needed for the activity. Refer to **Table 6** for the minimum infection prevention and control measures required on completion of the activity.

PERMIT: See the last page of this document for a fillable permit form to be used for posting at the activity site as needed.

Table 1 - Construction, Renovation, and/or Maintenance Activity Category

NOTE: *If any of the bulleted criteria in a higher activity category pertains to the work that will be done (even if the other criteria are in a lower category), use the higher activity category for the VHA ICRA.*

Activity Category determined from Table 1 (*A, B, C, or D*): D

Category A	**Inspection and/or facility upkeep generally defined as follows**: • Work can be completed in a single shift, not to exceed 10 hours. • Patients and/or employees may be in the area depending on the activity. • Work that does not create dust or debris. • Removal of ceiling tile or access to mechanical or electrical chase for visual inspection limited to 1 tile per 50 square feet with limited exposure time (not to exceed an hour for each tile) within the shift. • Minor interior updates (e.g., replacing floor or ceiling tiles, carpentry work to include hanging signage, and painting without sanding) that do not create dust or debris. • Limited building system maintenance such as plumbing on potable systems limited to faucet replacement etc. and electrical work such as replacement of bulbs, receptacles, or switches.
Category B	**General maintenance and repair work generally defined as follows:** • Prolonged inspection and work that may take longer than a single shift but not exceeding a week. • Patients and employees are not to be in the area until activity is completed. • Work that creates minimal dust and debris.

	• Interior finish or surface repairs, updates, or modifications such as repair of firewalls and barriers, and new flooring that produces minimal dust and debris. Controlled sanding activities (e.g., wet or dry sanding) that produce minimal dust and debris. • Plumbing work such as installation or replacement of a single fixture or piping for a single fixture. Any work on sanitary plumbing including snaking of drains. • Electrical work such as installation of cabling/wiring/conduit for a single device, installation of new device such as a light fixture that produces minimal dust and debris. • Air Handler and/or fan shutdown/startup and HVAC work such as replacement of a single diffuser, single terminal unit or a single device that produces minimal dust and debris.
Category C	**Small-scale construction, renovation, or maintenance generally defined as follows**: • Work requiring longer than a single week to complete but not exceeding 6 months. • Patients and employees are not to be in the area until activity is completed. • Demolition/removal of preexisting floor covering, casework, lay-in ceiling, or other architectural elements. • Demolition/removal of more than 32 ft^2 of drywall/framing, hard ceilings, and doors/framing and minimal infrastructure such as electrical circuits and branch piping. • Installation of new walls, ceilings and doors including framing, drywall/plaster and associated work. • Plumbing work such as the installation of new sinks, showers and toilets and associated plumbing. • Shut down of sections of potable water systems. • Electrical work such as installation of conduit and wire for lighting, receptacles and switches for an area, the installation of conduit and wire for new devices such as terminal units, fans etc. • Modification of existing fire alarm and suppression systems. • Mechanical work such as the installation of ductwork, diffusers, and terminal units for an area.

Category D	**Large-scale construction, renovation, or maintenance generally defined as follows**:
	• Work exceeding 6 months in duration.
	• Patients and employees are not to be in the area until activity is completed.
	• Large-scale demolition of building components and infrastructure including removal of multiple doors, walls, framing, ceilings, flooring, piping, electrical and HVAC.
	• The installation building components such as new walls, ceilings and doors including framing, drywall and associated plaster work.
	• Plumbing work such as the installation of:
	  ○ new medical gas systems,
	  ○ steam/heating hot water, condensate systems,
	  ○ multiple sinks, showers and toilets including associated plumbing.
	• Shutdown of potable water, steam/heating hot water, condensate, and medical gas systems.
	• Electrical work such as installation of electrical feeders, distribution panels, conduit and wire for lighting, receptacles and switches for an area, the installation of conduit and wire for new devices such as terminal units, fans etc.
	• Installation of fire alarm and suppression systems.
	• Electrical shutdown of multiple panels.
	• Mechanical work such as the installation of air handling equipment, associated ductwork, diffusers, heat exchangers, terminal units and controls.

VHA Infection Control Risk Assessment
for Construction, Renovation and Maintenance

Table 2 - Affected Area Assessment

Identify the areas and associated patients that will be affected by the construction/renovation/maintenance activity (see the Figure for a visual representation of adjacent affected areas).

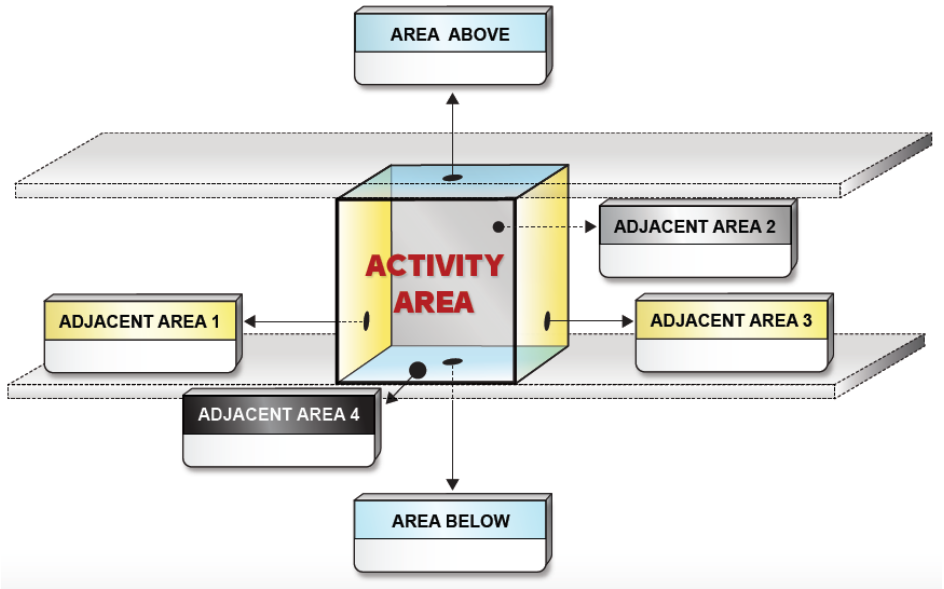

Figure: Isometric drawing of affected area assessment

Area	Service(s)/Type(s) of Area(s) *(e.g., OR, Unit/Ward, Sterile Processing, Administrative, etc.)**	Point of Contact (POC)	POC Contact Information
Activity Area**	Building 14 ground, 1st and 2nd floor	Anderson, Erik	Ext. 202163
Area Above	Empty	Anderson, Erik	Ext. 202163
Area Below	Ground Floor- Volunteer service	Anderson, Erik	Ext. 202163
Adjacent Area 1			
Adjacent Area 2			
Adjacent Area 3			
Adjacent Area 4			

* There may be more than one Service/type of area for each row. List all.

** List the area(s) in which the construction/renovation/maintenance activity will occur. ***NOTE: When the Activity Category is B, C, or D, the control measures are determined by the Patient Risk in the adjacent affected areas.***

VHA Infection Control Risk Assessment for Construction, Renovation and Maintenance

Table 3 - Patient Risk Category

Using Table 3, identify the patient risk category for each area listed in Table 2. Of the patient risk categories identified, select the one with the greatest risk as the overall Patient Risk Category for the activity.

Overall Patient Risk Category determined from Table 3 (*Low, Medium, High, or Highest*): Low

Low Risk	Medium Risk	High Risk	Highest Risk
Non-patient care areas such as:	Patient care support areas such as:	Patient care areas such as:	Procedural, invasive, sterile support and highly compromised patient care areas such as:
• Public hallways and gathering areas not in clinical areas • Office areas not in clinical areas • Breakrooms not in clinical areas • Bathrooms or locker rooms not in clinical areas • Mechanical/electrical rooms not in clinical areas	• Waiting areas • Clinical engineering (biomedical) • Materials management • Sterile processing department – dirty side • Kitchen, cafeteria, gift shop, coffee shop, and food kiosks	• Patient care rooms and areas, including spinal cord injury units • All acute care units, including mental health • All outpatient units and clinics • Emergency department • Community Living Centers, domiciliaries, and transitional residences • Employee health • Pharmacy – general work zone • Medication rooms and clean utility rooms • Imaging suites – diagnostic imaging • Laboratory	• All transplant units • All intensive care units • All oncology units and chemotherapy/infusion centers • OR theaters and restricted areas • Hemodialysis units • Procedural rooms* • Pharmacy compounding area • Sterile processing department – clean side • Transfusion services • Imaging suites – interventional imaging • Dedicated isolation wards/units for infectious diseases

***** Procedural Rooms are designated for the performance of patient care activities that may require high-level disinfected or sterile instruments and some environmental controls but is not required to be performed with the environmental controls of an operating room (OR). The room is intended for procedures that are performed in an aseptic surgical field and penetrates the protective surfaces of a patient's body (e.g., subcutaneous tissue, mucous membranes, cornea) or entry into or opening of a sterile body cavity. Examples of these spaces include Cardiac Catheterization Suites, Electrophysiology Suites, Endovascular/GI Suites, Angio Suites and other spaces which may have high risk patient populations.

Table 4 - Level of Infection Prevention and Control Precautions

Match the Overall Patient Risk Category (*Low, Medium, High, Highest*) determined from Table 3 with the planned Construction/Renovation/Maintenance Activity Category (*A, B, C, D*) from Table 1 to determine the minimum Level of Infection Prevention and Control Precautions (*I, II, III, or IV*) using Table 4 below.

Level of Precautions determined from Table 4 (*I, II, III, or IV*): III

Patient Risk Category	**Activity Category**			
	A	**B**	**C**	**D**
Low Risk	I	II	II	III
Medium Risk	I	II	III	IV
High Risk	I	II	IV	IV
Highest Risk	II	III	IV	IV

An infection prevention and control permit is required for Level III and Level IV. Consult with Infection Prevention and Control for Level I and Level II.

Table 5 - Required Infection Prevention and Control Measures, by Level of Precautions

Controls defined below for the Level of Precautions identified for the activity must be in place before the activity begins and maintained until work is completed and the area is activated. Control measures for each Precaution Level must also include the control measures in the preceding Level(s).

As the activity progresses, a full re-evaluation of remaining activity type and patient risk is required prior to downgrading the Level of Precautions.

Level of Precautions	**Control Measures**
Level I	1. Perform work activity in a manner that does not create dust. 2. Immediately replace any ceiling tile, close access panels, etc., upon completion of work. 3. Any materials and equipment being brought into the facility must be free of contaminants and loose material.
Level II	**All control measures in Level I and the following:** 1. Provide active means to control airborne dust from dispersing into occupied areas and/or water mist surface to control dust (e.g., Mobile Dust Containment Cart or some other system). 2. Ensure worker clothing is clean and free of visible dust before leaving the work area. 3. Remove or isolate air diffusers (supply and return) to protect the HVAC system from dust and reduce air turbulence. Rebalance system to address diffuser isolation.

	4. When the work involves or impacts potable water systems including stagnation due to reduced usage, the piping shall be flushed twice a week or isolated from the main system. 5. Seal doors to prevent dust migration. 6. Contain all trash and debris in the work area. Perform daily cleaning and disposal of trash (covered) from work area using an identified exit route. 7. Any equipment, tools, or materials removed from the work area must be in sealed containers and/or cleaned of dust and debris prior to removal from the area. 8. Nonporous/smooth and cleanable containers (with a hard lid) must be used to transport trash and debris from the construction areas. These containers must be damp-wiped cleaned and free of visible dust/debris before leaving the contained work area. 9. Install a sticky (dust collection) mat at entrance of contained work area based on facility policy. Sticky mats must be changed routinely and when visibly soiled. 10. Maintain clean surroundings when area is not contained by damp mopping or HEPA vacuuming surfaces at least daily.
Level III **X**	**<u>All control measures in Levels I and II</u> and the following:** 1. Ensure availability of equipment for cleaning hands. 2. Construct and complete critical barriers meeting NFPA 241 requirements. Barriers must extend to the ceiling or if ceiling tile is removed, to the deck above. 3. All (plastic or hard) barrier construction activities must be completed in a manner that prevents dust release. Plastic barriers must be effectively affixed to floor and ceiling (or floor/roof deck above) and secure from movement or damage. 4. Seal all penetrations in containment barriers, including floors and ceiling, using approved materials (UL schedule firestop if applicable for barrier type). 5. Maintain .01 inches /water gauge negative pressurization of the entire workspace by use of HEPA exhaust air systems directed outdoors (unless a work specific waiver is approved by VHA's Office of Healthcare Engineering); this must be maintained continuously 24/7 for the duration of the project. Exhaust discharged directly to the outdoors that is 25 feet or greater from entrances, air intakes and windows is not required to be HEPA-filtered. Exhausting discharged air into shared or recirculating HVAC systems, or other shared exhaust systems (e.g., bathroom exhaust) is <u>prohibited</u>. 6. Install a differential pressure sensing device (e.g., magnehelic, manometer, or digital monitoring) on exterior of work containment to continually monitor and document negative pressurization. The "ball in the wall" or similar apparatus are <u>not acceptable</u>.
Level IV	**<u>All control measures in Levels I, II and III</u> and the following:** 1. Barriers must be hard barriers unless temporary to install final barrier. 2. Containment must include an anteroom to ensure pressure control. Anteroom must be large enough for equipment staging, cart cleaning, workers' PPE and cleaning. 3. Worker clothing and/or PPE must be removed or clean and free of visible dust before leaving the work area anteroom. HEPA vacuuming of clothing or use of cover suits is acceptable. 4. Workers must wear shoe covers or have a method to clean shoes in anteroom. Shoe covers must be removed prior to exiting the anteroom to the occupied space (non-work area). Damaged shoe covers must be changed immediately.

Table 6 - Minimum Infection Prevention and Control Measures Required Upon Completion of the Activity

Controls defined below shall be completed upon completion of the activity and inspected prior to terminating measures defined in Table 5.

Level of Precautions	Measures
Levels I - II	**Cleaning:** 1. Clean work areas including all environmental surfaces, high horizontal surfaces and flooring materials. 2. Check all supply and return air registers for dust accumulation on upper surfaces as well as air diffuser surfaces. **HVAC Systems:** 1. Remove isolation of HVAC system in areas where work is being performed. Verify that HVAC systems are clean and operational. 2. Verify the HVAC systems meet original airflow and air exchange design specifications. **Water systems:** 1. Until the potable water system is activated and in use, flushing shall continue at least twice per week in accordance with VHA Directive 1061.
Levels III - IV	Construction areas must be inspected by an infection preventionist and engineering representative (and others as determined by the facility) for final activity/project close out and removal of infection prevention and control measures. **Work Area Cleaning:** 1. Clean work areas including all environmental surfaces, high horizontal surfaces and flooring materials. 2. Check all supply and return air registers for dust accumulation on upper surfaces as well as air diffuser surfaces. **Removal of Critical Barriers:** 1. Critical barriers must remain in place during all work involving drywall removal, creation of dust and activities beyond simple touch-up work. The barrier may NOT be removed until a work area cleaning has been performed. Additional cleaning may be needed after removal of barrier. 2. All (plastic or hard) barrier removal activities must be completed in a manner that prevents dust release. Use the following precautions when removing hard barriers: i. Carefully remove screws and painter tape. ii. If dust will be generated during screw removal, use hand-held HEPA vacuum. iii. Drywall cutting is prohibited during removal process. iv. Clean all stud tracks with HEPA vacuum before removing outer hard barrier. v. Use a plastic barrier to enclose area if dust could be generated. **Negative Air Requirements:** 1. The use of negative air must be designed to remove contaminants from the work area. 2. Negative air devices (fans, filters, monitoring and documentation equipment) must remain operational at all times and in place for a period after completion of dust creating activities to remove contaminants from the work area and before removal of critical barriers. **HVAC systems:** 1. Upon removal of critical barriers, remove isolation of HVAC system in areas where work is being performed. 2. Verify that HVAC systems are clean and operational. 3. Verify and document through a TAB the HVAC systems meets original airflow and air exchange design specifications. **Water systems:** 1. Until the potable water system is activated and in use, flushing shall continue at least twice per week in accordance with VHA Directive 1061.

Infection Prevention and Control Construction/Renovation/Maintenance Permit

This page must be posted at the entrance to the project area for Level III and Level IV activities.

Unique permit number: 2024-2			
Location of construction/renovation/maintenance	Building 14: 1, and 2nd floor.		
Project manager	Erik Anderson	Project start date	+- May 1, 2024
Contact phone number	845-505-3735	Completion date	3 years
Contractor	Nordstrom Contracting and Consulting Corp.	Permit expiration date	May 1, 2027

Activity Category (*A, B, C, or D*)	D	Overall Patient Risk Category (*Low, Medium, High, or Highest*)	Low	Level of Infection Prevention and Control Precautions (*I, II, III, or IV*)	III

Level of Precautions	Control measures to be in place for the duration of the activity (*Check the box for the activity's Level of Precautions to indicate the Control Measures*)
Level I ☐	1. Perform work activity in a manner that does not create dust. 2. Immediately replace any ceiling tile, close access panels, etc., upon completion of work. 3. Any materials and equipment being brought into the facility must be free of contaminants and loose material.
Level II ☐	**All control measures in Level I and the following:** 1. Provide active means to control airborne dust from dispersing into occupied areas and/or water mist surface to control dust (e.g., Mobile Dust Containment Cart or some other system). 2. Ensure worker clothing is clean and free of visible dust before leaving the work area. 3. Remove or isolate air diffusers (supply and return) to protect the HVAC system from dust and reduce air turbulence. Rebalance system to address diffuser isolation. 4. When the work involves or impacts potable water systems including stagnation due to reduced usage, the piping shall be flushed twice a week or isolated from the main system 5. Seal doors, to prevent dust migration. 6. Contain all trash and debris in the work area. Perform daily cleaning and disposal of trash (covered) from work area using an identified exit route. 7. Any equipment, tools, or materials removed from the work area must be in sealed containers and/or cleaned of dust and debris prior to removal from the area. 8. Nonporous/smooth and cleanable containers (with a hard lid) must be used to transport trash and debris from the construction areas. These containers must be damp-wiped cleaned and free of visible dust/debris before leaving the contained work area. 9. Install a sticky (dust collection) mat at entrance of contained work area based on facility policy. Sticky mats must be changed routinely and when visibly soiled. 10. Maintain clean surroundings when area is not contained by damp mopping or HEPA vacuuming surfaces at least daily.
Level III ☒	**All control measures in Levels I and II and the following:** 1. Ensure availability of equipment for cleaning hands. 2. Construct and complete critical barriers meeting NFPA 241 requirements. Barriers must extend to the ceiling or if ceiling tile is removed, to the deck above. 3. All (plastic or hard) barrier construction activities must be completed in a manner that prevents dust release. Plastic barriers must be effectively affixed to floor and ceiling (or floor/roof deck above) and secure from movement or damage. 4. Seal all penetrations in containment barriers, including floors and ceiling, using approved materials (UL schedule firestop if applicable for barrier type). 5. Maintain .01 inches /water gauge negative pressurization of the entire workspace by use of HEPA exhaust air systems directed outdoors (unless a work specific waiver is approved by VHA's Office of Healthcare Engineering); this must be maintained continuously 24/7 for the duration of the project. Exhaust discharged directly to the outdoors that is 25 feet or greater from entrances, air intakes and windows is not required to be HEPA-filtered. Exhausting discharged air into shared or recirculating HVAC systems, or other shared exhaust systems (e.g., bathroom exhaust) is prohibited. 6. Install a differential pressure sensing device (e.g., magnehelic, manometer, or digital monitoring) on exterior of work containment to continually monitor and document negative pressurization. The "ball in the wall" or similar apparatus are not acceptable.
Level IV ☐	**All control measures in Levels I, II and III and the following:** 1. Barriers must be hard barriers unless temporary to install final barrier. 2. Containment must include an anteroom to ensure pressure control, Anteroom must be large enough for equipment staging, cart cleaning, workers' PPE and cleaning. 3. Worker clothing and/or PPE must be removed or clean and free of visible dust before leaving the work area anteroom. HEPA vacuuming of clothing or use of cover suits is acceptable. 4. Workers must wear shoe covers or have a method to clean shoes in anteroom Shoe covers must be removed prior to exiting the anteroom to the occupied space (non-work area). Damaged shoe covers must be changed immediately.

Additional requirements:			
Project Manager signature	ERIK ANDERSON Digitally signed by ERIK ANDERSON Date: 2024.02.29 08:39:14 -05'00'	Date	
Infection Preventionist signature	Digitally signed by BARBARA REALE Date: 2024.02.29 08:23:26 -05'00'	Date	

SECTION 01 35 26.19

SPECIAL PROJECT PROCEDURES FOR HEALTHCARE FACILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Hudson Valley Health Care System Construction Forms.

B. Related Requirements:
   1. Section 01 35 26 SAFETY REQUIREMENTS.

PART 2 - NOT USED

PART 3 - EXECUTION

3.1 FORMS

A. Hudson Valley Health Care System Infection Control During Construction and Renovation Policy 11IC-05HV.
   1. Attachment A – ICRA Risk Matrix
   2. Attachment B – Infection Control Risk Assessment Work Permit
   3. Attachment C – Instruction for Completion of Infection Control Risk Assessment Work Permit
   4. Attachment D – Products and Materials for ICRA Containment – Examples
   5. Attachment E – Daily Construction – Infection Control Interventions Compliance Monitor
   6. Attachment F – Infection Prevention and Control During Construction Pamphlet

B. Hudson Valley Health Care System Construction Standard Procedures Quality Assurance for Project SOP 138-22HV.
   1. Attachment C: Equipment Installed Under Construction
   2. Attachment D: Hazard Evaluation
   3. Attachment E: Dig and Excavating Permit Request
   4. Attachment F: Electrical Outage Checklist.

3.2 ATTACHMENTS HUDSON VALLEY HEALTH CARE SYSTEM INFECTION CONTROL DURING CONSTRUCTION AND RENOVATION POLICY 11IC-05HV

END OF SECTION

SOP 138-22HV
CONSTRUCTION STANDARD PROCEDURES QUALITY ASSURANCE FOR PROJECTS
VA Hudson Valley Health Care System
Issue Date: 5/3/2019
Update: 5/3/2022

1. **PURPOSE:** To define the responsibilities for the Maintenance and Repair (M&R) Section and the Planning and Design Section relating to project planning and review.

2. **POLICY:** VA Hudson Valley Health Care System has established delineated responsibilities for the M&R Section and the Planning and Design Section related to project planning and review to ensure the provision of a substantial degree of quality assurance for projects.

3. **RESPONSIBILITIES:**

   a. **The Chief, Engineering Service** is responsible for the implementation of this standard operating procedure.

   b. **The Chief, Planning and Design Section** is responsible for:
      1) The development and accomplishment of all projects, including Recurring, Nonrecurring Maintenance (NRM), Minor Miscellaneous, Minor, and Major (delegated) Construction
      2) Informing the Maintenance General Foreman and Safety Manager (or designee) of projects to be developed and generally what type of information will be needed from each section

   c. **The Maintenance and Repair Section** is responsible for providing essential technical input during all phases of projects. This input begins with the formulation of project scopes and continues with project design and construction.

   d. **The Project Engineer** is responsible for:
      1) Developing the project scopes, justifications, cost estimates and drawings
      2) Ensuring the success of each project

4. **PROCEDURE:**

   a. General Processes:
      1) Project Development includes the preparation of the scope and justification, detailed cost estimate and justification, and conceptual drawings. All projects, except Recurring Projects, are submitted to VA Central Office for funding.
      2) Project Design includes preparation of preliminary designs, working drawings and specifications.
      3) Documents are developed by Architectural Engineers (A/E) or in-house by Project Engineers.
      4) The M&R Staff provides input needed for this development including information on existing utilities, equipment, etc., justifications (for

maintenance projects) and recommendations for the type of new or replacement construction and mechanical/electrical systems to be installed.

5) The Project Engineers works with the General Foreman (or his designees) and Safety Section to obtain specific information required.
6) The Project Engineers notify the General Foreman of any M&R input not to be incorporated in the project with an explanation.
7) The Project Engineers contact the Industrial Hygienist and also look-up the Asbestos Assessment Report to incorporate all necessary Asbestos Abatement work as part of the project.
8) The Safety Section assists the Planning and Design Section in project designs available in the project office.
9) The Safety Section shall review the drawings and specifications and provides comments to the Project Engineer thru the Chief, Planning and Design Section.
10) Projects are approved and funded based on information developed during this stage. The project scope will not be expanded, nor can the budget be increased after it is approved and funded.
11) Project Engineers administer A/E design contracts or develop designs themselves as directed by the Chief, Planning and Design Section.
12) The M&R Section provides technical input on existing and proposed utility systems, equipment and structural components necessary to successfully complete the designs.
13) The Chief, Planning and Design Section informs the Chief, Engineering Service and Safety Manager of projects to be designed including information on scopes, budget, and time frames for design. Design time frames will appear on the project list and be updated and discussed at the monthly project meetings.
14) For each project (contractor and station level), a Hazardous Evaluation Sheet must be filled out. An Infection Control Assessment Screen must be done for the project as well. This can be found in Infection Control Policy 11IC-05HV. For all projects, contractor or station level, Infection Control Policy 11IC-05HV will be strictly followed. If the Class of Precautions are three or higher, Infection Control approval will be required for the construction activity. These results will be documented on the Hazardous Evaluation Sheet (Attachment D).
15) For those projects that require excavation, a Dig Permit will be required (Attachment E).

b. <u>Specific Processes:</u>
   1) Design Stages:
      a) Pre-design Meeting - M&R Staff and Safety Section Staff will participate in a pre-design meeting called by the Engineer. They will have an opportunity to discuss existing problem areas; e.g.; an electrical system loaded beyond capacity, asbestos issues, make recommendations to correct deficiencies, and request specific design strategies.

b) Investigation of existing conditions- the M&R Section assist in providing information on existing construction, systems and equipment to the Engineer.
c) Inquires may take the form of meetings, walk-thru, conversations and written requests for information.
d) The Safety Section will participate in all design review meetings called by the Project Engineer.
e) Attachment #D will be filled out during design stage.

c. Reviews
1) Engineers will inform the General Foreman of project reviews using the Review Request Format (Attachment A). Review materials will be available to the M&R Section staff as directed by the General Foreman.
2) Materials to be reviewed will be developed to the extent required by the A/E contract for each review. This information will be described in the Review Request.
3) Time frames for review will be noted on the Review Request form.
4) M&R Section review comments will address the accuracy of existing conditions and technical acceptability of proposed solutions. They will be forwarded to the Project Engineer from the General Foreman using the Review Comment Format (Attachment B).
5) M&R Staff shall, if requested, participate in design review meetings called by the Project Engineer to discuss comments and answer questions.
6) The Project Engineer will notify the General Foreman of any M&R comments not to be incorporated into the design, with explanation.
7) The Safety Office review comments will address the existing conditions as well as the new conditions created as a result of the proposed project.

d. Project Construction
1) Project Engineers will administer construction contracts, as directed by the Chief, Planning and Design Section.
2) The Project Section will make inspections with M&R Section assistance to identify deficiencies in materials and workmanship. The M&R Section provides other technical assistance as necessary.
3) The Project Engineer will notify the General Foreman and Safety Office seven (7) days prior to formal inspections; i.e., rough-in, final, system tests, etc. Equipment manuals will be furnished to the M&R Staff at this time if they are available. The M&R Staff shall complete their inspection prior to the formal inspection.
4) In addition to the formal inspections, the M&R Staff and Safety Office are encouraged to inspect all construction at anytime, as their schedules permit. Arrangements shall be made with the Project Engineer.
5) Deficiencies identified shall be forwarded in writing to the Project Engineer, with copies to the Chief, Planning and Design Section.

6) The Project Engineer shall notify the General Foreman of M&R identified deficiencies not to be corrected with an explanation.
7) Before re-inspections by M&R staff are scheduled, the Project Engineer will determine if previously identified deficiencies have been corrected.
8) The M&R Staff shall provide technical support as required. This includes providing information on existing conditions, attending meetings to resolve disputes, etc.
9) Project Engineers and M&R Staff shall ensure compliance with Construction Safety and Legionella Directives in regard to safety and notifications.

e. Project Close Out Meeting
1) The meeting will be scheduled by the Project Engineer to give a final review of the project.
2) The Project Engineer will give a summary of project's accomplishments.
3) The remaining deficiencies will be identified, and suggested course of action will be given.
4) The areas of improvement for future projects will be discussed.

f. General Responsibilities:
1) The Project Section Contracting Officer Representative (COR) will maintain a file for each assigned project.
2) The Project Engineer, Construction Representative, or Engineering Technician will complete Attachment C, and forward all technical manuals and shop drawings to the Maintenance General Foreman for each piece of equipment installed or removed under the project.
3) Problems not resolved between the Project Engineer and M&R Staff will be referred to the next level of supervision in the appropriate section.
4) Attachment #F will be filled out by the appropriate engineering personnel for the proper notification of "Planned Electrical Outages".
5) An Electrician will be assigned to each patient care area to spot check the affected unit during the outage on a case by case basis to assist with any issues.

5. REFERENCE/S:

- 11IC-05HV: Infection Control During Construction & Renovation

6. RESCISSION: SOP 138-22HV Construction Standard Operating Procedures Quality Assurance for Projects, issued March 3, 2016

SOP 138-22HV
CONSTRUCTION STANDARD PROCEDURES QUALITY ASSURANCE FOR PROJECTS
VA Hudson Valley Health Care System

JOHN CLIFFE
Chief, Engineering Service
Attachments:

- Attachment A: Review Request Format
- Attachment B: Review Comment Format
- Attachment C: Equipment Installed Under Construction
- Attachment D: Hazard Evaluation
- Attachment E: Dig and Excavating Permit Request
- Attachment F: Electrical Outage Checklist

Originator: 138/MR
Distribution: WEB page

SOP 138-22HV
CONSTRUCTION STANDARD PROCEDURES QUALITY ASSURANCE FOR PROJECTS
VA Hudson Valley Health Care System

Attachment "A":

SOP-138-22a.doc

Attachment "B":

SOP-138-22b.doc

Attachment "C":

SOP-138-22c.doc

Attachment "D":

Attachment D.doc

Attachment "E":

SOP-138-22e.doc

Attachment "F":

Electrical Outage Checklist 2-12-16.doc

Attachment "A"

Date:

From: Project Engineer (138)

Subject: Project Review Request

To: General Maintenance/Repair Foreman (138B)

Thru: Chief, Project Section

1. Project Number:_____

2. Project Title: _____

3. Project Category: _____

4. Review Stage:

a. 50% Preliminary _____ c. 50% Working Drawing _____

b. 100% Preliminary _____ d. 100%Working Drawing _____

e. Other _____

5. Review Materials:

a. Narrative _____ c. Specifications _____

b. Drawings _____ d. Calculations _____

e. Other _____

Note: Attached is a copy of the A/E submission for the project mentioned to be reviewed.

_____
PROJECT ENGINEER

Attachment "B"

Shop Foreman (138____)

Project Review Comments

Project Engineer (138____)

Thru Chief, Project Section

1. Project Number: _____

2. Project Title: _____

3. Review Stage: _____

4. Comments: (NOTE: Comments should reference specific specification section or drawing number.)

_____

SHOP FOREMAN (138_____)
cc: M&R General Foreman (138B)

Attachment "C"

EQUIPMENT INSTALLED UNDER CONSTRUCTION

PROJECT: _____

Device Name: _____

Owning Service: _____

Location: Bldg #/Room #: _____

Model # _____ Serial # _____

Acquisition Date: _____ Acquisition Value: _____

Warranty Expirations: _____

P.O. # _____ Contract # _____

Maintenance Manuals are attached:

P.M. Frequency

SPECIAL REMARKS:

ttachment "D"

HAZARD EVALUATION

620-23-221 Bldg. 14
620-23-206 14CD Re

roject Title: Renovation of Building 14ABCD for Residential Programs | **Project Number:** 620-20-105 14AB Re

ampus: Montrose **Bldg:** 14 **Rm:** | **COR:** Melissa Metevelis / Mike Azzara

escription of Project Key Activities: Renovate 16,820 sq first floor & 16,820 sq second floor.

ection A:	Yes	No	Signature	Date
According to the most recent Asbestos Survey and ditional testing results as required, is Asbestos esent?	☑	☐		9/22/21
Will lead be disturbed during work activities	☑	☐		9/22/21
Project has been discussed with GEMS Coord.	☑	☐		9/22/21
Project has been discussed with Fire Chief, for nfined Space, Burn Permit, ILSM, Sprinkler, Smoke tection	☑	☐		9/22/21
Project has been assessed for transmission of berculosis (TB)	☑	☐		
Project has been discussed with SPS/SPD nagers	☑	☐	N/A DHMM	

omments / Action / Follow Up:
AFD Requires AE to ensure A FPE conducts 100% acceptance test
IAW NFPA 13 2022 BY Montrose

ection B: Check if utility is effected:

Heat	☑ Air Conditioning	Shop Signature:	Date 9/21/21
Water	☑ Steam	Shop Signature:	Date 9/21/21
Electricity	☑ Camera/	Shop Signature:	Date 9-21-21
Elevators	Card Access	Shop Signature:	Date 9/21/20
Medical Gases	☑ Plumbing ☑ Waste (Sewage)	Shop Signature:	Date 10/21

omments / Action / Follow Up:
ordinate utility outages w/ min 48hr advance notice.

gineering General Foreman Signature: PETERBAUER **Date:** 9-20-21

ection C: The Project Does Impact: (check all that apply)

- ☑ Air Quality/ Dust
- ☑ Noise Level
- ☑ Vibration
- ☑ Utility Services
- ☑ Emergency Procedures
- ☑ Structural Integrity
- ☑ Access to job site through patient care areas
- ☑ Disposal of debris through patient care areas
- ☑ Excavation (Dig Permit)
- ☑ Penetrations (Penetration Permit)
- ☐ Confined Space (Penetration Permit)
- ☑ Lockout/Tagout
- ☑ Fall Protection
- ☑ ILSM

mments / Action / Follow Up:

oject Engineer Signature: **Date:**

ction D: Infection Control Risk Assessment

ss of Precautions : ☐ Class I ☐ Class II ☒ Class III ☐ Class IV

mments / Action / Follow Up:

SOP 138-22HV
Construction Standard Operating Procedures Quality Assurance for Projects
VA Hudson Valley Healthcare System

Attachment "E"

HVHCS FDR & CP Campus
DIG AND EXCAVATING PERMIT REQUEST
(Electrical, water, gas, fiber optic, sewer, other)

ANY PENETRATIONS INTO THE GROUND ON VA PROPERTY REQUIRES A DIG PERMIT

When locating is COMPLETE, an APPROVED copy will be attached to the completed 138-022 Construction Safety form
Contact or Project Manager: _____Phone # _____
Dig Location: _____ Start Date: _____
A DRAWING WITH DIG LOCATION IDENTIFIED MUST BE ATTACHED

(Drawings are available in the Engineering Office)
DO NOT START unless you have received an approved hard copy of this request.

Purpose for digging: _____

Section doing the digging: _____ Phone #_____

Certified Equipment operator: _____

Equipment to be used: _____

Is fence required: Yes: _____ No: _____

All excavation on the HVHCS Campuses will be performed following the OSHA Regulations (Standards - 29 CFR) Specific Excavation Requirements 1926.651. All excavation will also conform to the facility's trenching and excavation SOP.

There are also some Electrical, Fiber Optic and Cable TV conductors owned by private companies on campus. It is the responsibility of the Contact Person or Project Manager to contact the local utility companies to obtain an approved dig permit. Please contact the Engineering Program Manager with any questions.

PROJECT #/WORK ORDER #._____

Area utilities located and identified by: _____ Date: _____

Electrical Supervisor approval: _____

Pipe fitter Supervisor approval: _____

Engineering Program Manager/Designee approval: _____

Comments: _____

Attachment F: Planned Electrical Outage Checklist

Electrical Outage Communication Checklist **Date:_____**

1. **Facility and Location:** _____

   a. **Date of Planned Outage:** _____ **Time of Outage:** _____ **Duration** _____

   b. **Buildings/Areas Affected:**

Building	*Area*	*Point of Contact*

2. **Notifications:**

Building/Area	*POC*	*Office*	*Date*

Signs posted by engineering in impacted areas 48 hours prior to outage: Yes ____ No _____

   a. Supplies and/or Equipment required by engineering to support operations during outage:

Equipment/Supplies	*Area required*

3. **Final checks after power is restored by Engineering:**

   Air Conditioning - Electrical Panels - Fire Alarm Panels

   Engineering POC _____ **Date:** _____

4. **After power outage review: Report any affected areas not planned on if applicable:**

SECTION 01 42 19

REFERENCE STANDARDS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the availability and source of references and standards specified in the project manual under paragraphs APPLICABLE PUBLICATIONS and/or shown on the drawings.

1.2 AVAILABILITY OF SPECIFICATIONS LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS FPMR PART 101-29 (FAR 52.211-1) (AUG 1998)

A. The GSA Index of Federal Specifications, Standards and Commercial Item Descriptions, FPMR Part 101-29 and copies of specifications, standards, and commercial item descriptions cited in the solicitation may be obtained for a fee by submitting a request to – GSA Federal Supply Service, Specifications Section, Suite 8100, 470 East L'Enfant Plaza, SW, Washington, DC 20407, Telephone (202) 619-8925, Facsimile (202) 619-8978.

B. If the General Services Administration, Department of Agriculture, or Department of Veterans Affairs issued this solicitation, a single copy of specifications, standards, and commercial item descriptions cited in this solicitation may be obtained free of charge by submitting a request to the addressee in paragraph (a) of this provision. Additional copies will be issued for a fee.

1.3 AVAILABILITY FOR EXAMINATION OF SPECIFICATIONS NOT LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS (FAR 52.211-4) (JUN 1988)

A. The specifications and standards cited in this solicitation can be examined at the following location:

1. DEPARTMENT OF VETERANS AFFAIRS
   Office of Construction & Facilities Management
   Facilities Quality Service (00CFM1A)
   425 Eye Street N.W, (sixth floor)
   Washington, DC 20001
   Telephone Numbers: (202) 632-5249 or (202) 632-5178
   Between 9:00 AM - 3:00 PM

1.4 AVAILABILITY OF SPECIFICATIONS NOT LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS (FAR 52.211-3) (JUN 1988)

A. The specifications cited in this solicitation may be obtained from the associations or organizations listed below.

1. AA Aluminum Association Inc.
   http://www.aluminum.org
2. AABC Associated Air Balance Council
   https://www.aabc.com
3. AAMA American Architectural Manufacturer's Association
   http://www.aamanet.org
4. AASHTO American Association of State Highway and Transportation Officials
   http://www.aashto.org
5. AATCC American Association of Textile Chemists and Colorists
   http://www.aatcc.org
6. ACGIH American Conference of Governmental Industrial Hygienists
   http://www.acgih.org

7. ACI American Concrete Institute
http://www.aci-int.net
8. ACPA American Concrete Pipe Association
http://www.concrete-pipe.org
9. ACPPA American Concrete Pressure Pipe Association
http://www.acppa.org
10. ADC Air Diffusion Council
http://flexibleduct.org
11. AGA American Gas Association
http://www.aga.org
12. AGC Associated General Contractors of America
http://www.agc.org
13. AGMA American Gear Manufacturers Association, Inc.
http://www.agma.org
14. AH American Hort
https://www.americanhort.org
15. AHAM Association of Home Appliance Manufacturers
http://www.aham.org
16. AIA American Institute of Architects
http://www.aia.org
17. AISC American Institute of Steel Construction
http://www.aisc.org
18. AISI American Iron and Steel Institute
http://www.steel.org
19. AITC American Institute of Timber Construction
https://aitc-glulam.org
20. AMCA Air Movement and Control Association, Inc.
http://www.amca.org
21. ANSI American National Standards Institute, Inc.
http://www.ansi.org
22. APA The Engineered Wood Association
http://www.apawood.org
23. ARI Air-Conditioning and Refrigeration Institute
http://www.ari.org
24. ARPM Association for Rubber Product Manufacturers
https://arpm.com
25. ASABE American Society of Agricultural and Biological Engineers
https://www.asabe.org
26. ASCE American Society of Civil Engineers
http://www.asce.org
27. ASHRAE American Society of Heating, Refrigerating, and Air-Conditioning Engineers
http://www.ashrae.org
28. ASME American Society of Mechanical Engineers
http://www.asme.org
29. ASSE American Society of Sanitary Engineering International
http://www.asse-plumbing.org
30. ASTM American Society for Testing and Materials International
http://www.astm.org
31. AWI Architectural Woodwork Institute
https://www.awinet.org
32. AWS American Welding Society
https://www.aws.org
33. AWWA American Water Works Association
https://www.awwa.org

34. BHMA Builders Hardware Manufacturers Association
https://www.buildershardware.com
35. BIA The Brick Industry Association
http://www.gobrick.com
36. CAGI Compressed Air and Gas Institute
https://www.cagi.org
37. CGA Compressed Gas Association, Inc.
https://www.cganet.com
38. CI The Chlorine Institute, Inc.
https://www.chlorineinstitute.org
39. CISCA Ceilings and Interior Systems Construction Association
https://www.cisca.org
40. CISPI Cast Iron Soil Pipe Institute
https://www.cispi.org
41. CLFMI Chain Link Fence Manufacturers Institute
https://www.chainlinkinfo.org
42. CPA Composite Panel Association
https://www.compositepanel.org
43. CPMB Concrete Plant Manufacturers Bureau
https://www.cpmb.org
44. CRA California Redwood Association
http://www.calredwood.org
45. CRSI Concrete Reinforcing Steel Institute
https://www.crsi.org
46. CTI Cooling Technology Institute
https://www.cti.org
47. DHA Decorative Hardwoods Association
https://www.decorativehardwoods.org
48. DHI Door and Hardware Institute
https://www.dhi.org
49. EGSA Electrical Generating Systems Association
http://www.egsa.org
50. EEI Edison Electric Institute
https://www.eei.org
51. EPA United States Environmental Protection Agency
https://www.epa.gov
52. ETL ETL Testing Services
http://www.intertek.com
53. FAA Federal Aviation Administration
https://www.faa.gov
54. FCC Federal Communications Commission
https://www.fcc.gov
55. FGI Facility Guidelines Institute
https://fgiguidelines.org
56. FPS Forest Products Society
http://www.forestprod.org
57. GANA Glass Association of North America
http://www.glasswebsite.com
58. FM Factory Mutual Global Insurance
https://www.fmglobal.com
59. GA Gypsum Association
https://gypsum.org
60. GSA General Services Administration
https://www.gsa.gov
61. HI Hydraulic Institute
http://www.pumps.org

62. ICC International Code Council
https://shop.iccsafe.org
63. ICEA Insulated Cable Engineers Association
https://www.icea.net
64. ICAC Institute of Clean Air Companies
http://www.icac.com
65. IEEE Institute of Electrical and Electronics Engineers
https://www.ieee.org
66. IGMA Insulating Glass Manufacturers Alliance
https://www.igmaonline.org
67. IMSA International Municipal Signal Association
http://www.imsasafety.org
68. MBMA Metal Building Manufacturers Association
https://www.mbma.com
69. MSS Manufacturers Standardization Society of the Valve and Fittings Industry
http://msshq.org
70. NAAMM National Association of Architectural Metal Manufacturers
https://www.naamm.org
71. PHCC Plumbing-Heating-Cooling Contractors Association
https://www.phccweb.org
72. NBS National Bureau of Standards
See - NIST
73. NBBI The National Board of Boiler and Pressure Vessel Inspectors
https://www.nationalboard.org
74. NEC National Electric Code
See - NFPA National Fire Protection Association
75. NEMA National Electrical Manufacturers Association
https://www.nema.org
76. NFPA National Fire Protection Association
https://www.nfpa.org
77. NHLA National Hardwood Lumber Association
https://www.nhla.com
78. NIH National Institute of Health
https://www.nih.gov
79. NIST National Institute of Standards and Technology
https://www.nist.gov
80. NELMA Northeastern Lumber Manufacturers Association, Inc.
http://www.nelma.org
81. NPA National Particleboard Association
(See CPA, Composite Panel Association)
82. NSF National Sanitation Foundation
http://www.nsf.org
83. OSHA Occupational Safety and Health Administration
Department of Labor
https://www.osha.gov
84. PCA Portland Cement Association
https://www.cement.org
85. PCI Precast Prestressed Concrete Institute
https://www.pci.org
86. PPI Plastics Pipe Institute
https://www.plasticpipe.org
87. PEI Porcelain Enamel Institute
http://www.porcelainenamel.com
88. PTI Post-Tensioning Institute
http://www.post-tensioning.org

89. RFCI Resilient Floor Covering Institute
https://www.rfci.com
90. RIS Redwood Inspection Service
(See Western Wood Products Association)
https://www.wwpa.org
91. SCMA Southern Cypress Manufacturers Association
http://www.cypressinfo.org
92. SDI Steel Door Institute
http://www.steeldoor.org
93. SJI Steel Joist Institute
https://www.steeljoist.org
94. SMACNA Sheet Metal & Air-Conditioning Contractors' National Association
https://www.smacna.org
95. SSPC The Society for Protective Coatings
https://www.sspc.org
96. STI Steel Tank Institute
https://www.steeltank.com
97. SWI Steel Window Institute
https://www.steelwindows.com
98. TCNA Tile Council of North America
https://www.tcnatile.com
99. TEMA Tubular Exchanger Manufacturers Association
http://www.tema.org
100. TPI Truss Plate Institute
https://www.tpinst.org
101. UBC The Uniform Building Code
(See ICC)
102. UL Underwriters' Laboratories Incorporated
https://www.ul.com
103. ULC Underwriters' Laboratories of Canada
https://www.ulc.ca
104. WCLB West Coast Lumber Inspection Bureau
http://www.wclib.org
105. WDMA Window and Door Manufacturers Association
https://www.wdma.com
106. WRCLA Western Red Cedar Lumber Association
https://www.realcedar.com
107. WWPA Western Wood Products Association
http://www.wwpa.org

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SECTION 01 45 00

QUALITY CONTROL

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies requirements for Contractor Quality Control (CQC) for Design-Bid-Build (DBB).

1.2 APPLICABLE PUBLICATIONS

A. The publication listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

B. ASTM International (ASTM)
   1. D3740 - (2012a) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
   2. E329 - (2014a) Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

1.3 SUBMITTALS

A. Government approval is required for all submittals. CQC inspection reports shall be submitted under this Specification section and follow the Applicable CQC Control Phase (Preparatory, Initial, or Follow-Up): Applicable Specification section naming convention.
   1. Preconstruction Submittals
      a. Interim CQC Plan
      b. CQC Plan
   2. Test Reports
      a. Verification Statement
   3. Third-Party Inspection Reports
      a. Third-Party Inspection Report shall be submitted to the COR.
      b. Inspection reports shall include work inspected or tested was or was not completed in conformance to approved construction documents.
         1) Discrepancies shall be brought to the immediate attention of the contractor and COR.
      c. Final Third-Party Inspection Report:
         1) Prior to the start of Commissioning activities, the Third-Party Inspection contractor shall submit a final Report documenting inspections and tests, and correction of any discrepancies noted in the inspections or tests.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Establish and maintain an effective quality control (QC) system that complies with the FAR Clause 52.246.12 titled “Inspection of Construction”. QC consists of plans, procedures, and organization necessary to produce an end product which complies with the Contract requirements. The QC system covers all design and construction operations, both onsite and offsite, and be keyed to the proposed design and construction sequence. The project superintendent will be held responsible for the quality of work and is subject to removal by the Contracting Office or Authorized designee for non-compliance with the quality requirements

specified in the Contract. In this context the highest level manager responsible for the overall construction activities at the site, including quality and production is the project superintendent. The project superintendent maintains a physical presence at the site at all times and is responsible for all construction and related activities at the site, except as otherwise acceptable to the Contracting Officer.

3.2 CQC PLAN:

A. Submit the CQC Plan to the CO or Designee to determine during Constructability review – no later than 15days after receipt of Notice to Proceed (NTP) proposed to implement the requirements of the FAR Clause 52.246.12 titled “Inspection of Construction”. The Government will consider an Interim CQC Plan for the first 15 days of operation, which must be accepted within 5business days of NTP. Design and/or construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an Interim plan applicable to the particular feature of work to be started. Work outside of the accepted Interim CQC Plan will not be permitted to begin until acceptance of a CQC Plan or another Interim CQC Plan containing the additional work scope is accepted.

B. Content of the CQC Plan: Include, as a minimum, the following to cover all design and construction operations, both onsite and offsite, including work by subcontractors, designers of record consultants, architects/engineers (A/E), fabricators, suppliers, and purchasing agents:

1. A description of the QC organization, including a chart showing lines of authority and acknowledgement that the CQC staff will implement the three phase control system for all aspects of the work specified. Include a CQC System Manager that reports to the project superintendent.
2. The name, qualifications (in resume format) duties, responsibilities, and authorities of each person assigned a CQC function.
3. A copy of the letter to the CQC System Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop work which is not in compliance with the Contract. Letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities will to the Contracting Officer or Authorized designee. be issued by the CQC System Manager. Furnish copies of these letters
4. Procedures for scheduling, reviewing, certifying, and managing submittals including those of subcontractors, designers of record, consultants, A/E’s offsite fabricators, suppliers and purchasing agents. These procedures must be in accordance with Section 01 33 23 Shop Drawings, Product Data, and Samples.
5. Control, verification, and acceptance of testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. (Laboratory facilities approved by the Contracting Officer or Authorized designee are required to be used)
6. Procedures for tracking Preparatory, Initial, and Follow-Up control phases and control, verification, and acceptance tests including documentation.
7. Procedures for tracking design and construction deficiencies from identification through acceptable corrective action. Establish verification procedures that identified deficiencies have been corrected.
8. Reporting procedures, including proposed reporting formats.
9. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks has separate control requirements, and is identified by different trades or disciplines, or it is work by the same trade in a different environment. Although each section of specifications can generally be considered as a definable feature of work, there are frequently more than one definable feature under a particular section. This list will be agreed upon during the Coordination meeting.
10. Coordinate schedule work with Special Inspections required by Section 01 45 35 Special Inspections, the Statement of Special Inspections and Schedule of Special Inspections. Where the applicable Code issue by the International Code Council (ICC) calls for

inspections by the Building Official, the Contractor must include the inspections in the CQC Plan and must perform the inspections required by the applicable ICC. The Contractor must perform these inspections using independent qualified inspectors. Include the Special Inspection Plan requirements in the CQC Plan.

C. Acceptance of Plan: Acceptance of the Contractor's plan is required prior to the start of design and construction. Acceptance is conditional and will be predicated on satisfactory performance during the design and construction. The Government reserves the right to require the Contractor to make changes in the CQC Plan and operations including removal of personnel as necessary, to obtain the quality specified.

D. Notification of Changes: After acceptance of the CQC Plan, notify the Contracting Officer or Authorized designee in writing of any proposed change. Proposed changes are subject to acceptance by the Government prior to implementation by the Contractor.

3.3 COORDINATION MEETING:

A. After the Preconstruction Conference Post-award Conference before start of design or construction, and prior to acceptance by the Government of the CQC Plan, meet with the Contracting Officer or Authorized designee to discuss the Contractor's quality control system. Submit the CQC Plan a minimum of 5 business days prior to the Coordination Meeting. During the meeting, a mutual understanding of the system details must be developed, including the forms for recording the CC operations, design activities (if applicable), control activities, testing, administration of the system for both onsite and offsite work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. Minutes of the meeting will be prepared by the Government, signed by both the Contractor and Contracting Officer or Authorized designee and will become a part of the contract file. There can be occasions when subsequent conferences will be called by either party to reconfirm mutual understandings or address deficiencies in the CQC system or procedures which can require corrective action by the Contractor.

3.4 QUALITY CONTROL ORGANIZATION:

A. Personnel Requirements: The requirements for the CQC organization are a Safety and Health Manager, CQC System Manager, a Design Quality Manager (if applicable), and sufficient number of additional qualified personnel to ensure safety and Contract compliance, and Third-Party Inspection. The Safety and Health Manager shall satisfy the requirements of Specification 01 35 26 Safety Requirements and reports directly to a senior project (or corporate) official independent from the CQC System Manager. The Safety and Health Manager will also serve as a member of the CQC Staff. Personnel identified in the technical provisions as requiring specialized skills to assure the required work is being performed properly will also be included as part of the CQC organization. The Contractor's CQC staff maintains a presence at the site at all times during progress of the work and have complete authority and responsibility to take any action necessary to ensure Contract compliance. The CQC staff will be subject to acceptance by the Contracting Officer or Authorized designee. Provide adequate office space, filing systems, and other resources as necessary to maintain an effective and fully functional CQC organization. Promptly complete and furnish all letters, material submittals, shop drawings submittals, schedules and all other project documentation to the CQC organization. The CQC organization is responsible to maintain these documents and records at the site at all times, except as otherwise acceptable to the Government.

B. CQC System Manager: Identify as CQC System Manager an individual within the onsite work organization that is responsible for overall management of CQC and has the authority to act in all CQC matters for the Contractor. The CQC system Manager is required to be a graduate engineer, graduate architect, or a graduate of construction management, with a minimum of three years construction experience on construction similar to the scope of this Contract. This CQC System manager is on the site at all times during construction and is employed by the General Contractor. Identify in the plan an alternate to serve in the event of the CDQC System

Manager's absence. The requirements for the alternate are the same as the CQC System Manager.

C. CQC Personnel: In addition to CQC personnel specified elsewhere in the contract, provide as part of the CQC organization specialized personnel to assist in the CQC System Manager for the following areas, as applicable: electrical, mechanical, civil, structural, environmental, architectural, materials technician submittals clerk, and low voltage systems. These individuals or specified technical companies are directly employed by the General Contractor and cannot be employed by a supplier or subcontractor on this project responsible to the CQC System Manager; be physically present at the construction site during work on the specialized personnel's areas of responsibility; have the necessary education or experience in accordance with the Experience Matrix listed herein. These individuals can perform other duties but need to be allowed sufficient time to perform the specialized personnel's assigned quality controls duties as described in the CQC Plan. A single person can cover more than one area provided that the single person is qualified to perform QC activities in each designated and that workload allows.

D. Third-Party Inspection Personnel:
1. In addition to CQC personnel specified elsewhere in the contract, provide Third-Party Inspection Personnel as part of the CQC organization specialized personnel to assist in the CQC System Manager for the following areas, as applicable: electrical, mechanical, civil, structural, environmental, architectural, and low voltage systems.
2. These individuals or specified technical companies are directly employed by the General Contractor and cannot be employed by a supplier or subcontractor on this project; be responsible to the CQC System Manager & COR; be physically present at the construction site to observe, inspect, test, and report the results before work is covered up. These individuals or specified technical companies shall have provide the specialized personnel's areas of responsibility; have the necessary education or experience in accordance with the Experience Matrix listed herein.
3. These individuals or companies have no other duties other than Third-Party Inspection. A single person can cover more than one area provided that the single person is qualified to perform Third-Party Inspection activities in each designated and that workload allows.
4. The individuals or specified technical companies shall be subject to acceptance by the Contracting Officer or Authorized designee.
5. These individuals or specified technical companies are not the same as Special Inspector of Record per Section 01 45 35, SPECIAL INSPECTIONS.

E. EXPERIENCE MATRIX

Area	Qualifications
Civil	Graduate Civil Engineer or Construction Manager with 2 years experience in the type of work being performed on this project or technician with 5 years related experience.
Mechanical	Graduate Mechanical Engineer with 2 years experience or construction professional with 5 years of experience supervising mechanical features of work in the field with a construction company.
Electrical	Graduate Electrical Engineer with 2 years related experience or construction professional with 5 years of experience supervising electrical features of work in the field with a construction company.

Area	Qualifications
Structural	Graduate Civil Engineer (with Structural Track or Focus), Structural Engineer, or Construction Manager with 2 years experience or construction professional with 5 years experience supervising structural features of work in the field with a construction company.
Architectural	Graduate Architect with 2 years experience or construction professional with 5 years of related experience.
Environmental	Graduate Environmental Engineer with 3 years experience.
Submittals	Submittal Clerk with 1 year experience.
Concrete, Pavement, and Soils	Materials Technician with 2 years experience for the appropriate area.
Testing, Adjusting, and Balancing (TAB)	Specialist must be a member of AABC or an experienced technician of the firm certified by the NEBB.
Design Quality Control Manager	Registered Architect or Professional Engineer

F. Additional Requirements: In addition to the above experience and education requirements, the CQC System Manager and Alternate CQC System Manager are required to have completed the Construction Quality Management (CQM) for Construction course. If the CQC System Manager does not have a current specification, obtain the CQM for Contractors course identification within 90 days of award. This course is periodically offered by the Naval Facilities Engineering Command and the Army Corps of Engineers. Contact the Contracting Officer or Authorized designee for information on the next scheduled class.

G. Organizational Changes: Maintain the CQC staff at full strength at all times. When it is necessary to make changes to the CQC staff, revise the CQC Plan to reflect the changes and submit the changes to the Contracting Officer or Authorized designee for acceptance.

3.5 SUBMITTALS AND DELIVERABLES:

A. Submittals have to comply with the requirements in Section 01 33 23 Shop Drawings, Product Data, and Samples. The CQC organization is responsible for certifying that all submittals and deliverables are in compliance with the contract requirements. When Section 01 91 00 General Commissioning Requirements is included in the contract, the submittals required by the section have to be coordinated with the Section 01 33 23 Shop Drawings, Product Data, and Samples to ensure adequate time is allowed for each type of submittal required.

1. Third-Party Inspection individuals or specified technical companies shall review the submittals before the contractor submits to the COR.

3.6 CONTROL:

A. CQC is the means by which the Contractor ensures that the construction, to include that of subcontractors and suppliers, complies with the requirements of the contract. At least three phases of control are required to be conducted by the CQC System Manager for each definable feature of the construction work as follows:

1. Preparatory Phase: This phase is performed prior to beginning work on each definable feature of work after all required plans/documents/materials are approved/accepted, and after copies are at the work site. This phase includes:

a. A review of each paragraph of applicable specifications, references codes, and standards. Make available during the preparatory inspection a copy of those sections of referenced codes and standards applicable to that portion of the work to be accomplished in the field. Maintain and make available in the field for use by Government personnel until final acceptance of the work.
b. Review of the Contract drawings.
c. Check to assure that all materials and equipment have been tested, submitted, and approved.
d. Review of provisions that have been made to provide required control inspection and testing.
e. Review Special Inspections required by Section 01 45 35 Special Inspections, that Statement of Special Inspections and the Schedule of Specials Inspections.
f. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the Contract.
g. Examination of required materials, equipment, and sample work to assure that they are on hand conform to approved shop drawings or submitted data, and are properly stored.
h. Review of the appropriate Activity Hazard Analysis (AHA) to assure safety requirements are met.
i. Discussion of procedures for controlling quality of the work including repetitive deficiencies. Document construction tolerances and workmanship standards – contract defined or industry standard if not contract defined - for that feature of work.
j. Check to ensure that the portion of the plan for the work to be performed has been accepted by the Contracting Officer.
k. Discussion of the initial control phase.
l. The Government needs to be notified at least 48 hours or 2 business days in advance of beginning the Preparatory control phase. Include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. Document the results of the Preparatory phase actions by separate minutes prepared by the CQC System Manager and attach to the daily CQC report. Instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.

B. Initial Phase: This phase is accomplished at the beginning of a definable feature of work. Accomplish the following:
1. Check work to ensure that it is in full compliance with contract requirements. Review minutes of the Preparatory meeting.
2. Verify adequacy of controls to ensure full contract compliance. Verify the required control inspection and testing is in compliance with the contract.
3. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with required sample panels as appropriate.
4. Resolve all differences.
5. Check safety to include compliance with an upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.
6. The Government needs to be notified at least 48 hours or 2 business days in advance of beginning the initial phase for definable features of work. Prepare separate minutes of this phase by the CQC System Manager and attach to the daily CQC report. Indicate the exact location of initial phase for definable feature of work for future reference and comparison with Follow-Up phases.
7. The initial phase for each definable feature of work is repeated for each new crew to work onsite, or any time acceptable specified quality standards are not being met.
8. Coordinate scheduled work with Special Inspections required by Section 01 45 35 Special Inspections, the Statement of Special Inspections, and the Schedule of Special Inspections.

C. Follow-Up Phase: Perform daily checks to assure control activities, including control testing, are providing continued compliance with contract requirements until the completion of the particular feature of work. Record the checks in the CQC documentation. Conduct final Follow-Up checks and correct all deficiencies prior to the start of additional features of work which may be affected by the deficient work. Do not build upon nor conceal non-conforming work. Coordinate scheduled work with Special Inspections required by Section 01 45 35 Special Inspections, the Statement of Special Inspections, and the Schedule of Special Inspections

D. Additional Preparatory and Initial Phases on the same definable features of work if: the quality ongoing work is unacceptable; if there are changes in the applicable CQC staff, onsite production supervision or work crew; if work on a definable feature is resumed after a substantial period of inactivity, or if other problems develop.

3.7 TESTS

A. Testing Procedure: Perform specified or required tests to verify that control measures are adequate to provide a product which conforms to contract requirements. Upon request, furnish to the Government duplicate samples of test specimens for possible testing by the Government. Testing includes operation and acceptance test when specified. Procure the services of a Department of Veteran Affairs approved testing laboratory or establish an approved testing laboratory at the project site. Perform the following activities and record and provide the following data:
   1. Verify that testing procedures comply with contract requirements.
   2. Verify that facilities and testing equipment are available and comply with testing standards.
   3. Check test instrument calibration data against certified standards.
   4. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.
   5. Record results of all tests taken, both passing and failing on the CQC report for the date taken. Specification paragraph reference, location where tests were taken, and the unique sequential control number identifying the test. If approved by the Contracting Officer or Authorized designee, actual test reports are submitted later with a reference to the test number and date taken. Provide an information copy of tests performed by an offsite or commercial test facility directly to the Contracting Officer or Authorized designee. Failure to submit timely test reports as stated results in nonpayment for related work performed and disapproval of the test facility for this Contract.

B. Testing Laboratories: All testing laboratories must be validated through the procedures contained in Specification section 01 45 29 Testing Laboratory Services.
   1. Capability Check: The Government reserves the right to check laboratory equipment in the proposed laboratory for compliance with the standards set forth in the contract specifications and to check the laboratory technician's testing procedures and techniques. Laboratories utilized for testing soils, concrete, asphalt and steel is required to meet criteria detailed in ASTM D3740 and ASTM E329.
   2. Capability Recheck: If the selected laboratory fails the capability check, the Contractor will be assessed a charge equal to value of recheck to reimburse the Government for each succeeding recheck of the laboratory or the checking of a subsequently selected laboratory. Such costs will be deducted from the Contract amount due the Contractor.

C. Onsite Laboratory: The Government reserves the right to utilize the Contractor's control testing laboratory and equipment to make assurance tests, and to check the Contractor's testing procedures, techniques, and test results at no additional cost to the Government.

3.8 COMPLETION INSPECTION

A. Punch-Out Inspection: Conduct an inspection of the work by the CQC system Manager near the end of the work, or any increment of the work established by a time stated FAR 52.211-10 – Commencement, Prosecution, and Completion of Work, or by the specifications. Prepare and include in the CQC documentation a punch list of items which do not conform to the approved

drawings and specifications. Include within the list of deficiencies the estimated date by which the deficiencies will be corrected. Make a second inspection the CQC System Manager or staff to ascertain that all deficiencies have been corrected. Once this is accomplished, notify the Government that the facility is ready for the Government Pre-Final Inspection.

52.211-10 -- Commencement, Prosecution, and Completion of Work.

As prescribed in 11.404(b), insert the following clause in solicitations and contracts when a fixed-price construction contract is contemplated. The clause may be changed to accommodate the issuance of orders under indefinite-delivery contracts for construction.

Commencement, Prosecution, and Completion of Work (Apr 1984)

The Contractor shall be required to:

(a) commence work under this contract within 90 calendar days after the date the Contractor receives the notice to proceed,
(b) prosecute the work diligently, and
(c) complete the entire work ready for use not later than 730 calendar days.* The time stated for completion shall include final cleanup of the premises.

(End of Clause)

B. Pre-Final Inspection: The Government will perform the Pre-Final Inspection to verify that the facility is complete and ready to be occupied. A Government Pre-Final Punch List may be developed as a result of this inspection. Ensure that all items on this list have been corrected before notifying the Government, so that a Final Acceptance Inspection with the customer can be scheduled. Correct any items noted on the Pre-Final Inspection in a timely manner. These inspections and any deficiency corrections required by this paragraph need to be accomplished within the time slated for completion of the entire work or any particular increment of the work if the project is divided into increments by separate construction completion dates.

C. Final Acceptance Inspection: The Contractor's QC Inspection personnel, plus the superintendent or other primary management person, and the Contracting Officer's Authorized designee is required to be in attendance at the Final Acceptance Inspection. Additional Government personnel can also be in attendance. The Final Acceptance Inspection will be formally scheduled by the Contracting Officer's or Authorized designee based upon results of the Pre-Final Inspection. Notify the Contracting Officer through the COR office at least 14 days prior to the Final Acceptance Inspection and include the Contractor's assurance that all specific items previously identified to the Contractor as being unacceptable, along with all remaining work performed under the contract, will be complete and acceptable by the date schedule for the Final Acceptance Inspection. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance with FAR Clause 52.246-12 titled "Inspection of Construction".

3.9 DOCUMENTATION

A. Quality Control Activities: Maintain current records providing factual evidence that required QC activities and tests have been performed. Include in these records the work of subcontractors and suppliers on an acceptable form that includes, as a minimum, the following information:
1. The name and area of responsibility of the Contractor/Subcontractor

2. Operating plant/equipment with hours worked, idle, or down for repair.
3. Work performed each day, giving location, description, and by whom. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.
4. Test and control activities performed with results and references to specification/drawing requirements. Identify the Control Phase (Preparatory, Initial, and/or Follow-Up). List deficiencies noted, along with corrective action.
5. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specification/drawing requirements.
6. Submittals and deliverables reviewed, with Contract reference, by whom, and action taken.
7. Offsite surveillance activities, including actions taken.
8. Job safety evaluations stating what was checked, results, and instructions or corrective actions.
9. Instructions given/received and conflicts in plans and specifications.

B. Verification Statement: Indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. Cover both conforming and deficient features and include a statement that equipment and materials incorporated in the work and workmanship comply with the Contract. Furnish the original and one copy of these records in report form to the Government daily with 1 week after the date covered by the report, except that reports need not be submitted for days on which no work is performed. As a minimum, prepare and submit on report for every 7 days of no work and on the last day of a no work period. All calendar days need to be accounted for throughout the life of the contract. The first report following a day of no work will be for that day only. Reports need to be signed and dated by the CQC System Manager. Include copies of test reports and copies of reports prepared by all subordinate QC personnel within the CQC System Manager Report.

3.10 SAMPLE FORMS

A. Templates of various quality control reports can be found on the Whole Building Design Guide website at https://www.wbdg.org/FFC/NAVGRAPH/quality_control_reports.pdf

3.11 NOTIFICATION OF NONCOMPLIANCE:

1. The Contracting Officer or Authorized designee will notify the Contractor of any detected noncompliance with the foregoing requirements. The Contractor should take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site will be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer can issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders will be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

--- END OF SECTION ---

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CONTRACTOR'S QUALITY CONTROL REPORT (QCR)	DATE:	REPORT NO.:

CONTRACT NUMBER AND NAME OF CONTRACTOR:	DESCRIPTION AND LOCATION OF THE WORK:

WEATHER CLASSIFICATION:

CLASS A No interruptions of any kind from weather conditions occurring on this or previous shifts.

CLASS B Weather occurred during this shift that caused a complete stoppage of all work.

CLASS C Weather occurred during this shift that caused a partial stoppage of work.

CLASS D Weather overhead excellent or suitable during shift. Work completely stopped due to results of previous adverse weather.

CLASS E Weather overhead excellent or suitable during shift but work partially stopped due to previous adverse manner.

OTHER Explain.

CLASSIFICATION:

CLASS _____

TEMPERATURE:

MAX _____ MIN _____

PRECIPITATION:

INCHES _____

CONTRACTOR/SUBCONTRACTORS AND AREA OF RESPONSIBILITY FOR WORK PERFORMED TODAY: *(Attach list of items of equipment either idle or working as appropriate.)*

a. _____

b. _____

c. _____

d. _____

e. _____

f. _____

g. _____

1. WORK PERFORMED TODAY: (Indicate location and description of work performed. Refer to work performed by prime and/or subcontractors by letter in Table above.)

2. TYPE AND RESULTS OF INSPECTION: (Indicate whether: P - Preparatory, I - Initial, or F - Follow-up and include satisfactory work completed or deficiencies with action to be taken.)

3. TESTS REQUIRED BY PLANS AND/OR SPECIFICATIONS PERFORMED AND RESULTS OF TESTS:

4. VERBAL INSTRUCTIONS RECEIVED: (List any instructions given by Government personnel on construction deficiencies. retesting required, etc., with action to be taken.)

5. REMARKS: (Cover any conflicts in plans, specifications or instructions: acceptability of incoming materials: offsite surveillance activities; progress of work, delays, causes and extent thereof; days of no work with reasons for same.)

6. SAFETY: (Include any infractions of approved safety plan, safety manual or instructions from Government personnel. Specify corrective action taken.)

INSPECTOR

CONTRACTOR'S CERTIFICATION: I certify that the above report is complete and correct and that all material and equipment used, work performed and tests conducted during this reporting period were in strict compliance with the contract plans and specifications except as noted above.

CONTRACTOR'S APPROVED AUTHORIZED REPRESENTATIVE

SECTION 01 45 29

TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies materials testing activities and inspection services required during project construction to be provided by a Testing Laboratory retained by the General Contractor.

B. All testing shall be by certified testing laboratories subcontracted by the Contractor. The Government shall not be required to contract testing for any trade.

1.2 APPLICABLE PUBLICATIONS:

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

B. American Association of State Highway and Transportation Officials (AASHTO):

T27-11 ..... Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates

T96-02 (R2006) ..... Standard Method of Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

T99-10 ..... Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5 Kg (5.5 lb.) Rammer and a 305 mm (12 in.) Drop

T104-99 (R2007) ..... Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate

T180-10 ..... Standard Method of Test for Moisture-Density Relations of Soils using a 4.54 kg (10 lb.) Rammer and a 457 mm (18 in.) Drop

T191-02(R2006) ..... Standard Method of Test for Density of Soil In-Place by the Sand-Cone Method

T310-13 ..... Standard Method of Test for In-place Density and Moisture Content of Soil and Soil-aggregate by Nuclear Methods (Shallow Depth)

C. American Concrete Institute (ACI):

506.4R-94 (R2004) ..... Guide for the Evaluation of Shotcrete

D. American Society for Testing and Materials (ASTM):

A370-12 ..... Standard Test Methods and Definitions for Mechanical Testing of Steel Products

A416/A416M-10 ..... Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete

C31/C31M-10 ..... Standard Practice for Making and Curing Concrete Test Specimens in the Field

C33/C33M-11a ..... Standard Specification for Concrete Aggregates

C39/C39M-12 ..... Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

C109/C109M-11b ..... Standard Test Method for Compressive Strength of Hydraulic Cement Mortars

C136-06.....Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

C138/C138M-10b.....Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete

C140-12.....Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units

C143/C143M-10a.....Standard Test Method for Slump of Hydraulic Cement Concrete

C172/C172M-10.....Standard Practice for Sampling Freshly Mixed Concrete

C173/C173M-10b.....Standard Test Method for Air Content of freshly Mixed Concrete by the Volumetric Method

C330/C330M-09.....Standard Specification for Lightweight Aggregates for Structural Concrete

C567/C567M-11.....Standard Test Method for Density Structural Lightweight Concrete

C780-11.....Standard Test Method for Pre-construction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry

C1019-11.....Standard Test Method for Sampling and Testing Grout

C1064/C1064M-11.....Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete

C1077-11c.....Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation

C1314-11a.....Standard Test Method for Compressive Strength of Masonry Prisms

D422-63(2007).....Standard Test Method for Particle-Size Analysis of Soils

D698-07e1.....Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort

D1140-00(2006).....Standard Test Methods for Amount of Material in Soils Finer than No. 200 Sieve

D1143/D1143M-07e1.....Standard Test Methods for Deep Foundations Under Static Axial Compressive Load

D1188-07e1.....Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples

D1556-07.....Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method

D1557-09.....Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft lbf/ft^3 (2,700 KNm/m^3))

D2166-06.....Standard Test Method for Unconfined Compressive Strength of Cohesive Soil

D2167-08).....Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method

D2216-10.....Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

D2974-07a.....Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils

D3666-11.....Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials

D3740-11.....Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as used in Engineering Design and Construction

D6938-10.....Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

E94-04(2010) .....Standard Guide for Radiographic Examination

E164-08.....Standard Practice for Contact Ultrasonic Testing of Weldments

E329-11c.....Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection

E543-09.....Standard Specification for Agencies Performing Non-Destructive Testing

E605-93(R2011).....Standard Test Methods for Thickness and Density of Sprayed Fire Resistive Material (SFRM) Applied to Structural Members

E709-08.....Standard Guide for Magnetic Particle Examination

E1155-96(R2008).....Determining FF Floor Flatness and FL Floor Levelness Numbers

F3125/F3125M-15.....Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions

E. American Welding Society (AWS):
D1.D1.1M-10.....Structural Welding Code-Steel

1.3 REQUIREMENTS:

A. Accreditation Requirements: Construction materials testing laboratories must be accredited by a laboratory accreditation authority and will be required to submit a copy of the Certificate of Accreditation and Scope of Accreditation. The laboratory's scope of accreditation must include the appropriate ASTM standards (i.e.; E329, C1077, D3666, D3740, A880, E543) listed in the technical sections of the specifications. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of OSHA and EPA. The policy applies to the specific laboratory performing the actual testing, not just the "Corporate Office."

B. Inspection and Testing: Testing laboratory shall inspect materials and workmanship and perform tests described herein and additional tests requested by COR. When it appears materials furnished, or work performed by Contractor fail to meet construction contract requirements, Testing Laboratory shall direct attention of COR to such failure.

C. Written Reports: Testing laboratory shall submit test reports to COR, Contractor, unless other arrangements are agreed to in writing by the COR. Submit reports of tests that fail to meet construction contract requirements on colored paper.

D. Verbal Reports: Give verbal notification to COR immediately of any irregularity.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EARTHWORK:

A. General: The Testing Laboratory shall provide qualified personnel, materials, equipment, and transportation as required to perform the services identified/required herein, within the agreed to schedule and/or time frame. The work to be performed shall be as identified herein and shall include but not be limited to the following:
   1. Observe fill and subgrades during proof-rolling to evaluate suitability of surface material to receive fill or base course. Provide recommendations to the Resident Engineer regarding suitability or unsuitability of areas where proof-rolling was observed. Where unsuitable results are observed, witness excavation of unsuitable material and recommend to Resident Engineer extent of removal and replacement of unsuitable materials and observe proof-rolling of replaced areas until satisfactory results are obtained.
   2. Provide full time observation of fill placement and compaction and field density testing in building areas and provide full time observation of fill placement and compaction and field density testing in pavement areas to verify that earthwork compaction obtained is in accordance with contract documents.
   3. Provide supervised geotechnical technician to inspect excavation, subsurface preparation, and backfill for structural fill.

B. Testing Compaction:
   1. Determine maximum density and optimum moisture content for each type of fill, backfill and subgrade material used, in compliance with ASTM D698 and/or ASTM D1557 as indicated in the geotechnical report.
   2. Make field density tests in accordance with the primary testing method following ASTM D6938 wherever possible. Field density tests utilizing ASTM D1556, or ASTM D2167 shall be utilized on a case by case basis only if there are problems with the validity of the results from the primary method due to specific site field conditions. Should the testing laboratory propose these alternative methods, they should provide satisfactory explanation to the COR before the tests are conducted.
      a. Building Slab Subgrade: At least one test of subgrade for every 185 m^2 (2000 square feet) of building slab, but in no case fewer than three tests. In each compacted fill layer, perform one test for every 185 m^2 (2000 square feet) of overlaying building slab, but in no case fewer than three tests.
      b. Foundation Wall Backfill: One test per 30 m (100 feet) of each layer of compacted fill but in no case fewer than two tests.
      c. Pavement Subgrade: One test for each 335 m^2 (400 square yards), but in no case fewer than two tests.
      d. Curb, Gutter, and Sidewalk: One test for each 90 m (300 feet), but in no case fewer than two tests.
      e. Trenches: One test at maximum 30 m (100 foot) intervals per 1200 mm (4 foot) of vertical lift and at changes in required density, but in no case fewer than two tests.
      f. Footing Subgrade: At least one test for each layer of soil on which footings will be placed. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested subgrade when acceptable to COR. In each compacted fill layer below wall footings, perform one field density test for every 30 m (100 feet) of wall. Verify subgrade is level, all loose or disturbed soils have been removed, and correlate actual soil conditions observed with those indicated by test borings.

C. Fill and Backfill Material Gradation: One test per stockpiled or in-place source material. Gradation of fill and backfill material shall be determined in accordance with ASTM C136 ASTM D422 ASTM D1140.

D. Testing for Footing Bearing Capacity: Evaluate if suitable bearing capacity material is encountered in footing subgrade.

E. Testing Materials: Test suitability of on-site and off-site borrow as directed by COR.

3.2 LANDSCAPING:

A. Test topsoil for organic materials, pH, phosphate, potash content, and gradation of particles.
   1. Test for organic material by using ASTM D2974.
   2. Determine percent of silt, sand, clay, and foreign materials such as rock, roots, and vegetation.

B. Submit laboratory test report of topsoil to COR.

3.3 ASPHALT CONCRETE PAVING:

A. Aggregate Base Course:
   1. Determine maximum density and optimum moisture content for aggregate base material in accordance with ASTM D1557, Method D.
   2. Make a minimum of three field density tests on each day's final compaction on each aggregate course in accordance with ASTM D1556.
   3. Sample and test aggregate as necessary to insure compliance with specification requirements for gradation, wear, and soundness as specified in the applicable state highway standards and specifications.

B. Asphalt Concrete:
   1. Aggregate: Sample and test aggregates in stock pile and hot-bins as necessary to insure compliance with specification requirements for gradation (AASHTO T27), wear (AASHTO T96), and soundness (AASHTO T104).
   2. Temperature: Check temperature of each load of asphalt concrete at mixing plant and at site of paving operation.
   3. Density: Make a minimum of two field density tests in accordance with ASTM D1188 of asphalt base and surface course for each day's paving operation.

3.4 SITE WORK CONCRETE:

A. Test site work concrete including materials for concrete as required in Section CONCRETE of this section.

3.5 CONCRETE:

A. Batch Plant Inspection and Materials Testing:
   1. Perform continuous batch plant inspection until concrete quality is established to satisfaction of COR with concurrence of Contracting Officer and perform periodic inspections thereafter as determined by COR.
   2. Periodically inspect and test batch proportioning equipment for accuracy and report deficiencies to COR.
   3. Sample and test mix ingredients as necessary to insure compliance with specifications.
   4. Sample and test aggregates daily and as necessary for moisture content. Test the dry rodded weight of the coarse aggregate whenever a sieve analysis is made, and when it appears there has been a change in the aggregate.
   5. Certify, in duplicate, ingredients and proportions and amounts of ingredients in concrete conform to approved trial mixes. When concrete is batched or mixed off immediate building site, certify (by signing, initialing or stamping thereon) on delivery slips (duplicate) that ingredients in truck-load mixes conform to proportions of aggregate weight, cement factor, and water-cement ratio of approved trial mixes.

B. Field Inspection and Materials Testing:
   1. Provide a technician at site of placement at all times to perform concrete sampling and testing.
   2. Review the delivery tickets of the ready-mix concrete trucks arriving on-site. Notify the Contractor if the concrete cannot be placed within the specified time limits or if the type of

concrete delivered is incorrect. Reject any loads that do not comply with the Specification requirements. Rejected loads are to be removed from the site at the Contractor's expense. Any rejected concrete that is placed will be subject to removal.

3. Take concrete samples at point of placement in accordance with ASTM C172. Mold and cure compression test cylinders in accordance with ASTM C31. Make at least three cylinders for each 40 m^3 (50 cubic yards) or less of each concrete type, and at least three cylinders for any one day's pour for each concrete type. After good concrete quality control has been established and maintained as determined by COR make three cylinders for each 80 m^3 (100 cubic yards) or less of each concrete type, and at least three cylinders from any one day's pour for each concrete type. [Label each cylinder with an identification number. COR may require additional cylinders to be molded and cured under job conditions.
4. Perform slump tests in accordance with ASTM C143. Test the first truck each day, and every time test cylinders are made. Test pumped concrete at the hopper and at the discharge end of the hose at the beginning of each day's pumping operations to determine change in slump.
5. Determine the air content of concrete per ASTM C173. For concrete required to be air-entrained, test the first truck and every 20 m^3 (25 cubic yards) thereafter each day. For concrete not required to be air-entrained, test every 80 m^3 (100 cubic yards) at random. For pumped concrete, initially test concrete at both the hopper and the discharge end of the hose to determine change in air content.
6. If slump or air content fall outside specified limits, make another test immediately from another portion of same batch.
7. Perform unit weight tests in compliance with ASTM C138 for normal weight concrete and ASTM C567 for lightweight concrete. Test the first truck and each time cylinders are made.
8. Notify laboratory technician at batch plant of mix irregularities and request materials and proportioning check.
9. Verify that specified mixing has been accomplished.
10. Environmental Conditions: Determine the temperature per ASTM C1064 for each truckload of concrete during hot weather and cold weather concreting operations:
    a. When ambient air temperature falls below 4.4 degrees C (40 degrees F), record maximum and minimum air temperatures in each 24 hour period; record air temperature inside protective enclosure; record minimum temperature of surface of hardened concrete.
    b. When ambient air temperature rises above 29.4 degrees C (85 degrees F), record maximum and minimum air temperature in each 24 hour period; record minimum relative humidity; record maximum wind velocity; record maximum temperature of surface of hardened concrete.
11. Inspect the reinforcing steel placement, including bar size, bar spacing, top and bottom concrete cover, proper tie into the chairs, and grade of steel prior to concrete placement. Submit detailed report of observations.
12. Observe conveying, placement, and consolidation of concrete for conformance to specifications.
13. Observe condition of formed surfaces upon removal of formwork prior to repair of surface defects and observe repair of surface defects.
14. Observe curing procedures for conformance with specifications, record dates of concrete placement, start of preliminary curing, start of final curing, end of curing period.
15. Observe preparations for placement of concrete:
    a. Inspect handling, conveying, and placing equipment, inspect vibrating and compaction equipment.
    b. Inspect preparation of construction, expansion, and isolation joints.
16. Observe preparations for protection from hot weather, cold weather, sun, and rain, and preparations for curing.
17. Observe concrete mixing:
    a. Monitor and record amount of water added at project site.

b. Observe minimum and maximum mixing times.

18. 18. Measure concrete flatwork for levelness and flatness as follows:
    a. Perform Floor Tolerance Measurements F_F and F_L in accordance with ASTM E1155. Calculate the actual overall F- numbers using the inferior/superior area method.
    b. Perform all floor tolerance measurements within 48 hours after slab installation and prior to removal of shoring and formwork.
    c. Provide the Contractor and the COR with the results of all profile tests, including a running tabulation of the overall F_F and F_L values for all slabs installed to date, within 72 hours after each slab installation.
19. Other inspections:
    a. Grouting under base plates.
    b. Grouting anchor bolts and reinforcing steel in hardened concrete.

C. Laboratory Tests of Field Samples:
1. Test compression test cylinders for strength in accordance with ASTM C39. For each test series, test one cylinder at 7 days and one cylinder at 28 days. Use remaining cylinder as a spare tested as directed by COR. Compile laboratory test reports as follows: Compressive strength test shall be result of one cylinder, except when one cylinder shows evidence of improper sampling, molding or testing, in which case it shall be discarded and strength of spare cylinder shall be used.
2. Make weight tests of hardened lightweight structural concrete in accordance with ASTM C567.
3. Furnish certified compression test reports (duplicate) to COR. In test report, indicate the following information:
    a. Cylinder identification number and date cast.
    b. Specific location at which test samples were taken.
    c. Type of concrete, slump, and percent air.
    d. Compressive strength of concrete in MPa (psi).
    e. Weight of lightweight structural concrete in kg/m^3 (pounds per cubic feet).
    f. Weather conditions during placing.
    g. Temperature of concrete in each test cylinder when test cylinder was molded.
    h. Maximum and minimum ambient temperature during placing.
    i. Ambient temperature when concrete sample in test cylinder was taken.
    j. Date delivered to laboratory and date tested.

3.6 REINFORCEMENT:

A. Review mill test reports furnished by Contractor.

B. Perform sampling at fabricating plant. Take two samples from each 23 t (25 tons) or fraction thereof of each size of reinforcing steel No. 10 thru No. 57 (No. 3 thru No. 18).

C. Make one tensile and one bend test in accordance with ASTM A370 from each pair of samples obtained.

D. Written report shall include, in addition to test results, heat number, manufacturer, type and grade of steel, and bar size.

E. Perform tension tests of mechanical and welded splices in accordance with ASTM A370.

3.7 MASONRY:

A. Mortar Tests:
1. Laboratory compressive strength test:
    a. Comply with ASTM C780.
    b. Obtain samples during or immediately after discharge from batch mixer.
    c. Furnish molds with 50 mm (2 inch), 3 compartment gang cube.
    d. Test one sample at 7 days and 2 samples at 28 days.

2. Two tests during first week of operation; one test per week after initial test until masonry completion.

B. Grout Tests:
1. Laboratory compressive strength test:
a. Comply with ASTM C1019.
b. Test one sample at 7 days and 2 samples at 28 days.
c. Perform test for each 230 m^2 (2500 square feet) of masonry.

C. Masonry Unit Tests:
1. Laboratory Compressive Strength Test:
a. Comply with ASTM C140.
b. Test 3 samples for each 460 m^2 (5000 square feet) of wall area.

D. Prism Tests: For each type of wall construction indicated, test masonry prisms per ASTM C1314 for each 460 m^2 (5000 square feet) of wall area. Prepare one set of prisms for testing at 7 days and one set for testing at 28 days.

3.8 STRUCTURAL STEEL:

A. General: Provide shop and field inspection and testing services to certify structural steel work is done in accordance with contract documents. Welding shall conform to AWS D1.1 Structural Welding Code.

B. Prefabrication Inspection:
1. Review design and shop detail drawings for size, length, type and location of all welds to be made.
2. Approve welding procedure qualifications either by pre-qualification or by witnessing qualifications tests.
3. Approve welder qualifications by certification or retesting.
4. Approve procedure for control of distortion and shrinkage stresses.
5. Approve procedures for welding in accordance with applicable sections of AWS D1.1.

C. Fabrication and Erection:
1. Weld Inspection:
a. Inspect welding equipment for capacity, maintenance and working condition.
b. Verify specified electrodes and handling and storage of electrodes in accordance with AWS D1.1.
c. Inspect preparation and assembly of materials to be welded for conformance with AWS D1.1.
d. Inspect preheating and interpass temperatures for conformance with AWS D1.1.
e. Measure 25 percent of fillet welds.
f. Welding Magnetic Particle Testing: Test in accordance with ASTM E709 for a minimum of:
1) 20 percent of all shear plate fillet welds at random, final pass only.
2) 20 percent of all continuity plate and bracing gusset plate fillet welds, at random, final pass only.
3) 100 percent of tension member fillet welds (i.e., hanger connection plates and other similar connections) for root and final passes.
4) 20 percent of length of built-up column member partial penetration and fillet welds at random for root and final passes.
5) 100 percent of length of built-up girder member partial penetration and fillet welds for root and final passes.
g. Welding Ultrasonic Testing: Test in accordance with ASTM E164 and AWS D1.1 for 100 percent of all full penetration welds, braced and moment frame column splices, and a minimum of 20 percent of all other partial penetration column splices, at random.
h. Welding Radiographic Testing: Test in accordance with ASTM E94, and AWS D1.1 for 5 percent of all full penetration welds at random.

i. Verify that correction of rejected welds are made in accordance with AWS D1.1.
j. Testing and inspection do not relieve the Contractor of the responsibility for providing materials and fabrication procedures in compliance with the specified requirements.

2. Bolt Inspection:
   a. Inspect high-strength bolted connections in accordance AISC Specifications for Structural Joints Using ASTM F3125 Bolts.
   b. Slip-Critical Connections: Inspect 10 percent of bolts, but not less than 2 bolts, selected at random in each connection in accordance with AISC Specifications for Structural Joints Using ASTM F3125 Bolts. Inspect all bolts in connection when one or more are rejected.
   c. Fully Pre-tensioned Connections: Inspect 10 percent of bolts, but not less than 2 bolts, selected at random in 25 percent of connections in accordance with AISC Specification for Structural Joints Using ASTM F3125 Bolts. Inspect all bolts in connection when one or more are rejected.
   d. Bolts installed by turn-of-nut tightening may be inspected with calibrated wrench when visual inspection was not performed during tightening.
   e. Snug Tight Connections: Inspect 10 percent of connections verifying that plies of connected elements have been brought into snug contact.
   f. f. Inspect field erected assemblies; verify locations of structural steel for plumbness, level, and alignment.

D. Submit inspection reports, record of welders and their certification, and identification, and instances of noncompliance to COR.

3.9 STEEL DECKING:

A. Provide field inspection of welds of metal deck to the supporting steel, and testing services to insure steel decking has been installed in accordance with contract documents and manufacturer's requirements.

B. Qualification of Field Welding: Qualify welding processes and welding operators in accordance with "Welder Qualification" procedures of AWS D1.1. Refer to the "Plug Weld Qualification Procedure" in Part 3 "Field Quality Control."

C. Submit inspection reports, certification, and instances of noncompliance to COR.

3.10 SHEAR CONNECTOR STUDS:

A. Provide field inspection and testing services required by AWS D.1 to insure shear connector studs have been installed in accordance with contract documents.

B. Tests: Test 20 percent of headed studs for fastening strength in accordance with AWS D1.1.

C. Submit inspection reports, certification, and instances of noncompliance to COR.

3.11 SPRAYED-ON FIREPROOFING:

A. Provide field inspection and testing services to certify sprayed-on fireproofing has been applied in accordance with contract documents.

B. Obtain a copy of approved submittals from COR.

C. Use approved installation in test areas as criteria for inspection of work.

D. Test sprayed-on fireproofing for thickness and density in accordance with ASTM E605.
   1. Thickness gauge specified in ASTM E605 may be modified for pole extension so that overhead sprayed material can be reached from floor.

E. Location of test areas for field tests as follows:
   1. Thickness: Select one bay per floor, or one bay for each 930 m^2 (10,000 square feet) of floor area, whichever provides for greater number of tests. Take thickness determinations from each of following locations: Metal deck, beam, and column.

2. Density: Take density determinations from each floor, or one test from each 930 m^2 (10,000 square feet) of floor area, whichever provides for greater number of tests, from each of the following areas: Underside of metal deck, beam flanges, and beam web.

F. Submit inspection reports, certification, and instances of noncompliance to COR.

- - - E N D - - -

SECTION 01 45 35

SPECIAL INSPECTIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This guide specification will be applicable to both new buildings and existing building rehabilitations/renovations. In addition to the Special Inspection and testing specified requirements, a registered design professional must perform structural observations during construction. All observed deficiencies will be immediately reported to the Contracting Officer. The registered design professional performing these observations will be a representative of the Designer of Record (DOR) for the building being constructed.

B. Structural observations are required for the following project conditions per IBC Chapter 17:
   1. Seismic Design Category D, E or F; and assigned to Risk Cat III, IV or V.
   2. Seismic Design Category D, E or F; and with a height greater than 22860 mm 75 ft.
   3. Seismic Design Category E, assigned to Risk Category I or II and the building is greater than two stories above grade plane.
   4. Nominal design wind speed in excess of 49 m/sec 110 mph; and assigned to Risk Cat III, IV or V.
   5. Nominal design wind speed in excess of 49 m/sec 110 mph; and with a height greater than 23 m 75 ft.

1.2 APPLICABLE PUBLICATIONS

A. The publication listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

B. American Society of Civil Engineers (ASCE)
   1. ASCE 7 - (2016; Errata 2020; Supplement 1) Minimum Design Loads for Buildings and Other Structures

C. International Code Council (ICC)
   1. ICC IBC - (2018) International Building Code]

1.3 GENERAL REQUIREMENTS

A. Perform Special Inspections in accordance with the Statement of Special Inspections, Schedule of Special Inspections and Chapter 17 of ICC IBC. The Statement of Special Inspections and Schedule of Special Inspections are included as an attachment to this specification. Special Inspections are to be performed by an independent third party and are intended to ensure that the work of the prime contractor is in accordance with the Contract Documents and applicable building codes. Special inspections do not take the place of the three phases of control inspections performed by the Contractor's QC Manager or any testing and inspections required by other sections of the specifications.

1.4 DEFINITIONS

A. Continuous Special Inspections – The constant monitoring of specific tasks by a special inspector. These inspections must be carried out continuously over the duration of the particular tasks.

B. Periodic Special Inspections – Special Inspections by the special inspector who is intermittently present where the work to be inspected has been or is being performed. Specific time interval on a specific Special Inspection should be indicated on the Schedule of Special Inspections.

C. Perform – Perform these Special Inspections tasks for each welded joint or member.

D. Observe – Observe these Special Inspections items on a random daily basis. Operations need not be delayed pending these inspections.

E. Special Inspector (SI) – A qualified person retained by the contractor and approved by the Contracting Officer as having the competence necessary to inspect a particular type of construction requiring Special Inspections. The SI must be an independent third party hired directly by the Prime Contractor.

F. Associate Special Inspector (ASI) – A qualified person who assists the SI in performing Special Inspections but must perform inspection under the direct supervision of the SI and cannot perform inspections without the SI on site.

G. Third Party – A third party inspector must not be company employee of the Contractor or any Sub-Contractor performing the work to be inspected.

H. Special Inspector of Record (SIOR) – SIOR must be an independent third party hired directly by the Prime Contractor and is required for the following project conditions:
   1. Seismic Design Category D, E, or F; and assigned to Risk Category III, IV, or V.
   2. Seismic Design Category D, E, or F; and with a height greater than 22860mm 75 ft.
   3. Seismic Design Category E, assigned to Risk Category I or II and the building is greater than two (2) stories above grade plane.
   4. Nominal design wind speed in excess o f49 m/sec 100 mph; and assigned to Risk Category III, IV, or V.
   5. Nominal design wind speed in excess of 49 mm/sec 100mph; and with a height greater than 23m 75ft.
   6. In addition to these conditions, the DOR is encouraged to consider using an SIOR on large magnitude or critical projects where this additional level of quality control is affordable.

I. Contracting Officer – The Government official having overall authority for administrative contracting actions. Certain contracting actions may be delegated to the Contracting Officer's Representative (COR).

J. Contractor’s Quality Control (QC) Manager – An individual retained by the prime contractor and qualified in accordance with the Section 01 45 00 QUALITY CONTROL having the overall responsibility for the contractor's QC organization.

K. Designer of Record (DOR) – A registered design professional is contracted by the Government as an A/E responsible for the overall design and review of submittal documents prepared by others. The DOR is registered or licensed to practice their respective design profession as defined by the statutory requirements of the professional registration laws in state in which the design professional works. The DOR is also referred to as the Engineer of Record (EOR) in design code documents.

L. Statement of Special Inspections (SSI) – A document developed by the DOR identifying the material, systems, components and work required to have Special Inspections and covering the following:
   1. List of the Architectural Designated Seismic Systems – these components are in or attached to a Risk Category IV or V structure and are needed for continued operation of the facility or their failure could impair the continued operation of the facility.
   2. List of the Mechanical Designated Seismic Systems
      a. For Seismic Design Category C or Risk V, list the following:
         1) Heating, ventilation, and air-conditioning (HVAC) ductwork containing hazardous materials and anchorage of such ductwork
         2) Piping systems and mechanical units containing flammable, combustible, or highly toxic materials.
      b. For Seismic Design Category D, E, or F or Risk Category V list mechanical system that meet one of the following:
         1) Life safety component required to function after an earthquake
         2) Component that contains hazardous content,

3) All components in an essential facility needed for continued operation after an earthquake.

3. List of the Electrical Designated Systems
   a. For Seismic Design Category C or Risk V, list the anchorage of electrical equipment used for emergency or standby power systems.
   b. For Seismic Design Category D, E or F list electrical system that meet one of the following:
      1) Life safety component required to function after an earthquake
      2) Component that contains hazardous content,
      3) All components in an essential facility needed for continued operation after an earthquake.
4. List of elements that are part of the progressive collapse resistance system.
   a. Provide a description of the following as they apply:
      1) Elements of the tie force system consisting of internal longitudinal and transverse, vertical, and peripheral ties.
      2) Elements of the alternate path system.
      3) Elements having enhanced local resistance. The Statement of Special Inspections and the Schedule of Special Inspections will be included as an attachment to this specification
         a) Schedule of Special Inspections – A schedule which lists each of the required Special Inspections, the extent to which each Special Inspections is to be performed, and the required frequency for each in accordance with ICC IBC Chapter 17. Template found here:

SECTION 01 45 35 Schedule of SI Templ

SECTION 01 45 35 Statement of SI Temp

         b) Designated Seismic System – Those nonstructural components that require design in accordance with ASCE 7 Chapter 13 and for which the component importance factor, Ip, is greater than 1.0. This designation applies to systems that are required to be operational following the Design Earthquake for RC I - IV structures and following the MCER for RC V structures. All systems in RC V facilities designated as MC-1 in accordance with UFC 3-310-04 are considered part of the Designated Seismic Systems.

1.5 SUBMITTALS: GOVERNMENT APPROVAL IS REQUIRED FOR ALL SUBMITTALS. CQC SPECIAL INSPECTION REPORTS SHALL BE SUBMITTED UNDER THIS SPECIFICATION SECTION AND FOLLOW THE SPECIAL INSPECTION: 01 45 35 CONVENTION. SUBMIT THE FOLLOWING:

1) SD-01 Preconstruction Submittals;
2) SIOR Letter of Acceptance;
3) Special Inspections Project Manual;
4) Special Inspections Agency's Written Practices
5) NDT Procedures and Equipment' Calibration Records;
6) SD-06 Test Reports;
7) Special Inspections
8) Daily Reports;
9) Special Inspections; Biweekly Reports;
10) SD-07 Certificates;
11) Fabrication Plant
12) Steel Truss Plant;

13) Wood Truss Plant;
14) AC472 Accreditation;
15) Steel Joist Institute Membership;
16) Precast Concrete Institute (PCI) Certified Plant;
17) Certificate of Compliance;
18) Special Inspector of Record Qualifications;
19) Special Inspector Qualifications;
20) Qualification Records for NDT technicians;
21) SD-11 Closeout Submittals;
22) Interim Final Report of Special Inspections;
23) Comprehensive Final Report of Special Inspections;

b. Special Inspector Qualifications: Submit qualifications for each SI, ASI, and the SIOR from the following certifying associations: Associated Air Balance Council (AABC); American Concrete Institute (ACI); Association of the Wall and Ceiling Industry (AWCI); American Welding Society (AWS); Factory Mutual (FM); International Code Council (ICC); Nondestructive Testing (NDT); National Institute for Certification in Engineering Technologies (NICET); Precast/Prestressed Concrete Institute (PCI); Post-Tensioning Institute (PTI); Underwriters Laboratories (UL). Qualifications should be in accordance with the following minimums.

1.6 QUALIFICATIONS

Area	Special Inspector	Associated Special Inspector	SIOR
Steel Construction and High Strength Bolting	ICC Structural Steel and Bolting Special Inspector certificate with on year of related experience, or Registered Professional Engineer with related experience.	Engineer-In-Training with one year of related experience.	
Welding Structural Steel (For highly complex steel use only AWS Certified Welding Inspectors)	ICC Welding Special Inspector certificate with one year of related experience or AWS Certified Welding Inspector	AWS Certified Associate Welding Inspector	
Nondestructive Testing of Welds	NDT Level II Certificate	NDT Level II Certificate plus one year of related experience	
Cold Formed Steel Framing	ICC Structural Steel and Bolting Special Inspector certificate with on year of related experience, or ICC Commercial Building Inspector with one year of experience; or Registered Professional Engineer with related experience.	Engineer-In-Training with one year of related experience.	
Concrete Construction	ICC Reinforced Concrete Special Inspector Certificate with one year of related	ACI Concrete Construction Special Inspector in Training, or Engineer-In-Training with	

Area	Special Inspector	Associated Special Inspector	SIOR
	experience, or ACI Concrete Construction Special Inspector, or NICET Concrete Technician Level III Certificate in Construction Materials Testing, or, Registered Professional Engineer with related experience	one year of related experience	
Prestressed Concrete Construction	ICC Pre-stressed Special Inspector Certificate with one year of related experience, or PCI Quality Control Technician/ Inspector Level II Certificate with one year of related experience, or Registered Professional Engineer with related experience.	PCI Quality Control Technician/ Inspector Level I Certificate with one year of related experience, or Engineer-In-Training with one year of related experience	
Post-Tensioned Concrete Construction	PTI Level 2 Unbonded PT Inspector Certificate, or Registered Professional Engineer with related experience	PTI Level 1 Unbonded PT Inspector Certificate with one year of related experience, or Engineer-In-Training with one year of related experience	
Masonry Construction	ICC Structural Masonry Special Inspector Certificate with one year of related experience, or Registered Professional Engineer with related experience	Engineer-In-Training with one year of related experience	
Wood	ICC Commercial Building Inspector Certificate with one year of related experience, or ICC Residential Building Inspector with on year of experience, or Registered Professional Engineer with related experience	Engineer-In-Training with one year of related experience	
Verification of Site Soil Condition, Fill Placement, and Load-Bearing Requirements	ICC Soils Special Inspector Certificate with one year of related experience, or NICET Soils Technician Level II Certificate in Construction Material Testing, or NICET Geotechnical Engineering Technician Level II Construction or Generalist Certificate, or Geologist-In-	NICET Soils Technician Level I Certificate in Construction Material Testing with one year of related experience, or NICET Geotechnical Engineering Technician Level I Construction, or Generalist Certificate with one year of related experience, or Engineer-In-	

Area	Special Inspector	Associated Special Inspector	SIOR
	Training with one year of related experience, or Registered Professional Engineer with related experience	Training with one year of related experience	
Deep Foundations	NICET Soils Technician Level II Certificate in Construction Material Testing, or NICET Geotechnical Engineering Technician Level II Construction or Generalist Certificate, or Geologist-In-Training with one year of related experience, or Registered Professional Engineer with related experience	NICET Soils Technician Level I Certificate in Construction Material Testing with one year of related experience, or NICET Geotechnical Engineering Technician Level I Construction or Generalist Certificate with one year of related experience, or Engineer-In-Training with one year of related experience	
Sprayed Fire Resistant Manual	ICC Spray-applied Fireproofing Special Inspector Certificate, or ICC Fire Inspector I Certificate with one year of related experience, or Registered Professional Engineer with related experience	Engineer-In-Training with one year of related experience	
Mastic and Intumescent Fire Resistant Coatings	ICC Spray-applied Fireproofing Special Inspector Certificate, or ICC Fire Inspector I Certificate with one year of related experience, or Registered Professional Engineer with related experience	Engineer-In-Training with one year of related experience.	
Fire-Resistant Penetrations and Joints	Passed the UL Firestop Exam with one year of related experience, or Passed the FM Firestop Exam with one year of related experience, or Registered Professional Engineer with related experience	Engineer-In-Training with one year of related experience.	
Smoke Control	AABC Technician Certification with one year of related experience, or Registered Professional	Engineer-In-Training with one year of related experience.	

Area	Special Inspector	Associated Special Inspector	SIOR
	Engineer with related experience		
SIOR			Registered Professional Engineer

PART 2 - PRODUCTS

2.1 FABRICATORS SPECIAL INSPECTION

A. Special Inspections of fabricator's work performed in the fabricator's shop is required to be inspected in accordance with the Statement of Special Inspections and the Schedule of Special Inspections unless the fabricator is certified by the approved agency to perform such work without Special Inspections. Submit the applicable certification(s) from the following list to the Contracting Officer for information to allow work performed in the fabricator's shop to not be subjected to Special Inspections.

B. The following certifications meet the requirements for fabricator approval in accordance with paragraph 1704.2.5.2 of IBC:
   1. American Institute of Steel Construction (AISC) Certified Fabrication Plant, Category STD.
   2. Truss Plate Institute (TPI) steel truss plate quality assurance program certification.
   3. Truss Plate Institute (TPI) wood truss plate quality assurance program certification.
   4. International Accreditation Service, AC472 Accreditation Steel Joist Institute Membership
   5. Precast Concrete Institute (PCI) Certified Plant, Group C

C. At the completion of fabrication, submit a certificate of compliance, to be included with the comprehensive final report of Special **Inspections, stating that the materials supplied and work performed by** the fabricator are in accordance the construction documents.

PART 3 - EXECUTION

3.1 RESPONSIBLY MATRIX

Inspector	Responsibility	Condition
SIOR	Supervise all Special Inspectors required by the contract documents and the IBC. Submit a SIOR Letter of Acceptance to the Contracting Officer attesting to acceptance of the duties of SIOR, signed and sealed by the SIOR. Verify the qualifications of all of the Special Inspectors. Verify the qualifications of fabricators.	Applicable when SIOR is required
SIOR	Submit Special Inspections agency's written practices for the monitoring and control of the agency's operations to include the following: The agency's procedures for the selection and administration of inspection personnel, describing the training, experience and examination requirements for qualifications and certification of inspection personnel.	Applicable when SIOR is required and when the structural design is required to follow AISC341 for seismic

Inspector	Responsibility	Condition
	The agency's inspection procedures, including general inspection, material controls, and visual welding inspection. Submit qualification records for nondestructive testing (NDT) technicians designated for the project. Submit NDT procedures and equipment calibration records for NDT to be performed and equipment to be used for the project.	design of steel structures
SIOR	Prepare a Special Inspections Project Manual, which will cover the following: Roles and responsibilities of the following individuals during Special Inspections: SIOR, SI, General Contractor, Subcontractors, QC Manager, and DOR. Organizational chart and/or communication plan, indicating lines of communication Contractor's internal plan for scheduling inspections. Address items such as timeliness of inspection requests, who to contact for inspection requests, and availability of alternate inspectors. Contractor's internal plan for scheduling inspections. Address items such as timeliness of inspection requests, who to contact for inspection requests, and availability of alternate inspectors. Indicate the government reporting procedures. Propose forms or templates to be used by SI and SIOR to document inspections. Indicate procedures for tracking nonconforming work and verification that corrective work is complete. Indicate how the SIOR and/or SI will participate in weekly QC meetings. Indicate how Special Inspections of shop fabricated items will be handled when the fabricator's shop is not certified per paragraph FABRICATOR SPECIAL INSPECTIONS. Include a section in the manual that covers each specific item requiring Special Inspections that is indicated on the Schedule of Special Inspections. Provide names and qualifications of each special inspector who will be performing the Special Inspections for each specific item. Provide detail on how the Special Inspections are to be carried out for each item so that the expectations are clear for the General Contractor and the Subcontractor performing the work. Make a copy of the Special Inspections Project Manual available on the job site during construction. Submit a copy of the Special Inspections Project Manual for approval. Attend coordination and mutual understanding meeting where the information in the Special Inspections Project Manual will be reviewed to verify that all parties have a clear understanding of the Special Inspections provisions and the individual duties and responsibilities of each party. Maintain a 3- ring binder for the Special Inspector's daily and biweekly reports and the Special Inspections Project Manual. This file must be located in a conspicuous place in the project trailer/office to allow review by the Contracting Officer and the DOR. Submit a copy of the Special Inspector's daily reports to the QC Manager. Discrepancies that are observed during Special Inspections must be reported to the QC Manager for correction. If discrepancies are not	Applicable when SIOR is required

Inspector	Responsibility	Condition
	corrected before the special inspector leaves the site the observed discrepancies must be documented in the daily report. Submit a biweekly Special Inspections report until all work requiring Special Inspections is complete. A report is required for each biweekly period in which Special Inspections activity occurs, and must include the following: A brief summary of the work performed during the reporting time frame. Changes and/or discrepancies with the drawings, specifications, and mechanical or electrical component certification if they require seismic systems, that were observed during the reporting period. Discrepancies which were resolved or corrected. A list of nonconforming items requiring resolution. All applicable test results including nondestructive testing reports.	
QC Manager	If there is no SIOR, QC Manager must Supervise all Special Inspectors required by the contract documents and the IBC; Verify the qualifications of all of the Special Inspectors; Verify the qualifications of fabricators; Maintain a 3- ring binder for the Special Inspector's daily and biweekly reports. This file must be located in a conspicuous place in the project trailer/office to allow review by the Contracting Officer and the DOR.	Applicable when SIOR is not required
QC Manager	Maintain a rework items list that includes discrepancies noted on the Special Inspectors daily report.	n/a
Special Inspectors	Inspect all elements of the project for which the special inspector is qualified to inspect and are identified in the Schedule of Special Inspections. Attend preparatory phase meetings related to the Definable Feature of Work (DFOW) for which the special inspector is qualified to inspect.	
Special Inspectors	Submit Special Inspections agency's written practices for the monitoring and control of the agency's operations to include the following: The agency's procedures for the selection and administration of inspection personnel, describing the training, experience and examination requirements for qualifications and certification of inspection personnel. The agency's inspection procedures, including general inspection, material controls, and visual welding inspection. Submit qualification records for nondestructive testing (NDT) technicians designated for the project. Submit NDT procedures and equipment calibration records for NDT to be performed and equipment to be used for the project.	Applicable when SIOR is NOT required and when the structural design is required to follow AISC 341 for seismic design of steel structures
Special Inspectors	Submit a copy of the daily reports to the QC Manager. Discrepancies that are observed during Special Inspections must be reported to the QC Manager for correction. If discrepancies are not corrected before the special inspector leaves the site the observed discrepancies must be documented in the daily report.	Applicable when SIOR is not required

Inspector	Responsibility	Condition
	Submit a biweekly Special Inspection Report until all inspections are complete. A report is required for each biweekly period in which Special Inspections activity occurs, and must include the following: A brief summary of the work performed during the reporting time frame Changes and/or discrepancies with the drawings, specifications, and mechanical or electrical component certification if they require seismic systems that were observed during the reporting period. Discrepancies which were resolved or corrected. A list of nonconforming items requiring resolution. All applicable test result including nondestructive testing reports. At the completion of the project submit a comprehensive final report of Special Inspections that documents the Special Inspections completed for the project and corrections of all discrepancies noted in the daily reports. The comprehensive final report of Special Inspections must be signed, dated and indicate the certification of the special inspector qualifying them to conduct the inspection.	
Special Inspectors	Submit daily reports to the SIOR	Applicable when SIOR is required

3.2 DEFECTIVE WORK

A. Check work as it progresses, but failure to detect any defective work or materials must in no way prevent later rejection if defective work or materials are discovered, nor obligate the Government to accept such work.

-- END OF SECTION –

SCHEDULE OF SPECIAL INSPECTIONS

Reference 01 45 35 for all requirements not noted as part of this schedule.

INSPECTION DEFINITIONS:

PERFORM: Perform these tasks for each weld, fastener or bolted connection, and noted verification.

OBSERVE: Observe these items randomly during the course of each work day to insure that applicable requirements are being met. Operations need not be delayed pending these inspections at contractor's risk.

DOCUMENT: Document, with a report, that the work has been performed in accordance with the contract documents. This is in addition to any other reports required in the Special Inspections guide specification.

CONTINUOUS: Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

A. STRUCTURAL - STEEL – WELDING SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

STEEL INSPECTION PRIOR TO WELDING – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.2.1, AISC 360-10: Table C-N5.4-1		
TASK	INSPECTION TYPE[1]	DESCRIPTION
1. Verify that the welding procedures specification (WPS) is available	**PERFORM**	
2. Verify manufacturer certifications for welding consumables are available	**PERFORM**	
3. Verify material identification	**PERFORM**	Type and grade.
4. Welder Identification System	**PERFORM**	The fabricator or erector, as applicable, shall maintain a system by which a welder who has welded a joint or member can be identified. Stamps, if used, shall be the low-stress type.
5. Fit-up of groove welds (including joint geometry)	OBSERVE	✓ Joint preparation ✓ Dimensions (alignment, root opening, root face, bevel) ✓ Cleanliness (condition of steel surfaces) ✓ Tacking (tack weld quality and location) ✓ Backing type and fit (if applicable)
6. Configuration and finish of access holes	OBSERVE	
7. Fit-up of fillet welds	OBSERVE	✓ Dimensions (alignment, gaps at root) ✓ Cleanliness (condition of steel surfaces) ✓ Tacking (tack weld quality and location)
STEEL INSPECTION DURING WELDING – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.2.1, AISC 360-10: Table C-N5.4-2		
TASK	INSPECTION TYPE	DESCRIPTION
8. Use of qualified welders	**PERFORM**	Welding by welders, welding operators, and tack welders who are qualified in conformance with requirements.
9. Control and handling of welding consumables	OBSERVE	✓ Packaging ✓ Electrode atmospheric exposure control
10. No welding over cracked tack welds	OBSERVE	
11. Environmental conditions	OBSERVE	✓ Wind speed within limits ✓ Precipitation and temperature
12. Welding Procedures Specification followed	OBSERVE	✓ Settings on welding equipment ✓ Travel speed ✓ Selected welding materials ✓ Shielding gas type/flow rate ✓ Preheat applied ✓ Interpass temperature maintained (min./max.) ✓ Proper position (F, V, H, OH) ✓ Intermix of filler metals avoided
13. Welding techniques	OBSERVE	✓ Interpass and final cleaning ✓ Each pass within profile limitations ✓ Each pass meets quality requirements

[1] **PERFORM**: Perform these tasks for each weld, fastener or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

A. STRUCTURAL - STEEL – WELDING SECTION (CONTINUED)

STEEL INSPECTION AFTER WELDING – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 2015 1705.2.1, AISC 360-10: Table C-N5.4-3		
TASK	INSPECTION TYPE [1]	DESCRIPTION
14. Welds cleaned	OBSERVE	
15. Size, length, and location of all welds	**PERFORM**	Size, length, and location of all welds conform to the requirements of the detail drawings.
16. Welds meet visual acceptance criteria	**PERFORM AND DOCUMENT**	✓ Crack prohibition ✓ Weld/base-metal fusion ✓ Crater cross section ✓ Weld profiles ✓ Weld size ✓ Undercut ✓ Porosity
17. Arc strikes	**PERFORM**	
18. k-area	**PERFORM**	When welding of doubler plates, continuity plates or stiffeners has been performed in the k-area, visually inspect the web k-area for cracks.
19. Backing removed, weld tabs removed and finished, and fillet welds added where required	**PERFORM**	
20. Repair activities	**PERFORM AND DOCUMENT**	
21. Document acceptance or rejection of welded joint or member	**PERFORM**	

END SECTION

[1] **PERFORM**: Perform these tasks for each weld, fastener or bolted connection, and required verification.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

B. STRUCTURAL - STEEL – BOLTING SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

STEEL INSPECTION TASKS PRIOR TO BOLTING – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.2.1, AISC 360-10: Table C-N5.6-1		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Manufacture's certifications available for fastener materials	**PERFORM**	
2. Fasteners marked in accordance with ASTM requirements	OBSERVE	
3. Proper fasteners selected for joint detail (grade, type, bolt length if threads are to be excluded from shear plane)	OBSERVE	
4. Proper bolting procedure selected for joint detail	OBSERVE	
5. Connecting elements, including appropriate faying surface condition and hole preparation, if specified, meet applicable requirements	OBSERVE	
6. Proper storage provided for bolts, nuts, washers, and other fastener components	OBSERVE	
STEEL INSPECTION TASKS DURING BOLTING – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.2.1, AISC 360-10: Table C-N5.6-2		
TASK	INSPECTION TYPE [1]	DESCRIPTION
7. Fastener assemblies of suitable condition, placed in all holes and washers (if required) are positioned as required	OBSERVE	
8. Joint brought to the snug-tight condition prior to pretensioning operation	OBSERVE	
9. Fastener component not turned by the wrench prevented from rotating	OBSERVE	
10. Bolts are pretensioned in accordance with RCSC Specification, progressing systematically from the most rigid point toward the free edges	OBSERVE	
STEEL INSPECTION TASKS AFTER BOLTING – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.2.1, AISC 360-10: Table C-N5.6-3		
TASK	INSPECTION TYPE [1]	DESCRIPTION
11. Document acceptance or rejection of all bolted connections	**DOCUMENT**	

[1] **PERFORM**: Perform these tasks for each weld, fastener or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

END SECTION

C. STRUCTURAL - STEEL - NON DESTRUCTIVE TESTING SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

NONDESTRUCTIVE TESTING OF WELDED JOINTS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.2.1, AISC 360-10: Section N5.5		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Use of qualified nondestructive testing personnel	**PERFORM**	Visual weld inspection and nondestructive testing (NDT) shall be conducted by personnel qualified in accordance with AWS D1.8 clause 7.2
2. CJP groove welds	OBSERVE	Dye penetrant testing (DT) and ultrasonic testing (UT) shall be performed on 20% of CJP groove welds for materials greater than 5/16" (8mm) thick. Testing rate must be increased to 100% if greater than 5% of welds tested have unacceptable defects.
3. Welded joints subject to fatigue	OBSERVE	Dye penetrant testing (DT) and Ultrasonic testing (UT) shall be performed on 100% of welded joints identified on contract drawings as being subject to fatigue.
4. Weld tab removal sites	OBSERVE	At the end of welds where weld tabs have been removed, magnetic particle testing shall be performed on the same beam-to-column joints receiving UT

END SECTION

[1] **PERFORM**: Perform these tasks for each weld, fastener or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

D. STRUCTURAL - STEEL – AISC 341 REQUIREMENTS (SEISMIC PROVISIONS) SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☐

NONDESTRUCTIVE TESTING OF WELDED JOINTS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.2.1, AISC 341-10: Section J6.2		
TASK	INSPECTION TYPE [1]	DESCRIPTION
5. CJP groove welds	OBSERVE	Dye penetrant testing (DT) and ultrasonic testing (UT) shall be performed on 100% of CJP groove welds for materials greater than 5/16" thick (8mm).
6. Beam cope and access hole.	OBSERVE	At welded splices and connections, thermally cut surfaces of beam copes and access holes shall be tested using magnetic particle testing (MT) or dye penetrant testing (DT), when the flange thickness exceeds 1 1/2 in. for rolled shapes, or when the web thickness exceeds 1 1/2 in. for built-up shapes.
7. K-area NDT (AISC 341)	**PERFORM**	Where welding of doubler plates, continuity plates or stiffeners has been performed in the k-area, the web shall be tested for cracks using magnetic particle testing (MT). The MT inspection area shall include the k-area base metal within 3-inches of the weld. The MT shall be performed no sooner than 48 hours following completion of the welding.
8. Placement of reinforcing or contouring fillet welds	**DOCUMENT**	

END SECTION

[1] **PERFORM**: Perform these tasks for each weld, fastener or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

E. STRUCTURAL - STEEL - COMPOSITE CONSTRUCTION [1]

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☐

COMPOSITE CONSTRUCTION PRIOR TO PLACING CONCRETE – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.2.1, AISC 360-10: Table N6.1, AISC 341-10: Table J9-1		
TASK	INSPECTION TYPE [2]	DESCRIPTION
1. Placement and installation of steel headed stud anchors	**PERFORM**	
2. Material identification of reinforcing steel (Type/Grade)	OBSERVE	
3. Determination of carbon equivalent for reinforcing steel other than ASTM A706	OBSERVE	
4. Proper reinforcing steel size, spacing, clearances, support, and orientation	OBSERVE	
5. Reinforcing steel has been tied and supported as required	OBSERVE	

END SECTION

F. STRUCTURAL - STEEL - OTHER INSPECTIONS

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

OTHER STEEL INSPECTIONS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.2.1, AISC 341-10: Tables J8-1 & J10-1		
TASK	INSPECTION TYPE [2]	DESCRIPTION
1. Anchor rods and other embedments supporting structural steel	**PERFORM**	Verify the diameter, grade, type, and length of the anchor rod or embedded item, and the extent or depth of embedment prior to placement of concrete.
2. Fabricated steel or erected steel frame	OBSERVE	Verify compliance with the details shown on the construction documents, such as braces, stiffeners, member locations and proper application of joint details at each connection.
3. Reduced beam sections (RBS) where/if occurs	**DOCUMENT**	✓ Contour and finish ✓ Dimensional tolerances
4. Protected zones	**DOCUMENT**	No holes or unapproved attachments made by fabricator or erector
5. H-piles where/if occurs	**DOCUMENT**	No holes or unapproved attachments made by the responsible contractor

[1] See Concrete Construction Section for all concrete related inspection of composite steel construction.

[2] **PERFORM**: Perform these tasks for each weld, fastener or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

END SECTION

G. STRUCTURAL - COLD-FORMED METAL DECK - PLACEMENT SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☐

METAL DECK INSPECTION PRIOR TO DECK PLACEMENT – VERIFY THE FOLLOWING ARE IN COMPLIANCE SDI QA/QC-2011, Appendix 1, Table 1.1		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Verify compliance of materials (deck and all deck accessories) with construction documents, including profiles, material properties, and base metal thickness	**PERFORM**	
2. Document acceptance or rejection of deck and deck accessories	**DOCUMENT**	
METAL DECK INSPECTION DURING DECK PLACEMENT – VERIFY THE FOLLOWING ARE IN COMPLIANCE SDI QA/QC-2011, Appendix 1, Table 1.2		
TASK	INSPECTION TYPE [1]	DESCRIPTION
3. Verify compliance of deck and all deck accessories installation with construction documents	**PERFORM**	
4. Verify deck materials are represented by the mill certifications that comply with the construction documents	**PERFORM**	
5. Document acceptance or rejection of installation of deck and deck accessories	**DOCUMENT**	
METAL DECK INSPECTION AFTER DECK PLACEMENT – VERIFY THE FOLLOWING ARE IN COMPLIANCE SDI QA/QC-2011, Appendix 1, Table 1.3		
TASK	INSPECTION TYPE [1]	DESCRIPTION
6. Welding procedure specification (WPS) available	**PERFORM**	
7. Manufactures certifications for welding consumables available	OBSERVE	
8. Material identification (type/grade)	OBSERVE	
9. Check welding equipment	OBSERVE	

END SECTION

[1] **PERFORM**: Perform these tasks for each weld, fastener or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

H. STRUCTURAL - COLD-FORMED METAL DECK – WELDING SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☐

METAL DECK INSPECTION DURING WELDING – VERIFY THE FOLLOWING ARE IN COMPLIANCE SDI QA/QC-2011, Appendix 1, Table 1.4		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Use of qualified welders	OBSERVE	
2. Control and handling of welding consumables	OBSERVE	
3. Environmental conditions (wind speed, moisture, temperature)	OBSERVE	
4. WPS followed	OBSERVE	
METAL DECK INSPECTION AFTER WELDING – VERIFY THE FOLLOWING ARE IN COMPLIANCE SDI QA/QC-2011, Appendix 1, Table 1.5		
TASK	INSPECTION TYPE [1]	DESCRIPTION
5. Verify size and location of welds, including support, sidelap, and perimeter welds.	**PERFORM**	
6. Welds meet visual acceptance criteria	**PERFORM**	
7. Verify repair activities	**PERFORM**	
8. Document acceptance or rejection of welds	**DOCUMENT**	

END SECTION

[1] **PERFORM**: Perform these tasks for each weld, fastener or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

I. STRUCTURAL - COLD-FORMED METAL DECK – FASTENING SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☐

METAL DECK INSPECTION BEFORE MECHANICAL FASTENING – VERIFY THE FOLLOWING ARE IN COMPLIANCE SDI QA/QC-2011, Appendix 1, Table 1.6		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Manufacturer installation instructions available for mechanical fasteners	OBSERVE	
2. Proper tools available for fastener installation	OBSERVE	
METAL DECK INSPECTION DURING MECHANICAL FASTENING – VERIFY THE FOLLOWING ARE IN COMPLIANCE SDI QA/QC-2011, Appendix 1, Table 1.7		
TASK	INSPECTION TYPE [1]	DESCRIPTION
3. Fasteners are positioned as required	OBSERVE	
4. Fasteners are installed in accordance with manufacturer's instructions	OBSERVE	
METAL DECK INSPECTION AFTER MECHANICAL FASTENING – VERIFY THE FOLLOWING ARE IN COMPLIANCE SDI QA/QC-2011, Appendix 1, Table 1.8		
TASK	INSPECTION TYPE [1]	DESCRIPTION
5. Check spacing, type, and installation of support fasteners	**PERFORM**	
6. Check spacing, type, and installation of sidelap fasteners	**PERFORM**	
7. Check spacing, type, and installation of perimeter fasteners	**PERFORM**	
8. Verify repair activities	**PERFORM**	
9. Document acceptance or rejection of mechanical fasteners	**DOCUMENT**	

END SECTION

[1] **PERFORM**: Perform these tasks for each weld, fastener or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.

J. STRUCTURAL - LIGHT GAUGE STEEL FRAMING AND/OR LIGHT GAUGE TRUSSES SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☐

LIGHT GAUGE STEEL CONSTRUCTION AND CONNECTIONS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.2.2, 1705.11.2, 1705.11.3, UFC 4 023 03		
TASK	INSPECTION TYPE[1]	DESCRIPTION
1. Trusses spanning 60-feet or greater where/if applies	**PERFORM**	Verify that temporary and permanent truss restraint/bracing is installed in accordance with approved truss submittal package.
2. Welded connections (seismic and/or wind resisting system)	OBSERVE	Visually inspect all welds composing part of the main wind or seismic force resisting system, including shearwalls, braces, collectors (drag struts), and hold-downs.
3. Connections (seismic and/or wind resisting system)	OBSERVE	Visually inspect all screw attachment, bolting, anchoring and other fastening of components within the main wind or seismic force resisting system, including roof deck, roof framing, exterior wall covering, wall to roof/floor connections, braces, collectors (drag struts) and hold-downs.
4. Cold-formed steel (progressive collapse resisting system where/if applies)	OBSERVE	Verify proper welding operations, screw attachment, bolting, anchoring and other fastening of components within the progressive collapse resisting system, including horizontal tie force elements, vertical tie force elements and bridging elements (UFC 4 023 03).

END SECTION

K. STRUCTURAL - OPEN-WEB STEEL JOISTS SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☐

OPEN-WEB STEEL JOISTS AND JOIST GIRDERS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC TABLE 1705.2.3		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Installation of open-web steel joists and joist girders	OBSERVE	✓ End connections – welded or bolted ✓ Bridging – horizontal and diagonal

END SECTION

[1] **PERFORM**: Perform these tasks for each weld, fastener or bolted connection, and required verification.
OBSERVE: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

L. STRUCTURAL - CONCRETE CONSTRUCTION SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

CONCRETE CONSTRUCTION, INCLUDING COMPOSITE DECK – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC TABLE 1705.3 (ACI 318 REFERENCES NOTED IN IBC TABLE)		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Inspect reinforcement, including prestressing tendons, and verify placement.	OBSERVE	Verify prior to placing concrete that reinforcing is of specified type, grade and size; that it is free of oil, dirt and unacceptable rust; that it is located and spaced properly; that hooks, bends, ties, stirrups and supplemental reinforcement are placed correctly; that lap lengths, stagger and offsets are provided; and that all mechanical connections are installed per the manufacturer's instructions and/or evaluation report.
2. Reinforcing bar welding	OBSERVE	✓ Verify weldability of reinforcing bars other than ASTM A 706 ✓ Inspect single-pass fillet welds, maximum 5/16" in accordance with AWS D1.4
3. All other welding	**CONTINUOUS**	Visually inspect all welds in accordance with AWS D1.4
4. Cast in place anchors and post installed drilled anchors (downward inclined)	OBSERVE	Verify prior to placing concrete that cast in place anchors and post installed drilled anchors have proper embedment, spacing and edge distance.
5. Post-installed adhesive anchors in horizontal or upward inclined orientations	**CONTINUOUS AND DOCUMENT**	✓ Inspect as required per approved ICC-ES report ✓ Verify that installer is certified for installation of horizontal and overhead installation applications ✓ Inspect proof loading as required by the contract documents
6. Verify use of required mix design	OBSERVE	Verify that all mixes used comply with the approved construction documents
7. Prior to concrete placement, fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete	**CONTINUOUS**	At the time fresh concrete is sampled to fabricate specimens for strength test verify these tests are performed by qualified technicians.
8. Inspect concrete and/or shotcrete placement for proper application techniques	**CONTINUOUS**	Verify proper application techniques are used during concrete conveyance and depositing avoids segregation or contamination. Verify that concrete is properly consolidated.
9. Verify maintenance of specified curing temperature and technique	OBSERVE	Inspect curing, cold weather protection, and hot weather protection procedures.

[1] **OBSERVE**: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.
CONTINUOUS: Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

10. Pre-stressed concrete	**CONTINUOUS**	Verify application of prestressing forces and grouting of bonded prestressing tendons.

CONTINUED ON FOLLOWING PAGE

K. STRUCTURAL - CONCRETE CONSTRUCTION (CONTINUED)

CONCRETE CONSTRUCTION, INCLUDING COMPOSITE DECK – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC TABLE 1705.3 (ACI 318 REFERENCES NOTED IN IBC TABLE)		
TASK	INSPECTION TYPE [1]	DESCRIPTION
11. Inspect erection of precast concrete members	OBSERVE	
12. Verify in-situ concrete strength, prior to stressing of tendons in post-tensioned concrete and prior to removal of shores and forms from beams and structural slabs.	OBSERVE	
13. Inspect formwork for shape, location and dimensions of the concrete member being formed.	OBSERVE	

END SECTION

[1] **OBSERVE**: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
DOCUMENT: Document in a report that the work has been performed as required. This is in addition to all other required reports.
CONTINUOUS: Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

M. STRUCTURAL - MASONRY CONSTRUCTION SECTION (ALL RISK CATEGORIES)

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☐

MASONRY CONSTRUCTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE AT START OF CONSTRUCTION IBC 1705.4 (ACI 530-13 TABLE 3.1.2 & 3.1.3)		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Compliance with approved submittals prior to start	OBSERVE	
2. Proportions of site-mixed mortar.	OBSERVE	
3. Grade and type of reinforcement, anchor bolts, and prestressing tendons and anchorages	OBSERVE	
4. Prestressing technique	OBSERVE	
5. Properties of thin bed mortar for AAC masonry	OBSERVE	
MASONRY CONSTRUCTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE PRIOR TO GROUTING IBC 1705.4 (ACI 530-13 TABLE 3.1.2 & 3.1.3)		
TASK	INSPECTION TYPE [1]	DESCRIPTION
6. Grout space	OBSERVE	
7. Proportions of site-prepared grout and prestressing grout for bonded tendons	OBSERVE	
8. Proportions of site-mixed grout and prestressing grout for bonded tendons	OBSERVE	
9. Placement of masonry units and mortar joints	OBSERVE	
10. Welding of reinforcement	**CONTINUOUS**	
MASONRY CONSTRUCTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE DURING CONSTRUCTION IBC 1705.4 (ACI 530-13 TABLE 3.1.2 & 3.1.3)		
TASK	INSPECTION TYPE [1]	DESCRIPTION
11. Size and location of structural elements is in compliance	OBSERVE	
12. Preparation, construction, and protection of masonry during cold weather (temperature below 40°F (4.4°c) or hot weather (temp above 90°F (32.2°C))	OBSERVE	
13. Application and measurement of prestressing force	**CONTINUOUS**	
14. Placement of grout and prestressing grout for bonded tendons	**CONTINUOUS**	
15. Placement of AAC masonry units and construction of thin bed mortar joints	**CONTINUOUS**	Continuous for first 5000 square feet only (465 square meters).
16. Observe preparation of grout specimens, mortar specimens, and/or prisms	OBSERVE	
17. Type, size and placement of reinforcement, connectors, anchor bolts and prestressing tendons	OBSERVE	

[1] **OBSERVE**: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

CONTINUOUS: Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

and anchorages, including details of anchorage of masonry to structural members, frames, or other construction		

END SECTION

N. STRUCTURAL - WOOD CONSTRUCTION – SPECIALTY ITEMS SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☐

WOOD CONSTRUCTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.5		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. High-load diaphragms where applicable	OBSERVE	Verify thickness and grade of sheathing, size of framing members at panel edges, nail diameters and length, and the number of fastener lines and that fastener spacing is per approved contract documents.
2. Metal-plate connected wood trusses spanning 60 feet or greater	OBSERVE	Verify that the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package

END SECTION

O. STRUCTURAL - WOOD CONSTRUCTION - SEISMIC & WIND SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☐

WOOD CONSTRUCTION SEISMIC AND WIND – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.5		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Nailing, bolting, anchoring and other fastening of elements of the main wind/seismic force-resisting system	OBSERVE	Includes connectors for: shearwall sheathing, roof/floor sheathing, drag struts/collectors, braces, hold downs, roof and floor framing connections to exterior walls.

END SECTION

P. STRUCTURAL – ISOLATION AND ENERGY DISSIPATION SYSTEMS SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☐

ISOLATION AND ENERGY DISSIPATION SYSTEMS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC TABLE 1705.2.3		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Fabrication and installation	OBSERVE	Verify that fabrication and installation of isolator units and energy dissipation devices conform to manufacturer's recommendations and approved construction documents

END SECTION

[1] **OBSERVE**: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

Q. GEOTECHNICAL - SOILS INSPECTION SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☐

SOILS INSPECTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.6		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Materials below shallow foundations are adequate to achieve the design bearing capacity.	OBSERVE	
2. Excavations are extended to proper depth and have reached proper material	OBSERVE	
3. Verify use of proper materials, densities and lift thicknesses during placement and compaction of compacted fill	**CONTINUOUS**	
4. Prior to placement of compacted fill, inspect subgrade and verify that site has been prepared properly.	OBSERVE	During fill placement, the special inspector shall verify that proper materials and procedures are used in accordance with the provisions of the approved geotechnical report

END SECTION

R. GEOTECHNICAL - DRIVEN DEEP FOUNDATION ELEMENTS SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☐

DEEP DRIVEN FOUNDATION CONSTRUCTION – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.5		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Verify element materials, sizes and lengths comply with requirements	**CONTINUOUS**	
2. Inspect driving operations and maintain complete and accurate records for each element	**CONTINUOUS**	
3. Verify placement locations and plumbness, confirm type and size of hammer, record number of blows per foot of penetration, determine required penetrations to achiever design capacity, record tip and butt elevations and document ay damage to foundation element	**CONTINUOUS**	

END SECTION

[1] **OBSERVE**: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.
CONTINUOUS: Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

S. GEOTECHNICAL - HELICAL PILE FOUNDATIONS SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☐

HELICAL PILE FOUNDATIONS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.9		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Record installation equipment used, pile dimensions, tip elevations, final depth, final installation torque and other pertinent installation data. The approved geotechnical report and the contract documents shall be used to determine compliance	**CONTINUOUS**	

END SECTION

T. GEOTECHNICAL - CAST IN PLACE DEEP FOUNDATION ELEMENTS SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☐

CAST IN PLACE DEEP FOUNDATION ELEMENTS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.8		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Inspect drilling operations and maintain complete and accurate records for each element.	**CONTINUOUS**	
2. Verify placement locations and plumbness, confirm element diameters, bell diameters (if applicable), lengths, embedment into bedrock (if applicable and adequate end-bearing strata capacity. Record concrete or grout volumes	**CONTINUOUS**	

END SECTION

[1] **CONTINUOUS:** Constant monitoring of identified tasks by a special inspector over the duration of performance of said tasks.

U. FIRE PROTECTION - SPRAYED FIRE-RESISTANT MATERIALS SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

SPRAYED FIRE RESISTANT MATERIALS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.14		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Surface condition	OBSERVE	Prior to application confirm that surface has been prepared per the approved fire-resistance design and manufacturer's instructions.
2. Application	OBSERVE	Prior to application confirm that the substrate meets the minimum ambient temperature per the approved fire-resistance design and manufacturer's instructions.
3. Material thickness	OBSERVE	Verify that the thickness of the SFRM to structural elements is not less than the thickness require by the fire-resistant design in more that 10 percent of the measurement, but in no case less than minimum allowable thickness required by 1705.14.
4. Material density	OBSERVE	Verify that the thickness of the SFRM to structural elements is not less than the thickness require by the fire-resistant design in more than 10 percent of the measurement, but in no case less than minimum allowable thickness required by IBC 1705.14.5
5. Bond strength	OBSERVE	Verify cohesive/adhesive bond strength of the cured SFRM applied to the structural element is not less than 150psf and according to IBC 1705.14.6

END SECTION

V. FIRE PROTECTION - MASTIC AND INTUMESCENT COATINGS SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

MASTIC AND INTUMESCENT FIRE-RESISTANT COATINGS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.15		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Surface preparation	OBSERVE	Inspections shall be performed in accordance with AWCI 12-B and the contract documents

END SECTION

W. FIRE PROTECTION – FIRE RESISTANT PENETRATIONS AND JOINTS SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

FIRE RESISTANT PENETRATIONS AND JOINTS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.17		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Inspections of penetration firestop systems conducted in accordance with ASTM E 2174.	OBSERVE	**NOTE: This section applies to Risk Category III, IV, & V only. DOR may choose to uncheck this section where project is assigned to Risk**

[1] **OBSERVE**: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

2. Inspections of fire-resistant joint systems conducted in accordance with ASTM E 2393	OBSERVE	**Category I or II. Confirm Risk Category with Structural Engineer**

END SECTION

X. FIRE PROTECTION – SMOKE CONTROL SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☒

SMOKE CONTROL – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.17		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Verify device locations and perform leakage testing	OBSERVE	Perform during erection of ductwork and prior to concealment
2. Pressure difference testing, flow measurements and detection and control verification	OBSERVE	Perform prior to occupancy and after sufficient completion

END SECTION

[1] **OBSERVE**: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

Y. ARCHITECTURAL - EXTERIOR INSULATION AND FINISH SYSTEMS SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☐

EXTERIOR INSULATION AND FINISH SYSTEMS (EIFS) – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.16		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Water resistive barrier coating applied over a sheathing substrate.	OBSERVE	Verify that water resistive barrier coating complies with ASTM E 2570. **NOTE: not applicable to masonry or concrete wall applications. Uncheck this section in those cases**

END SECTION

Z. ARCHITECTURAL – ARCHITECTURAL COMPONENTS

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☐

ARCHITECTURAL COMPONENTS – VERIFY THE FOLLOWING ARE IN COMPLIANCE IBC 1705.12.5, 1705.12.7		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Erection and fastening of exterior cladding and interior and exterior veneer.	OBSERVE	Verify appropriate materials, fasteners and attachment at commencement of work and at completion. **Inspector Note: Inspection not required if height is less than 30 feet or weight is less than 5psf**
2. Interior and exterior non-load bearing walls	OBSERVE	Verify appropriate materials, fasteners and attachment at commencement of work and at completion. **Inspector Note: Inspection not required if height is less than 30 feet. Also, Interior non-load bearing walls need not be inspected if weighing less than 15psf**
3. Access floors	OBSERVE	Verify that anchorage complies with approved construction documents. Inspection of post-installed anchors shall comply with approved ICC-ES report
4. Storage racks	OBSERVE	Verify that anchorage complies with approved construction documents. Inspection of post-installed anchors shall comply with approved ICC-ES report. **Inspector Note: Not required for racks less than 8 feet in height**

END SECTION

[1] **OBSERVE**: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

AA. PLUMBING/MECHANICAL/ELECTRICAL DESIGNATED SEISMIC SYSTEMS SECTION

THIS SECTION APPLICABLE IF BOX IS CHECKED: ☐

PLUMBING, MECHANICAL AND ELECTRICAL - DESIGNATED SEISMIC SYSTEMS IBC 1705.12.4		
TASK	INSPECTION TYPE [1]	DESCRIPTION
1. Designated Seismic Systems equipment verification	OBSERVE	✓ Verify model number and serial number are in conformance with project specific seismic qualification (PSSQ) ✓ Verify Tag ID is correct and installed per specifications
2. Designated Seismic Systems equipment Mounting	OBSERVE	✓ Verify that Anchor Base Bolting is installed per PSSQ ✓ Verify that Equipment Bracing is Installed per PSSQ ✓ Verify that Bracing Attachments are installed per PSSQ
3. Designated Seismic Systems utility Conduit/Piping	OBSERVE	✓ Verify that Conduit/Piping is connected to the equipment per PSSQ (flex or rigid) ✓ Verify that Conduit/Piping is seismically supported independently of equipment and in accordance with PSSQ support requirements
4. Designated Seismic Systems clearance	OBSERVE	✓ Adjacent Equipment – Verify that there is adequate gap to eliminate possibility of pounding ✓ Conduit/Piping - Verify that there is adequate gap to eliminate possibility of pounding

END SECTION

[1] **OBSERVE**: Observe these items on a random sampling basis daily to insure that applicable requirements are met. Operations need not be delayed pending these inspections at contractor's risk.

Project:	Renovate B14 ABCD - Residential Program
Location:	Montrose, New York
Project #:	620-20-105
Date:	9/20/2023

STATEMENT OF SPECIAL INSPECTIONS

Project Seismic Design Category:	B	
Project Risk Category:	III	
Project Design Wind Speed (mph):	123	
Number of Stories:	2	
Structure Height Above Grade (ft):	30	
Hazardous Occupancy or attached to such?	No	Group H Occupancies (2018 IBC, Section 415)

Special Inspector of Record (SIOR)

A Special Inspector of Record (SIOR) **IS** required (per UFGS 01 45 35, Section 1.3.8)

SIOR Name (Registered Professional):	Contractor to provide prior to construction start
Professional Registration Number:	
Consulting Firm Name (if any):	
SIOR Office AND Mobile Phone Number:	

Lateral Force Resisting System (LFRS)

2018 IBC 1704.3.2 and 1704.3.3

Following is a listing of critical main wind/seismic force resisting systems for this structure. Carefully inspect these elements as part of the roles and responsiblities of the Special Inspector (reference the Schedule of Special Inspections for inspection checklists).

Vertical LFRS Elements	Notes
Horizontal LFRS Elements	**Notes**
Out of Plane Wall Connections	See Structural Details D9 and F9 on S-520

Project: Renovate B14 ABCD - Residential Program
Location: Montrose, New York
Project #: 620-20-105
Date: 9/20/2023

Designated Seismic Systems (DSS)

(2018 IBC 1705.13.3.4) (ASCE 7-16, 13.2.2, C13.2.2) (UFC 3-310-04, 2-11.2 & 2-13.2.2)

DESIGNATED SEISMIC SYSTEMS DO NOT APPLY TO THIS PROJECT, due to the Seismic Design Category being less than C.

ELECTRICAL Designated Seismic Systems (DSS) Requiring a Certificate of Compliance	
1.	
2.	
3.	
4.	
5.	

If additional space is required, append an additional sheet listing the remaining DSS

MECHANICAL/PLUMBING Designated Seismic Systems (DSS) Requiring a Certificate of Compliance	
1.	
2.	
3.	
4.	
5.	
6.	

If additional space is required, append an additional sheet listing the remaining DSS

OTHER Designated Seismic Systems (DSS) Requiring a Certificate of Compliance	
1.	
2.	
3.	
4.	
5.	
6.	

Final Walk Down Inspection and Report

(UFC 3 301 01 SECTION 2-2.4.3)

Designated Seismic Systems shall receive a final walk-down inspection by the Registered Design Professional in Responsible Charge

Final Walk Down Report, Prepared by the Registered Design Professional in Responsible Charge, Must Include:

1. Record observations of Final Walk Down Inspection
2. Document that Inspections were performed in accordance with the Schedule of Special Inspections
3. Document that all Designated Seismic Systems are installed according to construction/manufacturer document requirements, and that Compliance Certificates have been collected (UFC 03 301 01, 2-13.2.2.1).

SECTION 01 57 19

TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the control of environmental pollution and damage that the Contractor must consider for air, water, and land resources. It includes management of visual aesthetics, noise, solid waste, radiant energy, and radioactive materials, as well as other pollutants and resources encountered or generated by the Contractor. The Contractor is obligated to consider specified control measures with the costs included within the various contract items of work.

B. Environmental pollution and damage is defined as the presence of chemical, physical, or biological elements or agents which:
   1. Adversely effect human health or welfare,
   2. Unfavorably alter ecological balances of importance to human life,
   3. Effect other species of importance to humankind, or;
   4. Degrade the utility of the environment for aesthetic, cultural, and historical purposes.

C. Definitions of Pollutants:
   1. Chemical Waste: Petroleum products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, organic chemicals, and inorganic wastes.
   2. Debris: Combustible and noncombustible wastes, such as leaves, tree trimmings, ashes, and waste materials resulting from construction or maintenance and repair work.
   3. Sediment: Soil and other debris that has been eroded and transported by runoff water.
   4. Solid Waste: Rubbish, debris, garbage, and other discarded solid materials resulting from industrial, commercial, and agricultural operations and from community activities.
   5. Surface Discharge: The term "Surface Discharge" implies that the water is discharged with possible sheeting action and subsequent soil erosion may occur. Waters that are surface discharged may terminate in drainage ditches, storm sewers, creeks, and/or "water of the United States" and would require a permit to discharge water from the governing agency.
   6. Rubbish: Combustible and noncombustible wastes such as paper, boxes, glass and crockery, metal and lumber scrap, tin cans, and bones.
   7. Sanitary Wastes:
      a. Sewage: Domestic sanitary sewage and human and animal waste.
      b. Garbage: Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.

1.2 QUALITY CONTROL

A. Establish and maintain quality control for the environmental protection of all items set forth herein.

B. Record on daily reports any problems in complying with laws, regulations, and ordinances. Note any corrective action taken.

1.3 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. U.S. National Archives and Records Administration (NARA):
   33 CFR 328 ..... Definitions

1.4 SUBMITTALS

A. In accordance with Section, 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:

1. Environmental Protection Plan: After the contract is awarded and prior to the commencement of the work, the Contractor shall meet with the Contracting Officer's Representative (COR) to discuss the proposed Environmental Protection Plan and to develop mutual understanding relative to details of environmental protection. Not more than 20 days after the meeting, the Contractor shall prepare and submit to the Contracting Officer for approval, a written and/or graphic Environmental Protection Plan including, but not limited to, the following:
   a. Name(s) of person(s) within the Contractor's organization who is (are) responsible for ensuring adherence to the Environmental Protection Plan.
   b. Name(s) and qualifications of person(s) responsible for manifesting hazardous waste to be removed from the site.
   c. Name(s) and qualifications of person(s) responsible for training the Contractor's environmental protection personnel.
   d. Description of the Contractor's environmental protection personnel training program.
   e. A list of Federal, State, and local laws, regulations, and permits concerning environmental protection, pollution control, noise control and abatement that are applicable to the Contractor's proposed operations and the requirements imposed by those laws, regulations, and permits.
   f. Methods for protection of features to be preserved within authorized work areas including trees, shrubs, vines, grasses, ground cover, landscape features, air and water quality, fish and wildlife, soil, historical, and archeological and cultural resources.
   g. Procedures to provide the environmental protection that comply with the applicable laws and regulations. Describe the procedures to correct pollution of the environment due to accident, natural causes, or failure to follow the procedures as described in the Environmental Protection Plan.
   h. Permits, licenses, and the location of the solid waste disposal area.
   i. Environmental Monitoring Plans for the job site including land, water, air, and noise.
   j. Work Area Plan showing the proposed activity in each portion of the area and identifying the areas of limited use or nonuse. Plan should include measures for marking the limits of use areas. This plan may be incorporated within the Erosion Control Plan.
   k. Inclusion of "best management practices" and methodologies.

B. Approval of the Contractor's Environmental Protection Plan will not relieve the Contractor of responsibility for adequate and continued control of pollutants and other environmental protection measures.

1. Handle and dispose of solid wastes in such a manner that will prevent contamination of the environment. Place solid wastes (excluding clearing debris) in containers that are emptied on a regular schedule. Transport all solid waste off Government property and dispose of waste in compliance with Federal, State, and local requirements.
2. Store chemical waste away from the work areas in corrosion resistant containers and dispose of waste in accordance with Federal, State, and local regulations.
3. Handle discarded materials other than those included in the solid waste category as directed by the COR.

1.5 PROTECTION OF ENVIRONMENTAL RESOURCES

A. Protect environmental resources within the project boundaries and those affected outside the limits of permanent work during the entire period of this contract. Confine activities to areas defined by the specifications and drawings.

B. Protection of Land Resources: Prior to construction, identify all land resources to be preserved within the work area. Do not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and landforms without permission from the COR. Do not fasten or attach ropes, cables, or guys to trees for anchorage unless specifically authorized, or where special emergency use is permitted. Provide erosion control plans, in phases where required.

1. Work Area Limits: Prior to any construction, mark the areas that require work to be performed under this contract. Mark or fence isolated areas within the general work area that are to be saved and protected. Protect monuments, works of art, and markers before construction operations begin. Convey to all personnel the purpose of marking and protecting all necessary objects.
2. Protection of Landscape: Protect trees, shrubs, vines, grasses, landforms, and other landscape features shown on the drawings to be preserved by marking, fencing, or using any other approved techniques.
   a. Box and protect from damage existing trees and shrubs to remain on the construction site.
   b. Immediately repair all damage to existing trees and shrubs by trimming, cleaning, and painting with antiseptic tree paint.
   c. Do not store building materials or perform construction activities closer to existing trees or shrubs than the farthest extension of their limbs.
3. Reduction of Exposure of Unprotected Erodible Soils: Plan and conduct earthwork to minimize the duration of exposure of unprotected soils. Clear areas in reasonably sized increments only as needed to use. Form earthwork to final grade as shown. Immediately protect side slopes and back slopes upon completion of rough grading.
4. Temporary Protection of Disturbed Areas: Construct diversion ditches, benches, and berms to retard and divert runoff from the construction site to protected drainage areas approved under paragraph 208 of the Clean Water Act.
   a. Sediment Basins: Trap sediment from construction areas in temporary or permanent sediment basins that accommodate the runoff of a local 10 (design year) storm. After each storm, pump the basins dry and remove the accumulated sediment. Control overflow/drainage with paved weirs or by vertical overflow pipes, draining from the surface.
   b. Reuse or conserve the collected topsoil sediment as directed by the COR. Topsoil use and requirements are specified in Section 31 20 11, EARTHWORK (Short Form).
   c. Institute effluent quality monitoring programs as required by Federal, State, and local environmental agencies.
5. Erosion and Sedimentation Control Devices: The erosion and sediment controls selected and maintained by the Contractor shall be such that water quality standards are not violated as a result of the Contractor's activities. Construct or install all temporary and permanent erosion and sedimentation control features shown. Maintain temporary erosion and sediment control measures such as berms, dikes, drains, sedimentation basins, grassing, and mulching, until permanent drainage and erosion control facilities are completed and operative.
6. Manage borrow areas on and off Government property to minimize erosion and to prevent sediment from entering nearby water courses or lakes.
7. Manage and control spoil areas on and off Government property to limit spoil to areas shown and prevent erosion of soil or sediment from entering nearby water courses or lakes.
8. Protect adjacent areas from despoilment by temporary excavations and embankments.
9. Handle and dispose of solid wastes in such a manner that will prevent contamination of the environment. Place solid wastes (excluding clearing debris) in containers that are emptied on a regular schedule. Transport all solid waste off Government property and dispose of waste in compliance with Federal, State, and local requirements.
10. Store chemical waste away from the work areas in corrosion resistant containers and dispose of waste in accordance with Federal, State, and local regulations.

11. Handle discarded materials other than those included in the solid waste category as directed by the COR.

C. Protection of Water Resources: Keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters and sewer systems. Implement management techniques to control water pollution by the listed construction activities that are included in this contract.
   1. Washing and Curing Water: Do not allow wastewater directly derived from construction activities to enter water areas. Collect and place wastewater in retention ponds allowing the suspended material to settle, the pollutants to separate, or the water to evaporate.
   2. Control movement of materials and equipment at stream crossings during construction to prevent violation of water pollution control standards of the Federal, State, or local government.
   3. Monitor water areas affected by construction.

D. Protection of Fish and Wildlife Resources: Keep construction activities under surveillance, management, and control to minimize interference with, disturbance of, or damage to fish and wildlife. Prior to beginning construction operations, list species that require specific attention along with measures for their protection.

E. Protection of Air Resources: Keep construction activities under surveillance, management, and control to minimize pollution of air resources. Burning is not permitted on the job site. Keep activities, equipment, processes, and work operated or performed, in strict accordance with the State of New York and Federal emission and performance laws and standards. Maintain ambient air quality standards set by the Environmental Protection Agency, for those construction operations and activities specified.
   1. Particulates: Control dust particles, aerosols, and gaseous by-products from all construction activities, processing, and preparation of materials (such as from asphaltic batch plants) at all times, including weekends, holidays, and hours when work is not in progress.
   2. Particulates Control: Maintain all excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and all other work areas within or outside the project boundaries free from particulates which would cause a hazard or a nuisance. Sprinklering, chemical treatment of an approved type, light bituminous treatment, baghouse, scrubbers, electrostatic precipitators, or other methods are permitted to control particulates in the work area.
   3. Hydrocarbons and Carbon Monoxide: Control monoxide emissions from equipment to Federal and State allowable limits.
   4. Odors: Control odors of construction activities and prevent obnoxious odors from occurring.

F. Reduction of Noise: Minimize noise using every action possible. Perform noise-producing work in less sensitive hours of the day or week as directed by the COR. Maintain noise-produced work at or below the decibel levels and within the time periods specified.
   1. Perform construction activities involving repetitive, high-level impact noise only between 8:00 a.m. and 6:00 p.m unless otherwise permitted by local ordinance or the COR. Repetitive impact noise on the property shall not exceed the following dB limitations:

Time Duration of Impact Noise	Sound Level in dB
More than 12 minutes in any hour	70
Less than 30 seconds of any hour	85
Less than three minutes of any hour	80
Less than 12 minutes of any hour	75

   2. Provide sound-deadening devices on equipment and take noise abatement measures that are necessary to comply with the requirements of this contract, consisting of, but not limited to, the following:

a. Maintain maximum permissible construction equipment noise levels at 15 meter (50 feet) (dBA):

EARTHMOVING		MATERIALS HANDLING	
FRONT LOADERS	75	CONCRETE MIXERS	75
BACKHOES	75	CONCRETE PUMPS	75
DOZERS	75	CRANES	75
TRACTORS	75	DERRICKS IMPACT	75
SCRAPERS	80	PILE DRIVERS	95
GRADERS	75	JACK HAMMERS	75
TRUCKS	75	ROCK DRILLS	80
PAVERS, STATIONARY	80	PNEUMATIC TOOLS	80
PUMPS	75	BLASTING	N/A
GENERATORS	75	SAWS	75
COMPRESSORS	75	VIBRATORS	75

b. Use shields or other physical barriers to restrict noise transmission.
c. Provide soundproof housings or enclosures for noise-producing machinery.
d. Use efficient silencers on equipment air intakes.
e. Use efficient intake and exhaust mufflers on internal combustion engines that are maintained so equipment performs below noise levels specified.
f. Line hoppers and storage bins with sound deadening material.
g. Conduct truck loading, unloading, and hauling operations so that noise is kept to a minimum.

3. Measure sound level for noise exposure due to the construction at least once every five successive working days while work is being performed above 55 dB(A) noise level. Measure noise exposure at the property line or 15 m (50 feet) from the noise source, whichever is greater. Measure the sound levels on the A weighing network of a General Purpose sound level meter at slow response. To minimize the effect of reflective sound waves at buildings, take measurements at 900 to 1800 mm (three to six feet) in front of any building face. Submit the recorded information to the COR noting any problems and the alternatives for mitigating actions.

G. Restoration of Damaged Property: If any direct or indirect damage is done to public or private property resulting from any act, omission, neglect, or misconduct, the Contractor shall restore the damaged property to a condition equal to that existing before the damage at no additional cost to the Government. Repair, rebuild, or restore property as directed or make good such damage in an acceptable manner.

H. Final Clean-up: On completion of project and after removal of all debris, rubbish, and temporary construction, Contractor shall leave the construction area in a clean condition satisfactory to the COR. Cleaning shall include off the station disposal of all items and materials not required to be salvaged, as well as all debris and rubbish resulting from demolition and new work operations.

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SECTION 01 58 16
TEMPORARY INTERIOR SIGNAGE

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies temporary interior signs.

PART 2 - PRODUCTS

2.1 TEMPORARY SIGNS

A. A. Fabricate from 50 Kg (110 pound) mat finish white paper.

B. B. Cut to 100 mm (4-inch) wide by 300 mm (12 inch) long size tag.

C. C. Punch 3 mm (1/8-inch) diameter hole centered on 100 mm (4-inch) dimension of tag. Edge of Hole spaced approximately 13 mm (1/2-inch) from one end on tag.

D. D. Reinforce hole on both sides with gummed cloth washer or other suitable material capable of preventing tie pulling through paper edge.

E. E. Ties: Steel wire 0.3 mm (0.0120-inch) thick, attach to tag with twist tie, leaving 150 mm (6-inch) long free ends.

PART 3 - EXECUTION

3.1 INSTALLATION

A. A. Install temporary signs attached to room door frame or room door knob, lever, or pull for doors on corridor openings.

B. B. Mark on signs with felt tip marker having approximately 3 mm (1/8-inch) wide stroke for clearly legible numbers or letters.

C. C. Identify room with numbers as designated on floor plans.

3.2 LOCATION

A. A. Install on doors that have room, corridor, and space numbers shown.

B. B. Doors that do not require signs are as follows:
1. 1. Corridor barrier doors (cross-corridor) in corridor with same number.
2. 2. Folding doors or partitions.
3. 3. Toilet or bathroom doors within and between rooms.
4. 4. Communicating doors in partitions between rooms with corridor entrance doors.
5. 5. Closet doors within rooms.

C. C. Replace missing, damaged, or illegible signs.

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SECTION 01 74 19
CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the requirements for the management of non-hazardous building construction and demolition waste.

B. Waste disposal in landfills shall be minimized to the greatest extent possible. Of the inevitable waste that is generated, as much of the waste material as economically feasible shall be salvaged, recycled or reused.

C. Contractor shall use all reasonable means to divert construction and demolition waste from landfills and incinerators, and facilitate their salvage and recycle not limited to the following:

D. Waste Management Plan development and implementation.

E. Techniques to minimize waste generation.

F. Sorting and separating of waste materials.

G. Salvage of existing materials and items for reuse or resale.

H. Recycling of materials that cannot be reused or sold.

I. At a minimum the following waste categories shall be diverted from landfills:
1. Soil.
2. Inerts (eg, concrete, masonry and asphalt).
3. Clean dimensional wood and palette wood.
4. Green waste (biodegradable landscaping materials).
5. Engineered wood products (plywood, particle board and I-joists, etc).
6. Metal products (eg, steel, wire, beverage containers, copper, etc).
7. Sheathings
8. Cardboard, paper and packaging.
9. Bitumen roofing materials.
10. Plastics (eg, ABS, PVC).
11. Carpet and/or pad.
12. Gypsum board.
13. Insulation.
14. Paint.
15. Fluorescent lamps.

1.2 RELATED WORK

A. Section 02 41 00, DEMOLITION.

B. Section 01 00 00, GENERAL REQUIREMENTS.

C. Lead Paint: Section 02 83 33.13, LEAD BASED PAINT REMOVAL AND DISPOSAL.

1.3 QUALITY ASSURANCE

A. Contractor shall practice efficient waste management when sizing, cutting and installing building products. Processes shall be employed to ensure the generation of as little waste as possible. Construction /Demolition waste includes products of the following:
1. Excess or unusable construction materials.
2. Packaging used for construction products.
3. Poor planning and/or layout.
4. Construction error.
5. Over ordering.

6. Weather damage.
7. Contamination.
8. Mishandling.
9. Breakage.

B. Establish and maintain the management of non-hazardous building construction and demolition waste set forth herein. Conduct a site assessment to estimate the types of materials that will be generated by demolition and construction.

C. Contractor shall develop and implement procedures to recycle construction and demolition waste to a minimum of 50 percent.

D. Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling. Any revenues or savings obtained from salvage or recycling shall accrue to the contractor.

E. Contractor shall provide all demolition, removal and legal disposal of materials. Contractor shall ensure that facilities used for recycling, reuse and disposal shall be permitted for the intended use to the extent required by local, state, federal regulations.

F. Contractor shall assign a specific area to facilitate separation of materials for reuse, salvage, recycling, and return. Such areas are to be kept neat and clean and clearly marked in order to avoid contamination or mixing of materials.

G. Contractor shall provide on-site instructions and supervision of separation, handling, salvaging, recycling, reuse and return methods to be used by all parties during waste generating stages.

H. Record on daily reports any problems in complying with laws, regulations and ordinances with corrective action taken.

1.4 TERMINOLOGY

A. Class III Landfill: A landfill that accepts non-hazardous resources such as household, commercial and industrial waste resulting from construction, remodeling, repair and demolition operations.

B. Clean: Untreated and unpainted; uncontaminated with adhesives, oils, solvents, mastics and like products.

C. Construction and Demolition Waste: Includes all non-hazardous resources resulting from construction, remodeling, alterations, repair and demolition operations.

D. Dismantle: The process of parting out a building in such a way as to preserve the usefulness of its materials and components.

E. Disposal: Acceptance of solid wastes at a legally operating facility for the purpose of land filling (includes Class III landfills and inert fills).

F. Inert Backfill Site: A location, other than inert fill or other disposal facility, to which inert materials are taken for the purpose of filling an excavation, shoring or other soil engineering operation.

G. Inert Fill: A facility that can legally accept inert waste, such as asphalt and concrete exclusively for the purpose of disposal.

H. Inert Solids/Inert Waste: Non-liquid solid resources including, but not limited to, soil and concrete that does not contain hazardous waste or soluble pollutants at concentrations in excess of water-quality objectives established by a regional water board, and does not contain significant quantities of decomposable solid resources.

I. Mixed Debris: Loads that include commingled recyclable and non-recyclable materials generated at the construction site.

J. Mixed Debris Recycling Facility: A solid resource processing facility that accepts loads of mixed construction and demolition debris for the purpose of recovering re-usable and recyclable materials and disposing non-recyclable materials.

K. Permitted Waste Hauler: A company that holds a valid permit to collect and transport solid wastes from individuals or businesses for the purpose of recycling or disposal.

L. Recycling: The process of sorting, cleansing, treating, and reconstituting materials for the purpose of using the altered form in the manufacture of a new product. Recycling does not include burning, incinerating or thermally destroying solid waste.
   1. On-site Recycling – Materials that are sorted and processed on site for use in an altered state in the work, i.e. concrete crushed for use as a sub-base in paving.
   2. Off-site Recycling – Materials hauled to a location and used in an altered form in the manufacture of new products.

M. Recycling Facility: An operation that can legally accept materials for the purpose of processing the materials into an altered form for the manufacture of new products. Depending on the types of materials accepted and operating procedures, a recycling facility may or may not be required to have a solid waste facilities permit or be regulated by the local enforcement agency.

N. Reuse: Materials that are recovered for use in the same form, on-site or off-site.

O. Return: To give back reusable items or unused products to vendors for credit.

P. Salvage: To remove waste materials from the site for resale or re-use by a third party.

Q. Source-Separated Materials: Materials that are sorted by type at the site for the purpose of reuse and recycling.

R. Solid Waste: Materials that have been designated as non-recyclable and are discarded for the purposes of disposal.

S. Transfer Station: A facility that can legally accept solid waste for the purpose of temporarily storing the materials for re-loading onto other trucks and transporting them to a landfill for disposal, or recovering some materials for re-use or recycling.

1.5 SUBMITTALS

A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES, furnish the following:

B. Prepare and submit to the COR a written demolition debris management plan. The plan shall include, but not be limited to, the following information:
   1. Procedures to be used for debris management.
   2. Techniques to be used to minimize waste generation.
   3. Analysis of the estimated job site waste to be generated:
      a. List of each material and quantity to be salvaged, reused, recycled.
      b. List of each material and quantity proposed to be taken to a landfill.
   4. Detailed description of the Means/Methods to be used for material handling.
      a. On site: Material separation, storage, protection where applicable.
      b. Off site: Transportation means and destination. Include list of materials.
         1) Description of materials to be site-separated and self-hauled to designated facilities.
         2) Description of mixed materials to be collected by designated waste haulers and removed from the site.
            a) The names and locations of mixed debris reuse and recycling facilities or sites.
            b) The names and locations of trash disposal landfill facilities or sites.
            c) Documentation that the facilities or sites are approved to receive the materials.

C. Designated Manager responsible for instructing personnel, supervising, documenting and administer over meetings relevant to the Waste Management Plan.

D. Monthly summary of construction and demolition debris diversion and disposal, quantifying all materials generated at the work site and disposed of or diverted from disposal through recycling.

E. Target waste diversion rate by material and an overall diversion rate.

F. Final report documenting the results of implementation of the preconstruction waste management plan.

1.6 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced by the basic designation only. In the event that criteria requirements conflict, the most stringent requirements shall be met.

B. U.S. Green Building Council (USGBC): LEED Green Building Rating System for New Construction

1.7 RECORDS

A. Maintain records to document the quantity of waste generated; the quantity of waste diverted through sale, reuse, or recycling; and the quantity of waste disposed by landfill or incineration. Records shall be kept in accordance with the LEED Reference Guide and LEED Template.

PART 2 - PRODUCTS

2.1 MATERIALS

A. List of each material and quantity to be salvaged, recycled, reused.

B. List of each material and quantity proposed to be taken to a landfill.

C. Material tracking data: Receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices, net total costs or savings.

PART 3 - EXECUTION

3.1 COLLECTION

A. Provide all necessary containers, bins and storage areas to facilitate effective waste management.

B. Clearly identify containers, bins and storage areas so that recyclable materials are separated from trash and can be transported to respective recycling facility for processing.

C. Hazardous wastes shall be separated, stored, disposed of according to local, state, federal regulations.

3.2 DISPOSAL

A. Contractor shall be responsible for transporting and disposing of materials that cannot be delivered to a source-separated or mixed materials recycling facility to a transfer station or disposal facility that can accept the materials in accordance with state and federal regulations.

B. Construction or demolition materials with no practical reuse or that cannot be salvaged or recycled shall be disposed of at a landfill or incinerator.

3.3 REPORT

A. With each application for progress payment, submit a summary of construction and demolition debris diversion and disposal including beginning and ending dates of period covered.

B. Quantify all materials diverted from landfill disposal through salvage or recycling during the period with the receiving parties, dates removed, transportation costs, weight tickets, manifests, invoices. Include the net total costs or savings for each salvaged or recycled material.

C. Quantify all materials disposed of during the period with the receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices. Include the net total costs for each disposal.

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SECTION 01 81 13

SUSTAINABLE CONSTRUCTION REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section describes general requirements and procedures to comply with federal mandates and U.S. Department of Veterans Affairs (VA) policies for sustainable construction.

B. The Design Professional has selected materials and utilized integrated design processes that achieve the Government's objectives. Contractor is responsible to maintain and support these objectives in developing means and methods for performing work and in proposing product substitutions or changes to specified processes. Obtain approval from Contracting Officer for all changes and substitutions to materials or processes. Proposed changes must meet, or exceed, materials or processes specified.

1.2 RELATED WORK

A. Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS.

B. Section 01 74 19 CONSTRUCTION WASTE MANAGEMENT.

C. Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

1.3 DEFINITIONS

A. Recycled Content: Recycled content of materials is defined according to Federal Trade Commission Guides for the Use of Environmental Marketing Claims (16 CFR Part 260). Recycled content value of a material assembly is determined by weight. Recycled fraction of assembly is multiplied by cost of assembly to determine recycled content value.
   1. "Post-Consumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
   2. "Pre-Consumer" material is defined as material diverted from waste stream during the manufacturing process. Excluded is reutilization of materials such as rework, regrind, or scrap generated in a process and capable of being reclaimed within the same process that generated it.

B. Biobased Products: Biobased products are derived from plants and other renewable agricultural, marine, and forestry materials and provide an alternative to conventional petroleum derived products. Biobased products include diverse categories such as lubricants, cleaning products, inks, fertilizers, and bioplastics.

C. Low Pollutant-Emitting Materials: Materials and products which are minimally odorous, irritating, or harmful to comfort and well-being of installers and occupants.

D. Volatile Organic Compounds (VOC): Chemicals that are emitted as gases from certain solids or liquids. VOCs include a variety of chemicals, some of which may have short- and long-term adverse health effects.

1.4 REFERENCE STANDARDS

A. Carpet and Rug Institute Green Label Plus program.

B. U.S. Department of Agriculture BioPreferred program (USDA BioPreferred).

C. U.S. Environmental Protection Agency Comprehensive Procurement Guidelines (CPG).

D. U.S. Environmental Protection Agency WaterSense Program (WaterSense).

E. U.S. Environmental Protection Agency ENERGY STAR Program (ENERGY STAR).

F. U. S. Department of Energy Federal Energy Management Program (FEMP).

G. Green Electronic Council EPEAT Program (EPEAT).

1.5 SUBMITTALS

A. All submittals to be provided by contractor to COR.

B. Sustainability Action Plan:
   1. Submit documentation as required by this section; provide additional copies of typical submittals required under technical sections when sustainable construction requires copies of record submittals.
   2. Within 30 days after Preconstruction Meeting provide a narrative plan for complying with requirements stipulated within this section.
   3. Sustainability Action Plan must:
      a. Make reference to sustainable construction submittals defined by this section.
      b. Address all items listed under PERFORMANCE CRITERIA.
      c. Indicate individual(s) responsible for implementing the plan.

C. Low Pollutant-Emitting Materials Tracking Spreadsheet: Within 30 days after Preconstruction Meeting provide a preliminary Low Pollutant-Emitting Materials Tracking Spreadsheet. The Low Pollutant-Emitting Materials Tracking Spreadsheet must be an electronic file and include all materials on Project in categories described under Low Pollutant-Emitting Materials in 01 81 13.

D. Construction Indoor Air Quality (IAQ) Management Plan:
   1. Not more than 30 days after Preconstruction Meeting provide a Construction IAQ Management Plan as an electronic file including descriptions of the following:
      a. Instruction procedures for meeting or exceeding minimum requirements of ANSI/SMACNA 008-2008, Chapter 3, including procedures for HVAC Protection, Source Control, Pathway Interruption, Housekeeping, and Scheduling.
      b. Instruction procedures for protecting absorptive materials stored on-site or installed from moisture damage.
      c. Schedule of submission of photographs of on-site construction IAQ management measures such as protection of ducts and on-site stored oil installed absorptive materials.
      d. Instruction procedures if air handlers must be used during construction, including a description of filtration media to be used at each return air grille.
      e. Instruction procedure for replacing all air-filtration media immediately prior to occupancy after completion of construction, including a description of filtration media to be used at each air handling or air supply unit.
      f. Instruction procedures and schedule for implementing building flush-out.

E. Product Submittals:
   1. Recycled Content: Submit product data from manufacturer indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content (excluding MEP systems equipment and components).
   2. Biobased Content: Submit product data for products to be installed or used which are included in any of the USDA BioPreferred program's product categories. Data to include percentage of biobased content and source of biobased material.
   3. Low Pollutant-Emitting Materials: Submit product data confirming compliance with relevant requirements for all materials on Project in categories described under Low Pollutant-Emitting Materials in 01 81 13.
   4. For applicable products and equipment, submit product documentation confirming ENERGY STAR label, FEMP certification, WaterSense, and/or EPEAT certification.

F. Sustainable Construction Progress Reports: Concurrent with each Application for Payment, submit a Sustainable Construction Progress Report to confirm adherence with Sustainability Action Plan.
   1. Include narratives of revised strategies for bringing work progress into compliance with plan and product submittal data.

2. Include updated and current Low Pollutant-Emitting Materials Tracking Spreadsheet.
3. Include construction waste tracking, in tons or cubic yards, including waste description, whether diverted or landfilled, hauler, and percent diverted for comingled quantities; and excluding land-clearing debris and soil. Provide haul receipts and documentation of diverted percentages for comingled wastes.

G. Closeout Submittals: Within 14 days after Substantial Completion provide the following:
1. Final version of Low Pollutant-Emitting Materials Tracking Spreadsheet.
2. Manufacturer's cut sheets and product data highlighting the Minimum Efficiency Reporting Value (MERV) for filtration media installed at return air grilles during construction if permanently installed air handling units are used during construction.
3. Manufacturer's cut sheets and product data highlighting the Minimum Efficiency Reporting Value (MERV) for final filtration media in air handling units.
4. Minimum 18 construction photographs including six photographs taken on three different occasions during construction of ANSI/SMACNA 008-2008, Chapter 3 approaches employed, along with a brief description of each approach, documenting implementation of IAQ management measures, such as protection of ducts and on-site stored or installed absorptive materials.
5. Flush-out Documentation:
   a. Product data for filtration media used during flush-out.
   b. Product data for filtration media installed immediately prior to occupancy.
   c. Signed statement describing building air flush-out procedures including dates when flush-out was begun and completed and statement that filtration media was replaced after flush-out.

1.6 QUALITY ASSURANCE

A. Preconstruction Meeting: After award of Contract and prior to commencement of Work, schedule and conduct meeting with COR/Resident Engineer and Architect to discuss the Project Sustainable Action Plan content as it applies to submittals, project delivery, required Construction Indoor Air Quality (IAQ) Management Plan, and other Sustainable Construction Requirements. The purpose of this meeting is to develop a mutual understanding of the Sustainable Construction Requirements and coordination of contractor's management of these requirements with the Contracting Officer and the Construction Quality Manager.

B. Construction Job Conferences: Status of compliance with Sustainable Construction Requirements of these specifications will be an agenda item at regular job meetings conducted during the course of work at the site.

1.7 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

B. Green Seal Standard GS-11, Paints, 1st Edition, May 20, 1993.

C. Green Seal Standard GC-03, Anti-Corrosive Paints, 2nd Edition, January 7, 1997.

D. Green Seal Standard GC-36, Commercial Adhesives, October 19, 2000.

E. South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings, rules in effect on January 1, 2004.

F. South Coast Air Quality Management District (SCAQMD) Rule 1168, July 1, 2005 and rule amendment date of January 7, 2005.

G. Sheet Metal and Air Conditioning National Contractors' Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 2nd Edition (ANSI/SMACNA 008-2008), Chapter 3.

H. California Department of Public Health Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers,

Version 1.1, Emission Testing method for California Specification 01350 (CDPH Standard Method V1.1-2010).

I. Federal Trade Commission Guides for the Use of Environmental Marketing Claims (16 CFR Part 260).

J. ASHRAE Standard 52.2-2007.

PART 2 - PRODUCTS

2.1 PERFORMANCE CRITERIA

A. Construction waste diversion from landfill disposal must comprise at least 50 percent of total construction waste, excluding land clearing debris and soil. Alternative daily cover (ADC) does not qualify as material diverted from disposal.

B. Low Pollutant-Emitting Materials:
   1. Adhesives, sealants and sealant primers applied on site within the weatherproofing membrane must comply with VOC limits of SCAQMD Rule 1168:
      a. Flooring Adhesives and Sealants:
         1) Indoor carpet adhesives: 50 g/L.
         2) Wood Flooring Adhesive: 100 g/L.
         3) Rubber Floor Adhesives: 60 g/L.
         4) Subfloor Adhesives: 50 g/L.
         5) Ceramic Tile Adhesives and Grout: 65 g/L.
         6) Cove Base Adhesives: 50 g/L.
         7) Multipurpose Construction Adhesives: 70 g/L.
         8) Porous Material (Except Wood) Substrate: 50 g/L.
         9) Wood Substrate: 30 g/L.
         10) Architectural Non-Porous Sealant Primer: 250 g/L.
         11) Architectural Porous Sealant Primer: 775 g/L.
         12) Other Sealant Primer: 750 g/L.
         13) Structural Wood Member Adhesive: 140 g/L.
         14) Sheet-Applied Rubber Lining Operations: 850 g/L.
         15) Top and Trim Adhesive: 250 g/L.
         16) Architectural Sealant: 250 g/L.
         17) Other Sealant: 420 g/L.
      b. Non-Flooring Adhesives and Sealants:
         1) Drywall and Panel Adhesives: 50 g/L.
         2) Multipurpose Construction Adhesives: 70 g/L.
         3) Structural Glazing Adhesives: 100 g/L.
         4) Metal-to-Metal Substrate Adhesives: 30 g/L.
         5) Plastic Foam Substrate Adhesive: 50 g/L.
         6) Porous Material (Except Wood) Substrate Adhesive: 50 g/L.
         7) Wood Substrate Adhesive: 30 g/L.
         8) Fiberglass Substrate Adhesive: 80 g/L.
         9) Architectural Non-Porous Sealant Primer: 250 g/L.
         10) Architectural Porous Sealant Primer: 775 g/L.
         11) Other Sealant Primer: 750 g/L.
         12) PVC Welding Adhesives: 510 g/L.
         13) CPVC Welding Adhesives: 490 g/L.
         14) ABS Welding Adhesives: 325 g/L.
         15) Plastic Cement Welding Adhesives: 250 g/L.
         16) Adhesive Primer for Plastic: 550 g/L.
         17) Contact Adhesive: 80 g/L.
         18) Special Purpose Contact Adhesive: 250 g/L.
         19) Structural Wood Member Adhesive: 140 g/L.

20) Sheet Applied Rubber Lining Operations: 850 g/L.
21) Top and Trim Adhesive: 250 g/L.
22) Architectural Sealants: 250 g/L.
23) Other Sealants: 420 g/L.

2. Aerosol adhesives applied on site within the weatherproofing membrane must comply with the following Green Seal GS-36.
   a. Aerosol Adhesive, General-Purpose Mist Spray: 65 percent VOCs by weight.
   b. Aerosol Adhesive, General-Purpose Web Spray: 55 percent VOCs by weight.
   c. Special-Purpose Aerosol Adhesive (All Types): 70 percent VOCs by weight.
3. Paints and coatings applied on site within the weatherproofing membrane must comply with the following criteria:
   a. VOC content limits for paints and coatings established in Green Seal Standard GS-11.
   b. VOC content limit for anti-corrosive and anti-rust paints applied to interior ferrous metal substrates of 250 g/L established in Green Seal GC-03.
   c. Clear wood finishes, floor coatings, stains, primers, sealers, and shellacs applied to interior elements must not exceed VOC content limits established in SCAQMD Rule 1113.
   d. Comply with the following VOC content limits:
      1) Anti-Corrosive/Antirust Paints: 250 g/L.
      2) Clear Wood Finish, Lacquer: 550 g/L.
      3) Clear Wood Finish, Sanding Sealer: 350 g/L.
      4) Clear Wood Finish, Varnish: 350 g/L.
      5) Floor Coating: 100 g/L.
      6) Interior Flat Paint, Coating or Primer: 50 g/L.
      7) Interior Non-Flat Paint, Coating or Primer: 150 g/L.
      8) Sealers and Undercoaters: 200 g/L.
      9) Shellac, Clear: 730 g/L.
      10) Shellac, Pigmented: 550 g/L.
      11) Stain: 250 g/L.
      12) Clear Brushing Lacquer: 680 g/L.
      13) Concrete Curing Compounds: 350 g/L.
      14) Japans/Faux Finishing Coatings: 350 g/L.
      15) Magnesite Cement Coatings: 450 g/L.
      16) Pigmented Lacquer: 550 g/L.
      17) Waterproofing Sealers: 250 g/L.
      18) Wood Preservatives: 350 g/L.
      19) Low-Solids Coatings: 120 g/L.
4. Carpet installed in building interior must comply with one of the following:
   a. Meet testing and product requirements of the Carpet and Rug Institute Green Label Plus program.
   b. Maximum VOC concentrations specified in CDPH Standard Method V1.1-2010, using office scenario at the 14 day time point.
5. Each non-carpet flooring element installed in building interior which is not inherently non-emitting (stone, ceramic, powder-coated metals, plated or anodized metal, glass, concrete, clay brick, and unfinished or untreated solid wood flooring) must comply with one of the following:
   a. Meet requirements of the FloorScore standard as shown with testing by an independent third-party.
   b. Maximum VOC concentrations specified in CDPH Standard Method V1.1-2010, using office scenario at 14 day time point.
6. Composite wood and agrifiber products used within the weatherproofing membrane must contain no added urea-formaldehyde resins.
7. Laminating adhesives used to fabricate on-site and shop-applied composite wood and agrifiber assemblies must not contain added urea-formaldehyde.

C. Recycled Content:
1. Any products being installed or used that are listed on EPA Comprehensive Procurement Guidelines designated product list must meet or exceed the EPA's recycled content recommendations. The EPA Comprehensive Procurement Guidelines categories include:
   a. Building insulation.
   b. Cement and concrete.
   c. Consolidated and reprocessed latex paint.
   d. Floor tiles.
   e. Flowable fill.
   f. Laminated paperboard.
   g. Modular threshold ramps.
   h. Nonpressure pipe.
   i. Patio blocks.
   j. Railroad grade crossing surfaces.
   k. Roofing materials.
   l. Shower and restroom dividers/partitions.
   m. Structural fiberboard.
   n. Nylon carpet and nylon carpet backing.
   o. Compost and fertilizer made from recovered organic materials.
   p. Hydraulic mulch.
   q. Lawn and garden edging.
   r. Plastic lumber landscaping timbers and posts.
   s. Park benches and picnic tables.
   t. Plastic fencing.
   u. Playground equipment.
   v. Playground surfaces.
   w. Bike racks.

D. Biobased Content:
1. Materials and equipment being installed or used that are listed on the USDA BioPreferred program product category list must meet or exceed USDA's minimum biobased content threshold. Refer to individual specification sections for detailed requirements applicable to that section.
   a. USDA BioPreferred program categories include:
      1) Adhesive and Mastic Removers.
      2) Carpets.
      3) Cleaners.
      4) Composite Panels.
      5) Corrosion Preventatives.
      6) Erosion Control Materials.
      7) Dust Suppressants.
      8) Fertilizers.
      9) Floor Cleaners and Protectors.
      10) Floor Coverings (Non-Carpet).
      11) Glass Cleaners.
      12) Hydraulic Fluids.
      13) Industrial Cleaners.
      14) Interior Paints and Coatings.
      15) Mulch and Compost Materials.
      16) Multipurpose Cleaners.
      17) Multipurpose Lubricants.
      18) Packaging Films.
      19) Paint Removers.
      20) Plastic Insulating Foam.
      21) Pneumatic Equipment Lubricants.
      22) Roof Coatings.

23) Wastewater Systems Coatings.
24) Water Tank Coatings.
25) Wood and Concrete Sealers.
26) Wood and Concrete Stains.

E. Materials, products, and equipment being installed which fall into a category covered by the WaterSense program must be WaterSense-labeled or meet or exceed WaterSense program performance requirements, unless disallowed for infection control reasons.
1. WaterSense categories include:
a. Bathroom Faucets
b. Commercial Toilets
c. Irrigation Controllers
d. Pre-Rinse Spray Valves
e. Residential Toilets
f. Showerheads
g. Spray Sprinkler Bodies
h. Urinals

F. Materials, products, and equipment being installed which fall into any of the following product categories must be Energy Star-labeled.
1. Applicable Energy Star product categories as of 09/14/2017 include:
a. Appliances:
1) Air Purifiers and Cleaners.
2) Clothes Dryers (Residential).
3) Clothes Washers (Commercial & Residential).
4) Dehumidifiers.
5) Dishwashers (Residential).
6) Freezers (Residential).
7) Refrigerators (Residential).
b. Electronics and Information Technology:
1) Audio/Video Equipment.
2) Computers.
3) Data Center Storage.
4) Digital Media Player.
5) Enterprise Servers.
6) Imaging Equipment.
7) Monitors.
8) Professional Displays.
9) Set-Top and Cable Boxes.
10) Telephones.
11) Televisions.
12) Uninterruptible Power Supplies.
13) Voice over Internet Protocol (VoIP) Phones.
c. Food Service Equipment (Commercial):
1) Dishwashers.
2) Fryers.
3) Griddles.
4) Hot Food Holding Cabinets.
5) Ice Makers.
6) Ovens.
7) Refrigerators and Freezers.
8) Steam Cookers.
9) Vending Machines.
d. Heating and Cooling Equipment:
1) Air-Source Heat Pumps (Residential).
2) Boilers.
3) Ceiling Fans (Residential).

4) Central Air Conditioners (Residential).
5) Ductless Heating and Cooling (Residential).
6) Furnaces (Residential).
7) Water Heaters.
8) Geothermal Heat Pumps (Residential).
9) Light Commercial Heating and Cooling Equipment.
10) Room Air Conditioners (Residential).
11) Ventilation Fans (Residential).

e. Other:
1) Decorative Light Strings.
2) Electric Vehicle Supply Equipment.
3) Laboratory-Grade Refrigerators and Freezers.
4) Light Bulbs.
5) Light Fixtures.
6) Pool Pumps.
7) Roof Products.
8) Water Coolers.
9) Windows, Doors, and Skylights.

G. Materials, products, and equipment being installed which fall into any of the following categories must be FEMP-designated. FEMP-designated product categories as of 09/14/2017 include:
1. Boilers (Commercial).
2. Dishwashers (Commercial).
3. Electric Chillers, Air-Cooled (Commercial).
4. Electric Chillers, Water-Cooled (Commercial).
5. Exterior Lighting.
6. Fluorescent Ballasts.
7. Fluorescent Lamps, General Service.
8. Ice Machines, Water-Cooled.
9. Industrial Lighting (High/Low Bay).
10. Light Emitting Diode (LED) Luminaires.

H. Electronic products and equipment being installed which fall into any of the following categories shall be EPEAT registered. Electronic products and equipment covered by EPEAT program as of 09/14/2017 include:
1. Computers.
2. Displays.
3. Imaging Equipment.
4. Televisions.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Construction Indoor Air Quality Management:
1. During construction, meet or exceed recommended control measures of ANSI/SMACNA 008-2008, Chapter 3.
2. Protect stored on-site and installed absorptive materials from moisture damage.
3. If permanently installed air handlers are used during construction, filtration media with a minimum efficiency reporting value (MERV) of 8 must be used at each return air grille, as determined by ASHRAE Standard 52.2-1999 (with errata but without addenda). Replace all filtration media immediately prior to occupancy.
4. Perform building flush-out as follows:
a. After construction ends, prior to occupancy and with interior finishes installed, perform a building flush-out by supplying a total volume of 14000 cu. ft. of outdoor air per sq. ft. of floor area while maintaining an internal temperature of at least 60 degrees Fahrenheit and a relative humidity no higher than 60 percent. OR

b. If occupancy is desired prior to flush-out completion, the space may be occupied following delivery of a minimum of 3500 cu. ft. of outdoor air per sq. ft. of floor area to the space. Once a space is occupied, it must be ventilated at a minimum rate of 0.30 cfm per sq. ft. of outside air or design minimum outside air rate determined until a total of 14000 cu. ft./sq. ft. of outside air has been delivered to the space. During each day of flush-out period, ventilation must begin a minimum of three hours prior to occupancy and continue during occupancy.

5. Provide construction dust control to comply with SCAQMD Rule 403.

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SECTION 01 91 00
GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 COMMISSIONING DESCRIPTION

A. This Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS shall form the basis of the construction phase commissioning process and procedures. The Commissioning Agent shall add, modify, and refine the commissioning procedures, as approved by the Department of Veterans Affairs (VA), to suit field conditions and actual manufacturer's equipment, incorporate test data and procedure results, and provide detailed scheduling for all commissioning tasks.

B. Various sections of the project specifications require equipment startup, testing, and adjusting services. Requirements for startup, testing, and adjusting services specified in Division 21, Division 22, Division 23, Division 26, Division 27, and Division 28 series sections of these specifications are intended to be provided in coordination with the commissioning services and are not intended to duplicate services. The Contractor shall coordinate the work required by individual specification sections with the commissioning services requirements specified herein.

C. Where individual testing, adjusting, or related services are required in the project specifications and not specifically required by this commissioning requirements specification, the specified services shall be provided and copies of documentation, as required by those specifications shall be submitted to the VA and the Commissioning Agent to be indexed for future reference.

D. Where training or educational services for VA are required and specified in other sections of the specifications, including but not limited to Division 21, Division 22, Division 23, Division 26, Division 27, and Division 28 series sections of the specification, these services are intended to be provided in addition to the training and educational services specified herein.

E. Commissioning is a systematic process of verifying that the building systems perform interactively according to the construction documents and the VA's operational needs. The commissioning process shall encompass and coordinate the system documentation, equipment startup, control system calibration, testing and balancing, performance testing and training. Commissioning during the construction and post-occupancy phases is intended to achieve the following specific objectives according to the contract documents:
   1. Verify that the applicable equipment and systems are installed in accordance with the contact documents and according to the manufacturer's recommendations.
   2. Verify and document proper integrated performance of equipment and systems.
   3. Verify that Operations & Maintenance documentation is complete.
   4. Verify that all components requiring servicing can be accessed, serviced and removed without disturbing nearby components including ducts, piping, cabling or wiring.
   5. Verify that the VA's operating personnel are adequately trained to enable them to operate, monitor, adjust, maintain, and repair building systems in an effective and energy-efficient manner.
   6. Document the successful achievement of the commissioning objectives listed above.

F. All systems/equipment shall have 30 days documented error-free operation prior to scheduling Cx Functional Performance Testing.

G. The commissioning process does not take away from or reduce the responsibility of the Contractor to provide a finished and fully functioning product.

1.2 CONTRACTUAL RELATIONSHIPS

A. For this construction project, the Department of Veterans Affairs has arranged for the Architect & Engineering firm to provide an Independent Third Party Construction Commissioning Firm for services. The contracts are administered by the A&E firm. On this project, the authority to

modify the contract in any way is strictly limited to the authority of the A&E firm acting to represent the best interests of the VA.

B. In this project, only two contract parties are recognized and communications on contractual issues are strictly limited to VA COR and the Contractor. It is the practice of the VA to require that communications between other parties to the contracts (Subcontractors and Vendors) be conducted through the COR and Contractor. It is also the practice of the VA that communications between other parties of the project (Commissioning Agent and Architect/Engineer) be conducted through the COR.

C. Whole Building Commissioning is a process that relies upon frequent and direct communications, as well as collaboration between all parties to the construction process. By its nature, a high level of communication and cooperation between the Commissioning Agent and all other parties (Architects, Engineers, Subcontractors, Vendors, third party testing agencies, etc.) is essential to the success of the Commissioning effort.

D. With these fundamental practices in mind, the commissioning process described herein has been developed to recognize that, in the execution of the Commissioning Process, the Commissioning Agent must develop effective methods to communicate with every member of the construction team involved in delivering commissioned systems while simultaneously respecting the exclusive contract authority of the Contracting Officer and COR. Thus, the procedures outlined in this specification must be executed within the following limitations:

1. No communications (verbal or written) from the Commissioning Agent shall be deemed to constitute direction that modifies the terms of any contract between the Department of Veterans Affairs and the Contractor.
2. Commissioning Issues identified by the Commissioning Agent will be delivered to the COR and copied to the designated Commissioning Representatives for the Contractor and subcontractors on the Commissioning Team for information only in order to expedite the communication process. These issues must be understood as the professional opinion of the Commissioning Agent and as suggestions for resolution.
3. In the event that any Commissioning Issues and suggested resolutions are deemed by the COR to require either an official interpretation of the construction documents or require a modification of the contract documents, the Contracting Officer or COR will issue an official directive to this effect.
4. All parties to the Commissioning Process shall be individually responsible for alerting the COR of any issues that they deem to constitute a potential contract change prior to acting on these issues.
5. Authority for resolution or modification of design and construction issues rests solely with the Contracting Officer or COR, with appropriate technical guidance from the Architect/Engineer and/or Commissioning Agent.

1.3 RELATED WORK

A. Section 01 00 00 GENERAL REQUIREMENTS.

B. Section 01 32.16.15 PROJECT SCHEDULES (SMALL PROJECTS – DESIGN/BID/BUILD)

C. Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

D. Section 01 81 13 SUSTAINABLE CONSTRUCTION REQUIREMENTS

E. Section 21 08 00 COMMISSIONING OF FIRE PROTECTION SYSTEMS.

F. Section 22 08 00 COMMISSIONING OF PLUMBING SYSTEMS.

G. Section 23 08 00 COMMISSIONING OF HVAC SYSTEMS.

H. Section 26 08 00 COMMISSIONING OF ELECTRICAL SYSTEMS.

I. Section 27 08 00 COMMISSIONING OF COMMUNICATIONS SYSTEMS.

J. Section 28 08 00 COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS.

1.4 SUMMARY

A. This Section includes general requirements that apply to implementation of commissioning without regard to systems, subsystems, and equipment being commissioned.

B. The commissioning activities have been developed to support the VA requirements to meet guidelines for Federal Leadership in Environmental, Energy, and Economic Performance.

C. The commissioning activities have been developed to support the United States Green Building Council's (USGBC) LEED ™ rating program and to support delivery of project performance in accordance with the VA requirements developed for the project to support the following credits:
   1. Commissioning activities and documentation for the LEED™ section on "Energy and Atmosphere" and the prerequisite of "Fundamental Building Systems Commissioning."
   2. Commissioning activities and documentation for the LEED™ section on "Energy and Atmosphere" requirements for the "Enhanced Building System Commissioning" credit.
   3. Activities and documentation for the LEED™ section on "Measurement and Verification" requirements for the Measurement and Verification credit.

D. The commissioning activities have been developed to support the Green Buildings Initiative's Green Globes rating program and to support delivery of project performance in accordance with the VA requirements developed for the project.

1.5 ACRONYMS

List of Acronyms	
Acronym	Meaning
A/E	Architect / Engineer Design Team
AHJ	Authority Having Jurisdiction
ASHRAE	Association Society for Heating Air Condition and Refrigeration Engineers
BOD	Basis of Design
BSC	Building Systems Commissioning
CCTV	Closed Circuit Television
CD	Construction Documents
CMMS	Computerized Maintenance Management System
CO	Contracting Officer (VA)
COR	Contracting Officer's Representative (see also VA-RE)
COBie	Construction Operations Building Information Exchange
CPC	Construction Phase Commissioning
Cx	Commissioning
CxA	Commissioning Agent
CxM	Commissioning Manager
CxR	Commissioning Representative
DPC	Design Phase Commissioning
FPT	Functional Performance Test
GBI-GG	Green Building Initiative - Green Globes
HVAC	Heating, Ventilation, and Air Conditioning

List of Acronyms	
Acronym	Meaning
LEED	Leadership in Energy and Environmental Design
NC	Department of Veterans Affairs National Cemetery
NCA	Department of Veterans Affairs National Cemetery Administration
NEBB	National Environmental Balancing Bureau
O&M	Operations & Maintenance
OPR	Owner's Project Requirements
PFC	Pre-Functional Checklist
PFT	Pre-Functional Test
SD	Schematic Design
SO	Site Observation
TAB	Test Adjust and Balance
VA	Department of Veterans Affairs
VAMC	VA Medical Center
VA CFM	VA Office of Construction and Facilities Management
VACO	VA Central Office
VA PM	VA Project Manager
VA-RE	VA Resident Engineer or VA Contracting Officers Representative
USGBC	United States Green Building Council

1.6 DEFINITIONS

A. **Acceptance Phase Commissioning:** Commissioning tasks executed after most construction has been completed, most Site Observations and Static Tests have been completed and Pre-Functional Testing has been completed and accepted. The main commissioning activities performed during this phase are verification that the installed systems are functional by conducting Systems Functional Performance tests and Owner Training.

B. **Accuracy:** The capability of an instrument to indicate the true value of a measured quantity.

C. **Back Check:** A back check is a verification that an agreed upon solution to a design comment has been adequately addressed in a subsequent design review

D. **Basis of Design (BOD):** The Engineer's Basis of Design is comprised of two components: the Design Criteria and the Design Narrative, these documents record the concepts, calculations, decisions, and product selections used to meet the Owner's Project Requirements (OPR) and to satisfy applicable regulatory requirements, standards, and guidelines.

E. **Benchmarks:** Benchmarks are the comparison of a building's energy usage to other similar buildings and to the building itself.. For example, ENERGY STAR Portfolio Manager is a frequently used and nationally recognized building energy benchmarking tool.

F. **Building Information Modeling (BIM):** Building Information Modeling is a parametric database which allows a building to be designed and constructed virtually in 3D, and provides reports both in 2D views and as schedules. This electronic information can be extracted and

reused for pre-populating facility management CMMS systems. Building Systems Commissioning (BSC): NEBB acronym used to designate its commissioning program.

G. **Calibrate:** The act of comparing an instrument of unknown accuracy with a standard of known accuracy to detect, correlate, report, or eliminate by adjustment any variation in the accuracy of the tested instrument.

H. **CCTV:** Closed circuit Television. Normally used for security surveillance and alarm detections as part of a special electrical security system.

I. **COBie:** Construction Operations Building Information Exchange (COBie) is an electronic industry data format used to transfer information developed during design, construction, and commissioning into the Computer Maintenance Management Systems (CMMS) used to operate facilities. See the Whole Building Design Guide website for further information (http://www.wbdg.org/resources/cobie.php)

J. **Commissionability:** Defines a design component or construction process that has the necessary elements that will allow a system or component to be effectively measured, tested, operated and commissioned

K. **Commissioning Agent (CxA):** The qualified Commissioning Professional who administers the Cx process by managing the Cx team and overseeing the Commissioning Process. Where CxA is used in this specification it means the Commissioning Agent, members of his staff or appointed members of the commissioning team. Note that LEED uses the term Commissioning Authority in lieu of Commissioning Agent.

L. **Commissioning Checklists:** Lists of data or inspections to be verified to ensure proper system or component installation, operation, and function. Verification checklists are developed and used during all phases of the commissioning process to verify that the Owner's Project Requirements (OPR) is being achieved.

M. **Commissioning Design Review:** The commissioning design review is a collaborative review of the design professionals design documents for items pertaining to the following: owner's project requirements; basis of design; operability and maintainability (O&M) including documentation; functionality; training; energy efficiency, control systems' sequence of operations including building automation system features; commissioning specifications and the ability to functionally test the systems.

N. **Commissioning Issue:** A condition identified by the Commissioning Agent or other member of the Commissioning Team that adversely affects the commissionability, operability, maintainability, or functionality of a system, equipment, or component. A condition that is in conflict with the Contract Documents and/or performance requirements of the installed systems and components. (See also – Commissioning Observation).

O. **Commissioning Manager (CxM):** A qualified individual appointed by the Contractor to manage the commissioning process on behalf of the Contractor.

P. **Commissioning Observation:** An issue identified by the Commissioning Agent or other member of the Commissioning Team that does not conform to the project OPR, contract documents or standard industry best practices. (See also Commissioning Issue)

Q. **Commissioning Plan:** A document that outlines the commissioning process, commissioning scope and defines responsibilities, processes, schedules, and the documentation requirements of the Commissioning Process.

R. **Commissioning Process:** A quality focused process for enhancing the delivery of a project. The process focuses upon verifying and documenting that the facility and all of its systems, components, and assemblies are planned, designed, installed, tested, can be operated, and maintained to meet the Owner's Project Requirements.

S. **Commissioning Report:** The final commissioning document which presents the commissioning process results for the project. Cx reports include an executive summary, the

commissioning plan, issue log, correspondence, and all appropriate check sheets and test forms.

T. **Commissioning Representative (CxR): An individual appointed by a sub-contractor to manage the commissioning process on behalf of the sub-contractor.**

U. **Commissioning Specifications:** The contract documents that detail the objective, scope and implementation of the commissioning process as developed in the Commissioning Plan.

V. **Commissioning Team:** Individual team members whose coordinated actions are responsible for implementing the Commissioning Process.

W. **Construction Phase Commissioning:** All commissioning efforts executed during the construction process after the design phase and prior to the Acceptance Phase Commissioning.

X. **Contract Documents (CD):** Contract documents include design and construction contracts, price agreements and procedure agreements. Contract Documents also include all final and complete drawings, specifications and all applicable contract modifications or supplements.

Y. **Construction Phase Commissioning (CPC):** All commissioning efforts executed during the construction process after the design phase and prior to the Acceptance Phase Commissioning.

Z. **Coordination Drawings:** Drawings showing the work of all trades that are used to illustrate that equipment can be installed in the space allocated without compromising equipment function or access for maintenance and replacement. These drawings graphically illustrate and dimension manufacturers' recommended maintenance clearances. On mechanical projects, coordination drawings include structural steel, ductwork, major piping and electrical conduit and show the elevations and locations of the above components.

AA. **Data Logging:** The monitoring and recording of temperature, flow, current, status, pressure, etc. of equipment using stand-alone data recorders.

BB. **Deferred System Test:** Tests that cannot be completed at the end of the acceptance phase due to ambient conditions, schedule issues or other conditions preventing testing during the normal acceptance testing period.

CC. **Deficiency:** See "Commissioning Issue".

DD. **Design Criteria:** A listing of the VA Design Criteria outlining the project design requirements, including its source. These are used during the design process to show the design elements meet the OPR.

EE. **Design Intent:** The overall term that includes the OPR and the BOD. It is a detailed explanation of the ideas, concepts, and criteria that are defined by the owner to be important. The design intent documents are utilized to provide a written record of these ideas, concepts and criteria.

FF. **Design Narrative:** A written description of the proposed design solutions that satisfy the requirements of the OPR.

GG. **Design Phase Commissioning (DPC):** All commissioning tasks executed during the design phase of the project.

HH. **Environmental Systems:** Systems that use a combination of mechanical equipment, airflow, water flow and electrical energy to provide heating, ventilating, air conditioning, humidification, and dehumidification for the purpose of human comfort or process control of temperature and humidity.

II. **Executive Summary:** A section of the Commissioning report that reviews the general outcome of the project. It also includes any unresolved issues, recommendations for the resolution of unresolved issues and all deferred testing requirements.

JJ. **Functionality:** This defines a design component or construction process which will allow a system or component to operate or be constructed in a manner that will produce the required outcome of the OPR.

KK. **Functional Test Procedure (FTP):** A written protocol that defines methods, steps, personnel, and acceptance criteria for tests conducted on components, equipment, assemblies, systems, and interfaces among systems.

LL. **Industry Accepted Best Practice:** A design component or construction process that has achieved industry consensus for quality performance and functionality. Refer to the current edition of the NEBB Design Phase Commissioning Handbook for examples.

MM. **Installation Verification:** Observations or inspections that confirm the system or component has been installed in accordance with the contract documents and to industry accepted best practices.

NN. **Integrated System Testing:** Integrated Systems Testing procedures entail testing of multiple integrated systems performance to verify proper functional interface between systems. Typical Integrated Systems Testing includes verifying that building systems respond properly to loss of utility, transfer to emergency power sources, re-transfer from emergency power source to normal utility source; interface between HVAC controls and Fire Alarm systems for equipment shutdown, interface between Fire Alarm system and elevator control systems for elevator recall and shutdown; interface between Fire Alarm System and Security Access Control Systems to control access to spaces during fire alarm conditions; and other similar tests as determined for each specific project.
Issues Log: A formal and ongoing record of problems or concerns – and their resolution – that have been raised by members of the Commissioning Team during the course of the Commissioning Process.

OO. **Lessons Learned Workshop:** A workshop conducted to discuss and document project successes and identify opportunities for improvements for future projects.

PP. **Maintainability:** A design component or construction process that will allow a system or component to be effectively maintained. This includes adequate room for access to adjust and repair the equipment. Maintainability also includes components that have readily obtainable repair parts or service.

QQ. **Manual Test:** Testing using hand-held instruments, immediate control system readouts or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the 'observation').

RR. **Owner's Project Requirements (OPR):** A written document that details the project requirements and the expectations of how the building and its systems will be used and operated. These include project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.

SS. **Peer Review:** A formal in-depth review separate from the commissioning review processes. The level of effort and intensity is much greater than a typical commissioning facilitation or extended commissioning review. The VA usually hires an independent third-party (called the IDIQ A/E) to conduct peer reviews.

TT. **Precision:** The ability of an instrument to produce repeatable readings of the same quantity under the same conditions. The precision of an instrument refers to its ability to produce a tightly grouped set of values around the mean value of the measured quantity.

UU. **Pre-Design Phase Commissioning:** Commissioning tasks performed prior to the commencement of design activities that includes project programming and the development of the commissioning process for the project

VV. **Pre-Functional Checklist (PFC):** A form used by the contractor to verify that appropriate components are onsite, correctly installed, set up, calibrated, functional and ready for functional testing.

WW. **Pre-Functional Test (PFT):** An inspection or test that is done before functional testing. PFT's include installation verification and system and component start up tests.

XX. **Procedure or Protocol:** A defined approach that outlines the execution of a sequence of work or operations. Procedures are used to produce repeatable and defined results.

YY. **Range:** The upper and lower limits of an instrument's ability to measure the value of a quantity for which the instrument is calibrated.

ZZ. **Resolution:** This word has two meanings in the Cx Process. The first refers to the smallest change in a measured variable that an instrument can detect. The second refers to the implementation of actions that correct a tested or observed deficiency.

AAA. **Site Observation Visit:** On-site inspections and observations made by the Commissioning Agent for the purpose of verifying component, equipment, and system installation, to observe contractor testing, equipment start-up procedures, or other purposes.

BBB. **Site Observation Reports (SO):** Reports of site inspections and observations made by the Commissioning Agent. Observation reports are intended to provide early indication of an installation issue which will need correction or analysis.

CCC. **Special System Inspections:** Inspections required by a local code authority prior to occupancy and are not normally a part of the commissioning process.

DDD. **Static Tests:** Tests or inspections that validate a specified static condition such as pressure testing. Static tests may be specification or code initiated.

EEE. **Start Up Tests:** Tests that validate the component or system is ready for automatic operation in accordance with the manufactures requirements.

FFF. **Systems Manual:** A system-focused composite document that includes all information required for the owners operators to operate the systems.

GGG. **Test Procedure:** A written protocol that defines methods, personnel, and expectations for tests conducted on components, equipment, assemblies, systems, and interfaces among systems.

HHH. **Testing:** The use of specialized and calibrated instruments to measure parameters such as: temperature, pressure, vapor flow, air flow, fluid flow, rotational speed, electrical characteristics, velocity, and other data in order to determine performance, operation, or function.

III. **Testing, Adjusting, and Balancing (TAB):** A systematic process or service applied to heating, ventilating and air-conditioning (HVAC) systems and other environmental systems to achieve and document air and hydronic flow rates. The standards and procedures for providing these services are referred to as "Testing, Adjusting, and Balancing" and are described in the Procedural Standards for the Testing, Adjusting and Balancing of Environmental Systems, published by NEBB or AABC.

JJJ. **Thermal Scans:** Thermographic pictures taken with an Infrared Thermographic Camera. Thermographic pictures show the relative temperatures of objects and surfaces and are used to identify leaks, thermal bridging, thermal intrusion, electrical overload conditions, moisture containment, and insulation failure.

KKK. **Training Plan:** A written document that details, in outline form the expectations of the operator training. Training agendas should include instruction on how to obtain service, operate, startup, shutdown and maintain all systems and components of the project.

LLL. **Trending:** Monitoring over a period of time with the building automation system.

MMM. **Unresolved Commissioning Issue:** Any Commissioning Issue that, at the time that the Final Report or the Amended Final Report is issued that has not been either resolved by the construction team or accepted by the VA. Validation: The process by which work is verified as complete and operating correctly:

1. First party validation occurs when a firm or individual verifying the task is the same firm or individual performing the task.
2. Second party validation occurs when the firm or individual verifying the task is under the control of the firm performing the task or has other possibilities of financial conflicts of

interest in the resolution (Architects, Designers, General Contractors and Third Tier Subcontractors or Vendors).

3. Third party validation occurs when the firm verifying the task is not associated with or under control of the firm performing or designing the task.

NNN. **Verification:** The process by which specific documents, components, equipment, assemblies, systems, and interfaces among systems are confirmed to comply with the criteria described in the Owner's Project Requirements.

OOO. **Warranty Phase Commissioning:** Commissioning efforts executed after a project has been completed and accepted by the Owner. Warranty Phase Commissioning includes follow-up on verification of system performance, measurement and verification tasks and assistance in identifying warranty issues and enforcing warranty provisions of the construction contract.

PPP. **Warranty Visit:** A commissioning meeting and site review where all outstanding warranty issues and deferred testing is reviewed and discussed.

QQQ. **Whole Building Commissioning:** Commissioning of building systems such as Building Envelope, HVAC, Electrical, Special Electrical (Fire Alarm, Security & Communications), Plumbing and Fire Protection as described in this specification.

1.7 SYSTEMS TO BE COMMISSIONED

A. Commissioning of a system or systems specified for this project is part of the construction process. Documentation and testing of these systems, as well as training of the VA's Operation and Maintenance personnel, is required in cooperation with the VA and the Commissioning Agent.

B. The following systems will be commissioned as part of this project:

Systems To Be Commissioned	
System	**Description**
Building Exterior Closure	
Foundations (excluding structural)	Standard, special, slab-on-grade, vapor barriers, air barriers
Basements	Basement walls, crawl spaces, waterproofing, drainage
Superstructure	Floor construction, roof construction, sunshades, connections to adjacent structures
Exterior Closure	Exterior walls, exterior windows, exterior doors, louvers, grilles and sunscreens,
Roofing	Roof system (including parapet), roof openings (skylights, pipe chases, ducts, equipment curbs, etc.)
Note:	The emphasis on commissioning the above building envelope systems is on control of air flow, heat flow, noise, infrared, ultraviolet, rain penetration, moisture, durability, security, reliability, constructability, maintainability, and sustainability.
Specialties	

Systems To Be Commissioned	
System	**Description**
Equipment	
Conveying Equipment	
Fire Suppression	
Fire Pump	Fire Pump, jockey pump, fire pump controller/ATS
Fire Sprinkler Systems	Wet pipe system, dry pipe system, pre-action system, special agent systems
Plumbing	
Domestic Water Distribution	Booster pumps, backflow preventers, water softeners, potable water storage tanks
Domestic Hot Water Systems	Water heaters**, heat exchangers, circulation pumps, point-of-use water heaters*
Reverse-Osmosis Systems	Packaged Reverse-Osmosis systems
Water De-Alkalizing Systems	Package Water De-Alkalizing systems

Systems To Be Commissioned	
System	**Description**
HVAC	
Noise and Vibration Control	Noise and vibration levels for critical equipment such as Air Handlers, Chillers, Cooling Towers, Boilers, Generators, etc. will be commissioned as part of the system commissioning
Direct Digital Control System**	Operator Interface Computer, Operator Work Station (including graphics, point mapping, trends, alarms), Network Communications Modules and Wiring, Integration Panels. DDC Control panels will be commissioned with the systems controlled by the panel
Chilled Water System**	Chillers (centrifugal, rotary screw, air-cooled), pumps (primary, secondary, variable primary), VFDs associated with chilled water system components, DDC Control Panels (including integration with Building Control System)
Steam/Heating Hot Water System**	Boilers, boiler feed water system, economizers/heat recovery equipment, condensate recovery, water treatment, boiler fuel system, controls, interface with facility DDC system.
HVAC Air Handling Systems**	Air handling Units, packaged rooftop AHU, Outdoor Air conditioning units, humidifiers, DDC control panels
HVAC Ventilation/Exhaust Systems	General exhaust, toilet exhaust, laboratory exhaust, isolation exhaust, room pressurization control systems
HVAC Energy Recovery Systems**	Heat Wheels, Heat Recovery Loops, AHU Integrated Heat Recovery
HVAC Terminal Unit Systems**	VAV Terminal Units, CAV terminal units, fan coil units, fin-tube radiation, unit heaters
Decentralized Unitary HVAC Systems*	Split-system HVAC systems, controls, interface with facility DDC
Humidity Control Systems	Humidifiers, de-humidifiers, controls, interface with facility DDC
Hydronic Distribution Systems	Pumps, DDC control panels, heat exchangers,

Systems To Be Commissioned	
System	**Description**
Electrical	
Medium-Voltage Electrical Distribution Systems	Medium-Voltage Switchgear, Medium-Voltage Switches, Underground ductbank and distribution, Pad-Mount Transformers, Medium-Voltage Load Interrupter Switches,
Grounding & Bonding Systems	Witness 3rd party testing, review reports
Electric Power Monitoring Systems	Metering, sub-metering, power monitoring systems, PLC control systems
Electrical System Protective Device Study	Review reports, verify field settings consistent with Study
Secondary Unit Substations	Medium-voltage components, transformers, low-voltage distribution, verify breaker testing results (injection current, etc)
Low-Voltage Distribution System	Normal power distribution system, Life-safety power distribution system, critical power distribution system, equipment power distribution system, switchboards, distribution panels, panelboards, verify breaker testing results (injection current, etc)
Emergency Power Generation Systems	Generators, Generator paralleling switchgear, automatic transfer switches, PLC and other control systems
Lighting & Lighting Control** Systems	Emergency lighting, occupancy sensors, lighting control systems, architectural dimming systems, theatrical dimming systems, exterior lighting and controls
Cathodic Protection Systems	Review 3rd party testing results.
Lightning Protection System	Witness 3rd party testing, review reports
Communications	
Grounding & Bonding System	Witness 3rd party testing, review reports
Structured Cabling System	Witness 3rd party testing, review reports
Master Antenna Television System	Witness 3rd party testing, review reports

Systems To Be Commissioned	
System	**Description**
Public Address & Mass Notification Systems	Witness 3rd party testing, review reports
Intercom & Program Systems	Witness 3rd party testing, review reports
Nurse Call & Code Blue Systems	Witness 3rd party testing, review reports
Security Emergency Call Systems	Witness 3rd party testing, review reports
Duress Alarm Systems	Witness 3rd party testing, review reports
Electronic Safety and Security	
Grounding & Bonding	Witness 3rd party testing, review reports
Physical Access Control Systems	Witness 3rd party testing, review reports
Access Control Systems	Witness 3rd party testing, review reports
Security Access Detection Systems	Witness 3rd party testing, review reports
Video Surveillance System	Witness 3rd party testing, review reports
Electronic Personal Protection System	Witness 3rd party testing, review reports
Fire Detection and Alarm System	100% device acceptance testing, battery draw-down test, verify system monitoring, verify interface with other systems.
Renewable Energy Sources	
Site Utilities	
Water Utilities	City Water Service Entrance, Backflow Prevention, Pressure Control, Booster Pumps, Irrigation Systems
Sanitary Sewerage Utilities	City Sanitary Connection, Waste Treatment Systems
Storm Drainage Utilities	City Storm Water Connection, Site Storm Water Distribution
Energy Distribution Utilities	Connection to Third Party Energy (Steam, High Temp Hot Water, Chilled Water) Supply Systems, Metering, Pressure Control

Systems To Be Commissioned	
System	**Description**
Transportation	
Integrated Systems Tests	
Loss of Power Response	Loss of power to building, loss of power to campus, restoration of power to building, restoration of power to campus.
Fire Alarm Response	Integrated System Response to Fire Alarm Condition and Return to Normal
Table Notes	
** Denotes systems that LEED requires to be commissioned to comply with the LEED Fundamental Commissioning pre-requisite.	

a.

1.8 COMMISSIONING TEAM

A. The commissioning team shall consist of, but not be limited to, representatives of Contractor, including Project Superintendent and subcontractors, installers, schedulers, suppliers, and specialists deemed appropriate by the Department of Veterans Affairs (VA) and Commissioning Agent.

B. Members Appointed by Contractor:
   1. Contractor' Commissioning Manager: The designated person, company, or entity that plans, schedules and coordinates the commissioning activities for the construction team.
   2. Contractor's Commissioning Representative(s): Individual(s), each having authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated actions.

C. Members Appointed by VA:
   1. Commissioning Agent: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. The VA will engage the A&E to provide a CxA under a separate contract.
   2. User: Representatives of the facility user and operation and maintenance personnel.
   3. A/E: Representative of the Architect and engineering design professionals.

1.9 VA'S COMMISSIONING RESPONSIBILITIES

A. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities including, but not limited to, the following:
   1. Coordination meetings.
   2. Training in operation and maintenance of systems, subsystems, and equipment.
   3. Testing meetings.
   4. Witness and assist in Systems Functional Performance Testing.
   5. Demonstration of operation of systems, subsystems, and equipment.

B. Provide the Construction Documents, prepared by Architect and approved by VA, to the Commissioning Agent and for use in managing the commissioning process, developing the commissioning plan, systems manuals, and reviewing the operation and maintenance training plan.

1.10 CONTRACTOR'S COMMISSIONING RESPONSIBILITIES

A. Appoint an individual, company or firm to act as the Commissioning Agent.

B. The Contractor shall assign a Commissioning Manager to manage commissioning activities of the Contractor, and subcontractors.

C. The Contractor shall ensure that the commissioning responsibilities outlined in these specifications are included in all subcontracts and that subcontractors comply with the requirements of these specifications.

D. The Contractor shall ensure that each installing subcontractor shall assign representatives with expertise and authority to act on behalf of the subcontractor and schedule them to participate in and perform commissioning team activities including, but not limited to, the following:
   1. Participate in commissioning coordination meetings.
   2. Conduct operation and maintenance training sessions in accordance with approved training plans.
   3. Verify that Work is complete and systems are operational according to the Contract Documents, including calibration of instrumentation and controls.
   4. Evaluate commissioning issues and commissioning observations identified in the Commissioning Issues Log, field reports, test reports or other commissioning documents. In collaboration with entity responsible for system and equipment installation, recommend corrective action.
   5. Review and comment on commissioning documentation.
   6. Participate in meetings to coordinate Systems Functional Performance Testing.
   7. Provide schedule for operation and maintenance data submittals, equipment startup, and testing to Commissioning Agent for incorporation into the commissioning plan.
   8. Provide information to the Commissioning Agent for developing commissioning plan.
   9. Participate in training sessions for VA's operation and maintenance personnel.
   10. Provide technicians who are familiar with the construction and operation of installed systems and who shall develop specific test procedures to conduct Systems Functional Performance Testing of installed systems.

1.11 COMMISSIONING AGENT’S RESPONSIBILITIES

A. Organize and lead the commissioning team.

B. Prepare the commissioning plan. See Paragraph 1.11-A of this specification Section for further information.

C. Review and comment on selected submittals from the Contractor for general conformance with the Construction Documents. Review and comment on the ability to test and operate the system and/or equipment, including providing gages, controls and other components required to operate, maintain, and test the system. Review and comment on performance expectations of systems and equipment and interfaces between systems relating to the Construction Documents.

D. At the beginning of the construction phase, conduct an initial construction phase coordination meeting for the purpose of reviewing the commissioning activities and establishing tentative schedules for operation and maintenance submittals; operation and maintenance training sessions; TAB Work; Pre-Functional Checklists, Systems Functional Performance Testing; and project completion.

E. Convene commissioning team meetings for the purpose of coordination, communication, and conflict resolution; discuss status of the commissioning processes. Responsibilities include arranging for facilities, preparing agenda and attendance lists, and notifying participants. The Commissioning Agent shall prepare and distribute minutes to commissioning team members and attendees within five workdays of the commissioning meeting.

F. Observe construction and report progress, observations and issues. Observe systems and equipment installation for adequate accessibility for maintenance and component replacement or repair, and for general conformance with the Construction Documents.

G. Prepare Project specific Pre-Functional Checklists and Systems Functional Performance Test procedures.

H. Coordinate Systems Functional Performance Testing schedule with the Contractor.

I. Witness selected systems startups.

J. Verify selected Pre-Functional Checklists completed and submitted by the Contractor.

K. Witness and document Systems Functional Performance Testing.

L. Compile test data, inspection reports, and certificates and include them in the systems manual and commissioning report.

M. Review and comment on operation and maintenance (O&M) documentation and systems manual outline for compliance with the Contract Documents. Operation and maintenance documentation requirements are specified in Paragraph 1.25, Section 01 00 00 GENERAL REQUIREMENTS.

N. Review operation and maintenance training program developed by the Contractor. Verify training plans provide qualified instructors to conduct operation and maintenance training.

O. Prepare commissioning Field Observation Reports.

P. Prepare the Final Commissioning Report.

Q. Return to the site at 10 months into the 12 month warranty period and review with facility staff the current building operation and the condition of outstanding issues related to the original and seasonal Systems Functional Performance Testing. Also interview facility staff and identify problems or concerns they have operating the building as originally intended. Make suggestions for improvements and for recording these changes in the O&M manuals. Identify areas that may come under warranty or under the original construction contract. Assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.

R. Assemble the final commissioning documentation, including the Final Commissioning Report and Addendum to the Final Commissioning Report.

1.12 COMMISSIONING DOCUMENTATION

A. Commissioning Plan: A document, prepared by Commissioning Agent, that outlines the schedule, allocation of resources, and documentation requirements of the commissioning process, and shall include, but is not limited, to the following:

1. Plan for delivery and review of submittals, systems manuals, and other documents and reports. Identification of the relationship of these documents to other functions and a detailed description of submittals that are required to support the commissioning processes. Submittal dates shall include the latest date approved submittals must be received without adversely affecting commissioning plan.
2. Description of the organization, layout, and content of commissioning documentation (including systems manual) and a detailed description of documents to be provided along with identification of responsible parties.
3. Identification of systems and equipment to be commissioned.
4. Schedule of Commissioning Coordination meetings.
5. Identification of items that must be completed before the next operation can proceed.
6. Description of responsibilities of commissioning team members.
7. Description of observations to be made.
8. Description of requirements for operation and maintenance training.
9. Schedule for commissioning activities with dates coordinated with overall construction schedule.

10. Process and schedule for documenting changes on a continuous basis to appear in Project Record Documents.
11. Process and schedule for completing prestart and startup checklists for systems, subsystems, and equipment to be verified and tested.
12. Preliminary Systems Functional Performance Test procedures.

B. Systems Functional Performance Test Procedures: The Commissioning Agent will develop Systems Functional Performance Test Procedures for each system to be commissioned, including subsystems, or equipment and interfaces or interlocks with other systems. Systems Functional Performance Test Procedures will include a separate entry, with space for comments, for each item to be tested. Preliminary Systems Functional Performance Test Procedures will be provided to the VA, Architect/Engineer, and Contractor for review and comment. The Systems Performance Test Procedure will include test procedures for each mode of operation and provide space to indicate whether the mode under test responded as required. Each System Functional Performance Test procedure, regardless of system, subsystem, or equipment being tested, shall include, but not be limited to, the following:
1. Name and identification code of tested system.
2. Test number.
3. Time and date of test.
4. Indication of whether the record is for a first test or retest following correction of a problem or issue.
5. Dated signatures of the person performing test and of the witness, if applicable.
6. Individuals present for test.
7. Observations and Issues.
8. Issue number, if any, generated as the result of test.

C. Pre-Functional Checklists: The Commissioning Agent will prepare Pre-Functional Checklists. Pre-Functional Checklists shall be completed and signed by the Contractor, verifying that systems, subsystems, equipment, and associated controls are ready for testing. The Commissioning Agent will spot check Pre-Functional Checklists to verify accuracy and readiness for testing. Inaccurate or incomplete Pre-Functional Checklists shall be returned to the Contractor for correction and resubmission.

D. Test and Inspection Reports: The Commissioning Agent will record test data, observations, and measurements on Systems Functional Performance Test Procedure. The report will also include recommendation for system acceptance or non-acceptance. Photographs, forms, and other means appropriate for the application shall be included with data. Commissioning Agent Will compile test and inspection reports and test and inspection certificates and include them in systems manual and commissioning report.

E. Corrective Action Documents: The Commissioning Agent will document corrective action taken for systems and equipment that fail tests. The documentation will include any required modifications to systems and equipment and/or revisions to test procedures, if any. The Commissioning Agent will witness and document any retesting of systems and/or equipment requiring corrective action and document retest results.

F. Commissioning Issues Log: The Commissioning Agent will prepare and maintain Commissioning Issues Log that describes Commissioning Issues and Commissioning Observations that are identified during the Commissioning process. These observations and issues include, but are not limited to, those that are at variance with the Contract Documents. The Commissioning Issues Log will identify and track issues as they are encountered, the party responsible for resolution, progress toward resolution, and document how the issue was resolved. The Master Commissioning Issues Log will also track the status of unresolved issues.
1. Creating an Commissioning Issues Log Entry:
   a. Identify the issue with unique numeric or alphanumeric identifier by which the issue may be tracked.
   b. Assign a descriptive title for the issue.

c. Identify date and time of the issue.
d. Identify test number of test being performed at the time of the observation, if applicable, for cross reference.
e. Identify system, subsystem, and equipment to which the issue applies.
f. f. Identify location of system, subsystem, and equipment.
g. Include information that may be helpful in diagnosing or evaluating the issue.
h. Note recommended corrective action.
i. Identify commissioning team member responsible for corrective action.
j. Identify expected date of correction.
k. Identify person that identified the issue.

2. Documenting Issue Resolution:
   a. Log date correction is completed or the issue is resolved.
   b. Describe corrective action or resolution taken. Include description of diagnostic steps taken to determine root cause of the issue, if any.
   c. Identify changes to the Contract Documents that may require action.
   d. State that correction was completed and system, subsystem, and equipment are ready for retest, if applicable.
   e. Identify person(s) who corrected or resolved the issue.
   f. Identify person(s) verifying the issue resolution.

G. Final Commissioning Report: The Commissioning Agent will document results of the commissioning process, including unresolved issues, and performance of systems, subsystems, and equipment. The Commissioning Report will indicate whether systems, subsystems, and equipment have been properly installed and are performing according to the Contract Documents. This report will be used by the Department of Veterans Affairs when determining that systems will be accepted. This report will be used to evaluate systems, subsystems, and equipment and will serve as a future reference document during VA occupancy and operation. It shall describe components and performance that exceed requirements of the Contract Documents and those that do not meet requirements of the Contract Documents. The commissioning report will include, but is not limited to, the following:
1. Lists and explanations of substitutions; compromises; variances with the Contract Documents; record of conditions; and, if appropriate, recommendations for resolution. Design Narrative documentation maintained by the Commissioning Agent.
2. Commissioning plan.
3. Pre-Functional Checklists completed by the Contractor, with annotation of the Commissioning Agent review and spot check.
4. Systems Functional Performance Test Procedures, with annotation of test results and test completion.
5. Commissioning Issues Log.
6. Listing of deferred and off season test(s) not performed, including the schedule for their completion.

H. Addendum to Final Commissioning Report: The Commissioning Agent will prepare an Addendum to the Final Commissioning Report near the end of the Warranty Period. The Addendum will indicate whether systems, subsystems, and equipment are complete and continue to perform according to the Contract Documents. The Addendum to the Final Commissioning Report shall include, but is not limited to, the following:
1. Documentation of deferred and off season test(s) results.
2. Completed Systems Functional Performance Test Procedures for off season test(s).
3. Documentation that unresolved system performance issues have been resolved.
4. Updated Commissioning Issues Log, including status of unresolved issues.
5. Identification of potential Warranty Claims to be corrected by the Contractor.

I. Systems Manual: The Commissioning Agent will gather required information and compile the Systems Manual. The Systems Manual will include, but is not limited to, the following:
1. Design Narrative, including system narratives, schematics, single-line diagrams, flow diagrams, equipment schedules, and changes made throughout the Project.

2. Reference to Final Commissioning Plan.
3. Reference to Final Commissioning Report.
4. Approved Operation and Maintenance Data as submitted by the Contractor.

1.13 SUBMITTALS

A. Preliminary Commissioning Plan Submittal: The Commissioning Agent has prepared a Preliminary Commissioning Plan based on the final Construction Documents. The Preliminary Commissioning Plan is included as an Appendix to this specification section. The Preliminary Commissioning Plan is provided for information only. It contains preliminary information about the following commissioning activities:
   1. The Commissioning Team: A list of commissioning team members by organization.
   2. Systems to be commissioned. A detailed list of systems to be commissioned for the project. This list also provides preliminary information on systems/equipment submittals to be reviewed by the Commissioning Agent; preliminary information on Pre-Functional Checklists that are to be completed; preliminary information on Systems Performance Testing, including information on testing sample size (where authorized by the VA).
   3. Commissioning Team Roles and Responsibilities: Preliminary roles and responsibilities for each Commissioning Team member.
   4. Commissioning Documents: A preliminary list of commissioning-related documents, include identification of the parties responsible for preparation, review, approval, and action on each document.
   5. Commissioning Activities Schedule: Identification of Commissioning Activities, including Systems Functional Testing, the expected duration and predecessors for the activity.
   6. Pre-Functional Checklists: Preliminary Pre-Functional Checklists for equipment, components, subsystems, and systems to be commissioned. These Preliminary Pre-Functional Checklists provide guidance on the level of detailed information the Contractor shall include on the final submission.
   7. Systems Functional Performance Test Procedures: Preliminary step-by-step System Functional Performance Test Procedures to be used during Systems Functional Performance Testing. These Preliminary Systems Functional Performance procedures provide information on the level of testing rigor, and the level of Contractor support required during performance of system's testing.

B. Final Commissioning Plan Submittal: Based on the Final Construction Documents and the Contractor's project team, the Commissioning Agent will prepare the Final Commissioning Plan as described in this section. The Commissioning Agent will submit three hard copies and three sets of electronic files of Final Commissioning Plan. The Contractor shall review the Commissioning Plan and provide any comments to the VA. The Commissioning Agent will incorporate review comments into the Final Commissioning Plan as directed by the VA.

C. Systems Functional Performance Test Procedure: The Commissioning Agent will submit preliminary Systems Functional Performance Test Procedures to the Contractor, and the VA for review and comment. The Contractor shall return review comments to the VA and the Commissioning Agent. The VA will also return review comments to the Commissioning Agent. The Commissioning Agent will incorporate review comments into the Final Systems Functional Test Procedures to be used in Systems Functional Performance Testing.

D. Pre-Functional Checklists: The Commissioning Agent will submit Pre-Functional Checklists to be completed by the Contractor.

E. Test and Inspection Reports: The Commissioning Agent will submit test and inspection reports to the VA with copies to the Contractor and the Architect/Engineer.

F. Corrective Action Documents: The Commissioning Agent will submit corrective action documents to the VA COR with copies to the Contractor and Architect.

G. Preliminary Commissioning Report Submittal: The Commissioning Agent will submit three electronic copies of the preliminary commissioning report. One electronic copy, with review comments, will be returned to the Commissioning Agent for preparation of the final submittal.

H. Final Commissioning Report Submittal: The Commissioning Agent will submit four sets of electronically formatted information of the final commissioning report to the VA. The final submittal will incorporate comments as directed by the VA.

I. Data for Commissioning:
   1. The Commissioning Agent will request in writing from the Contractor specific information needed about each piece of commissioned equipment or system to fulfill requirements of the Commissioning Plan.
   2. The Commissioning Agent may request further documentation as is necessary for the commissioning process or to support other VA data collection requirements, including Construction Operations Building Information Exchange (COBIE), Building Information Modeling (BIM), etc.

1.14 COMMISSIONING PROCESS

A. The Commissioning Agent will be responsible for the overall management of the commissioning process as well as coordinating scheduling of commissioning tasks with the VA and the Contractor. As directed by the VA, the Contractor shall incorporate Commissioning tasks, including, but not limited to, Systems Functional Performance Testing (including predecessors) with the Master Construction Schedule.

B. Within 30 days of contract award, the Contractor shall designate a specific individual as the Commissioning Manager (CxM) to manage and lead the commissioning effort on behalf of the Contractor. The Commissioning Manager shall be the single point of contact and communications for all commissioning related services by the Contractor.

C. Within 30 days of contract award, the Contractor shall ensure that each subcontractor designates specific individuals as Commissioning Representatives (CXR) to be responsible for commissioning related tasks. The Contractor shall ensure the designated Commissioning Representatives participate in the commissioning process as team members providing commissioning testing services, equipment operation, adjustments, and corrections if necessary. The Contractor shall ensure that all Commissioning Representatives shall have sufficient authority to direct their respective staff to provide the services required, and to speak on behalf of their organizations in all commissioning related contractual matters.

1.15 QUALITY ASSURANCE

A. Instructor Qualifications: Factory authorized service representatives shall be experienced in training, operation, and maintenance procedures for installed systems, subsystems, and equipment.

B. Test Equipment Calibration: The Contractor shall comply with test equipment manufacturer's calibration procedures and intervals. Recalibrate test instruments immediately whenever instruments have been repaired following damage or dropping. Affix calibration tags to test instruments. Instruments shall have been calibrated within six months prior to use.

1.16 COORDINATION

A. Management: The Commissioning Agent will coordinate the commissioning activities with the VA and Contractor. The Commissioning Agent will submit commissioning documents and information to the VA. All commissioning team members shall work together to fulfill their contracted responsibilities and meet the objectives of the contract documents.

B. Scheduling: The Contractor shall work with the Commissioning Agent and the VA to incorporate the commissioning activities into the construction schedule. The Commissioning Agent will provide sufficient information (including, but not limited to, tasks, durations and predecessors) on commissioning activities to allow the Contractor and the VA to schedule commissioning activities. All parties shall address scheduling issues and make necessary notifications in a timely manner in order to expedite the project and the commissioning process. The Contractor shall update the Master Construction as directed by the VA.

C. Initial Schedule of Commissioning Events: The Commissioning Agent will provide the initial schedule of primary commissioning events in the Commissioning Plan and at the commissioning coordination meetings. The Commissioning Plan will provide a format for this schedule. As construction progresses, more detailed schedules will be developed by the Contractor with information from the Commissioning Agent.

D. Commissioning Coordinating Meetings: The Commissioning Agent will conduct periodic Commissioning Coordination Meetings of the commissioning team to review status of commissioning activities, to discuss scheduling conflicts, and to discuss upcoming commissioning process activities.

E. Pretesting Meetings: The Commissioning Agent will conduct pretest meetings of the commissioning team to review startup reports, Pre-Functional Checklist results, Systems Functional Performance Testing procedures, testing personnel and instrumentation requirements.

F. Systems Functional Performance Testing Coordination: The Contractor shall coordinate testing activities to accommodate required quality assurance and control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting. The Contractor shall coordinate the schedule times for tests, inspections, obtaining samples, and similar activities.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. The Contractor shall provide all standard and specialized testing equipment required to perform Systems Functional Performance Testing. Test equipment required for Systems Functional Performance Testing will be identified in the detailed System Functional Performance Test Procedure prepared by the Commissioning Agent.

B. Data logging equipment and software required to test equipment shall be provided by the Contractor.

C. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5 ^{o}C (1.0 ^{o}F) and a resolution of + or - 0.1 ^{o}C (0.2 ^{o}F). Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and following any repairs to the equipment. Calibration tags shall be affixed or certificates readily available.

PART 3 - EXECUTION

3.1 COMMISSIONING PROCESS ROLES AND RESPONSIBILITIES

A. The following table outlines the roles and responsibilities for the Commissioning Team members during the Construction Phase:

Construction Phase		CxA = Commissioning Agent RE = Resident Engineer/COR A/E = Design Arch/Engineer PC = Prime Contractor O&M = Gov't Facility O&M					L = Lead P = Participate A = Approve R = Review O = Optional
Commissioning Roles & Responsibilities							
Category	Task Description	CxA	RE	A/E	PC	O&M	Notes
Meetings	Construction Commissioning Kick Off meeting	L	A	P	P	O	
	Commissioning Meetings	L	A	P	P	O	
	Project Progress Meetings	P	A	P	L	O	
	Controls Meeting	L	A	P	P	O	
Coordination	Coordinate with [OGC's, AHJ, Vendors, etc.] to ensure that Cx interacts properly with other systems as needed to support the OPR and BOD.	L	A	P	P	N/A	
Cx Plan & Spec	Final Commissioning Plan	L	A	R	R	O	
Schedules	Duration Schedule for Commissioning Activities	L	A	R	R	N/A	
OPR and BOD	Maintain OPR on behalf of Owner	L	A	R	R	O	
	Maintain BOD/DID on behalf of Owner	L	A	R	R	O	

Construction Phase		CxA = Commissioning Agent					L = Lead
Commissioning Roles & Responsibilities		RE = Resident Engineer/COR					P = Participate
		A/E = Design Arch/Engineer					A = Approve
		PC = Prime Contractor					R = Review
		O&M = Gov't Facility O&M					O = Optional
Category	Task Description	CxA	RE	A/E	PC	O&M	Notes
Document Reviews	TAB Plan Review	L	A	R	R	O	
	Submittal and Shop Drawing Review	R	A	R	L	O	
	Review Contractor Equipment Startup Checklists	L	A	R	R	N/A	
	Review Change Orders, ASI, and RFI	L	A	R	R	N/A	
Site Observations	Witness Factory Testing	P	A	P	L	O	
	Construction Observation Site Visits	L	A	R	R	O	
Functional Test Protocols	Final Pre-Functional Checklists	L	A	R	R	O	
	Final Functional Performance Test Protocols	L	A	R	R	O	
Technical Activities	Issues Resolution Meetings	P	A	P	L	O	
Reports and Logs	Status Reports	L	A	R	R	O	
	Maintain Commissioning Issues Log	L	A	R	R	O	

B. B. The following table outlines the roles and responsibilities for the Commissioning Team members during the Acceptance Phase:

C.

Acceptance Phase Commissioning Roles & Responsibilities		CxA = Commissioning Agent RE = Resident Engineer/COR A/E = Design Arch/Engineer PC = Prime Contractor O&M = Gov't Facility O&M					L = Lead P = Participate A = Approve R = Review O = Optional
Category	Task Description	CxA	RE	A/E	PC	O&M	Notes
Meetings	Commissioning Meetings	L	A	P	P	O	
	Project Progress Meetings	P	A	P	L	O	
	Pre-Test Coordination Meeting	L	A	P	P	O	
	Lessons Learned and Commissioning Report Review Meeting	L	A	P	P	O	
Coordination	Coordinate with [OGC's, AHJ, Vendors, etc.] to ensure that Cx interacts properly with other systems as needed to support OPR and BOD	L	P	P	P	O	
Cx Plan & Spec	Maintain/Update Commissioning Plan	L	A	R	R	O	
Schedules	Prepare Functional Test Schedule	L	A	R	R	O	
OPR and BOD	Maintain OPR on behalf of Owner	L	A	R	R	O	
	Maintain BOD/DID on behalf of Owner	L	A	R	R	O	
Document Reviews	Review Completed Pre-Functional Checklists	L	A	R	R	O	
	Pre-Functional Checklist Verification	L	A	R	R	O	
	Review Operations & Maintenance Manuals	L	A	R	R	R	
	Training Plan Review	L	A	R	R	R	
	Warranty Review	L	A	R	R	O	
	Review TAB Report	L	A	R	R	O	

Acceptance Phase Commissioning Roles & Responsibilities		CxA = Commissioning Agent RE = Resident Engineer/COR A/E = Design Arch/Engineer PC = Prime Contractor O&M = Gov't Facility O&M					L = Lead P = Participate A = Approve R = Review O = Optional
Category	Task Description	CxA	RE	A/E	PC	O&M	Notes
Site Observations	Construction Observation Site Visits	L	A	R	R	O	
	Witness Selected Equipment Startup	L	A	R	R	O	
Functional Test Protocols	TAB Verification	L	A	R	R	O	
	Systems Functional Performance Testing	L	A	P	P	P	
	Retesting	L	A	P	P	P	
Technical Activities	Issues Resolution Meetings	P	A	P	L	O	
	Systems Training	L	S	R	P	P	
Reports and Logs	Status Reports	L	A	R	R	O	
	Maintain Commissioning Issues Log	L	A	R	R	O	
	Final Commissioning Report	L	A	R	R	R	
	Prepare Systems Manuals	L	A	R	R	R	

D. C. The following table outlines the roles and responsibilities for the Commissioning Team members during the Warranty Phase:

Warranty Phase Commissioning Roles & Responsibilities		CxA = Commissioning Agent RE = Resident Engineer/COR A/E = Design Arch/Engineer PC = Prime Contractor O&M = Gov't Facility O&M					L = Lead P = Participate A = Approve R = Review O = Optional
Category	Task Description	CxA	RE	A/E	PC	O&M	Notes
Meetings	Post-Occupancy User Review Meeting	L	A	O	P	P	

Warranty Phase		CxA = Commissioning Agent RE = Resident Engineer/COR A/E = Design Arch/Engineer PC = Prime Contractor O&M = Gov't Facility O&M					L = Lead P = Participate A = Approve R = Review O = Optional
Commissioning Roles & Responsibilities							
Category	Task Description	CxA	RE	A/E	PC	O&M	Notes
Site Observations	Periodic Site Visits	L	A	O	O	P	
Functional Test Protocols	Deferred and/or seasonal Testing	L	A	O	P	P	
Technical Activities	Issues Resolution Meetings	L	S	O	O	P	
	Post-Occupancy Warranty Checkup and review of Significant Outstanding Issues	L	A		R	P	
Reports and Logs	Final Commissioning Report Amendment	L	A		R	R	
	Status Reports	L	A		R	R	

3.2 STARTUP, INITIAL CHECKOUT, AND PRE-FUNCTIONAL CHECKLISTS

A. The following procedures shall apply to all equipment and systems to be commissioned, according to Part 1, Systems to Be Commissioned.

1. Pre-Functional Checklists are important to ensure that the equipment and systems are hooked up and operational. These ensure that Systems Functional Performance Testing may proceed without unnecessary delays. Each system to be commissioned shall have a full Pre-Functional Checklist completed by the Contractor prior to Systems Functional Performance Testing. No sampling strategies are used.
   a. The Pre-Functional Checklist will identify the trades responsible for completing the checklist. The Contractor shall ensure the appropriate trades complete the checklists.
   b. The Commissioning Agent will review completed Pre-Functional Checklists and field-verify the accuracy of the completed checklist using sampling techniques.
2. Startup and Initial Checkout Plan: The Contractor shall develop detailed startup plans for all equipment. The primary role of the Contractor in this process is to ensure that there is written documentation that each of the manufacturer recommended procedures have been completed. Parties responsible for startup shall be identified in the Startup Plan and in the checklist forms.
   a. The Contractor shall develop the full startup plan by combining (or adding to) the checklists with the manufacturer's detailed startup and checkout procedures from the O&M manual data and the field checkout sheets normally used by the Contractor. The plan shall include checklists and procedures with specific boxes or lines for recording and documenting the checking and inspections of each procedure and a summary statement with a signature block at the end of the plan.
   b. The full startup plan shall at a minimum consist of the following items:
      1) The Pre-Functional Checklists.
      2) The manufacturer's standard written startup procedures copied from the installation manuals with check boxes by each procedure and a signature block added by hand at the end.
      3) The manufacturer's normally used field checkout sheets.
   c. The Commissioning Agent will submit the full startup plan to the VA and Contractor for review. Final approval will be by the VA.
   d. The Contractor shall review and evaluate the procedures and the format for documenting them, noting any procedures that need to be revised or added.
3. Sensor and Actuator Calibration
   a. All field installed temperature, relative humidity, CO2 and pressure sensors and gages, and all actuators (dampers and valves) on all equipment shall be calibrated using the methods described in Division 21, Division 22, Division 23, Division 26, Division 27, and Division 28 specifications.
   b. All procedures used shall be fully documented on the Pre-Functional Checklists or other suitable forms, clearly referencing the procedures followed and written documentation of initial, intermediate and final results.
4. Execution of Equipment Startup

   a. Four weeks prior to equipment startup, the Contractor shall schedule startup and checkout with the VA and Commissioning Agent. The performance of the startup and checkout shall be directed and executed by the Contractor.
   b. The Commissioning Agent will observe the startup procedures for selected pieces of primary equipment.
   c. The Contractor shall execute startup and provide the VA and Commissioning Agent with a signed and dated copy of the completed startup checklists, and contractor tests.
   d. Only individuals that have direct knowledge and witnessed that a line item task on the Startup Checklist was actually performed shall initial or check that item off. It is not acceptable for witnessing supervisors to fill out these forms.

3.3 DEFICIENCIES, NONCONFORMANCE, AND APPROVAL IN CHECKLISTS AND STARTUP

A. The Contractor shall clearly list any outstanding items of the initial startup and Pre-Functional Checklist procedures that were not completed successfully, at the bottom of the procedures form or on an attached sheet. The procedures form and any outstanding deficiencies shall be provided to the VA and the Commissioning Agent within two days of completion.

B. The Commissioning Agent will review the report and submit comments to the VA. The Commissioning Agent will work with the Contractor to correct and verify deficiencies or uncompleted items. The Commissioning Agent will involve the VA and others as necessary. The Contractor shall correct all areas that are noncompliant or incomplete in the checklists in a timely manner, and shall notify the VA and Commissioning Agent as soon as outstanding items have been corrected. The Contractor shall submit an updated startup report and a Statement of Correction on the original noncompliance report. When satisfactorily completed, the Commissioning Agent will recommend approval of the checklists and startup of each system to the VA.

C. The Contractor shall be responsible for resolution of deficiencies as directed the VA.

3.4 PHASED COMMISSIONING

A. The project may require startup and initial checkout to be executed in phases. This phasing shall be planned and scheduled in a coordination meeting of the VA, Commissioning Agent, and the Contractor. Results will be added to the master construction schedule and the commissioning schedule.

3.5 DDC SYSTEM TRENDING FOR COMMISSIONING

A. Trending is a method of testing as a standalone method or to augment manual testing. The Contractor shall trend any and all points of the system or systems at intervals specified below.

B. Alarms are a means to notify the system operator that abnormal conditions are present in the system. Alarms shall be structured into three tiers – Critical, Priority, and Maintenance.
   1. Critical alarms are intended to be alarms that require the immediate attention of and action by the Operator. These alarms shall be displayed on the Operator Workstation in a popup style window that is graphically linked to the associated unit's graphical display. The popup style window shall be displayed on top of any active window within the screen, including non DDC system software.
   2. Priority level alarms are to be printed to a printer which is connected to the Operator's Work Station located within the engineer's office. Additionally Priority level alarms shall be able to be monitored and viewed through an active alarm application. Priority level alarms are alarms which shall require reaction from the operator or maintenance personnel within a normal work shift, and not immediate action.
   3. Maintenance alarms are intended to be minor issues which would require examination by maintenance personnel within the following shift. These alarms shall be generated in a scheduled report automatically by the DDC system at the start of each shift. The generated maintenance report will be printed to a printer located within the engineer's office.

C. The Contractor shall provide a wireless internet network in the building for use during controls programming, checkout, and commissioning. This network will allow project team members to more effectively program, view, manipulate and test control devices while being in the same room as the controlled device.

D. The Contractor shall provide graphical trending through the DDC control system of systems being commissioned. Trending requirements are indicated below and included with the Systems Functional Performance Test Procedures. Trending shall occur before, during and after Systems Functional Performance Testing. The Contractor shall be responsible for producing graphical representations of the trended DDC points that show each system operating properly during steady state conditions as well as during the System Functional Testing. These graphical

reports shall be submitted to the COR and Commissioning Agent for review and analysis before, during dynamic operation, and after Systems Functional Performance Testing. The Contractor shall provide, but not limited to, the following trend requirements and trend submissions:

1. Pre-testing, Testing, and Post-testing – Trend reports of trend logs and graphical trend plots are required as defined by the Commissioning Agent. The trend log points, sampling rate, graphical plot configuration, and duration will be dictated by the Commissioning Agent. At any time during the Commissioning Process the Commissioning Agent may recommend changes to aspects of trending as deemed necessary for proper system analysis. The Contractor shall implement any changes as directed by the COR. Any pre-test trend analysis comments generated by the Commissioning Team should be addressed and resolved by the Contractor, as directed by the COR, prior to the execution of Systems Functional Performance Testing.
2. Dynamic plotting – The Contractor shall also provide dynamic plotting during Systems Functional Performance testing at frequent intervals for points determined by the Systems Functional Performance Test Procedure. The graphical plots will be formatted and plotted at durations listed in the Systems Functional Performance Test Procedure.
3. Graphical plotting - The graphical plots shall be provided with a dual y-axis allowing 15 or more trend points (series) plotted simultaneously on the graph with each series in distinct color. The plots will further require title, axis naming, legend etc. all described by the Systems Functional Performance Test Procedure. If this cannot be sufficiently accomplished directly in the Direct Digital Control System then it is the responsibility of the Contractor to plot these trend logs in Microsoft Excel.
4. The following tables indicate the points to be trended and alarmed by system. The Operational Trend Duration column indicates the trend duration for normal operations. The Testing Trend Duration column indicates the trend duration prior to Systems Functional Performance Testing and again after Systems Functional Performance Testing. The Type column indicates point type: AI = Analog Input, AO = Analog Output, DI = Digital Input, DO = Digital Output, Calc = Calculated Point. In the Trend Interval Column, COV = Change of Value. The Alarm Type indicates the alarm priority; C = Critical, P = Priority, and M = Maintenance. The Alarm Range column indicates when the point is considered in the alarm state. The Alarm Delay column indicates the length of time the point must remain in an alarm state before the alarm is recorded in the DDC. The intent is to allow minor, short-duration events to be corrected by the DDC system prior to recording an alarm.

Dual-Path Air Handling Unit Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
OA Temperature	AI	15 Min	24 hours	3 days	N/A		
RA Temperature	AI	15 Min	24 hours	3 days	N/A		
RA Humidity	AI	15 Min	24 hours	3 days	P	>60% RH	10 min
Mixed Air Temp	AI	None	None	None	N/A		
SA Temp	AI	15 Min	24 hours	3 days	C	±5°F from SP	10 min
Supply Fan Speed	AI	15 Min	24 hours	3 days	N/A		
Return Fan Speed	AI	15 Min	24 hours	3 days	N/A		
RA Pre-Filter Status	AI	None	None	None	N/A		

Dual-Path Air Handling Unit Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
OA Pre-Filter Status	AI	None	None	None	N/A		
After Filter Status	AI	None	None	None	N/A		
SA Flow	AI	15 Min	24 hours	3 days	C	±10% from SP	10 min
OA Supply Temp	AI	15 Min	24 hours	3 days	P	±5°F from SP	10 min
RA Supply Temp	AI	15 Min	24 hours	3 days	N/A		
RA CHW Valve Position	AI	15 Min	24 hours	3 days	N/A		
OA CHW Valve Position	AI	15 Min	24 hours	3 days	N/A		
OA HW Valve Position	AI	15 Min	24 hours	3 days	N/A		
OA Flow	AI	15 Min	24 hours	3 days	P	±10% from SP	5 min
RA Flow	AI	15 Min	24 hours	3 days	P	±10% from SP	5 min
Initial UVC Intensity (%)	AI	None	None	None	N/A		
Duct Pressure	AI	15 Min	24 hours	3 days	C	±25% from SP	6 min
CO2 Level	AI	15 Min	24 hours	3 days	P	±10% from SP	10 min
Supply Fan Status	DI	COV	24 hours	3 days	C	Status <> Command	10 min
Return Fan Status	DI	COV	24 hours	3 days	C	Status <> Command	10 Min
High Static Status	DI	COV	24 hours	3 days	P	True	1 min
Fire Alarm Status	DI	COV	24 hours	3 days	C	True	5 min
Freeze Stat Level 1	DI	COV	24 hours	3 days	C	True	10 min
Freeze Stat Level 2	DI	COV	24 hours	3 days	C	True	5 min
Freeze Stat Level 3	DI	COV	24 hours	3 days	P	True	1 min
Fire/Smoke Damper Status	DI	COV	24 hours	3 days	P	Closed	1 min
Emergency AHU Shutdown	DI	COV	24 hours	3 days	P	True	1 min
Exhaust Fan #1 Status	DI	COV	24 hours	3 days	C	Status <> Command	10 min
Exhaust Fan #2 Status	DI	COV	24 hours	3 days	C	Status <> Command	10 min
Exhaust Fan #3 Status	DI	COV	24 hours	3 days	C	Status <> Command	10 min

Dual-Path Air Handling Unit Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
OA Alarm	DI	COV	24 hours	3 days	C	True	10 min
High Static Alarm	DI	COV	24 hours	3 days	C	True	10 min
UVC Emitter Alarm	DI	COV	24 hours	3 days	P	True	10 min
CO2 Alarm	DI	COV	24 hours	3 days	P	True	10 min
Power Failure	DI	COV	24 hours	3 days	P	True	1 min
Supply Fan Speed	AO	15 Min	24 hours	3 days	N/A		
Return Fan Speed	AO	15 Min	24 hours	3 days	N/A		
RA CHW Valve Position	AO	15 Min	24 hours	3 days	N/A		
OA CHW Valve Position	AO	15 Min	24 hours	3 days	N/A		
OA HW Valve Position	AO	15 Min	24 hours	3 days	N/A		
Supply Fan S/S	DO	COV	24 hours	3 days	N/A		
Return Fan S/S	DO	COV	24 hours	3 days	N/A		
Fire/Smoke Dampers	DO	COV	24 hours	3 days	N/A		
Exhaust Fan S/S	DO	COV	24 hours	3 days	N/A		
Exhaust Fan S/S	DO	COV	24 hours	3 days	N/A		
Exhaust Fan S/S	DO	COV	24 hours	3 days	N/A		
AHU Energy	Calc	1 Hour	30 day	N/A	N/A		
Terminal Unit (VAV, CAV, etc.) Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Space Temperature	AI	15 Min	12 hours	3 days	P	±5°F from SP	10 min
Air Flow	AI	15 Min	12 hours	3 days	P	±5°F from SP	10 min
SA Temperature	AI	15 Min	12 hours	3 days	P	±5°F from SP	10 min
Local Setpoint	AI	15 Min	12 hours	3 days	M	±10°F from SP	60 min
Space Humidity	AI	15 Min	12 hours	3 days	P	> 60% RH	5 min

Dual-Path Air Handling Unit Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Unoccupied Override	DI	COV	12 hours	3 days	M	N/A	12 Hours
Refrigerator Alarm	DI	COV	12 hours	3 days	C	N/A	10 min
Damper Position	AO	15 Minutes	12 hours	3 days	N/A		
Heating coil Valve Position	AO	15 Minutes	12 hours	3 days	N/A		
4-Pipe Fan Coil Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Space Temperature	AI	15 Minutes	12 hours	3 days	P	±5°F from SP	10 min
SA Temperature	AI	15 Minutes	12 hours	3 days	P	±5°F from SP	10 min
Pre-Filter Status	AI	None	None	None	M	> SP	1 hour
Water Sensor	DI	COV	12 hours	3 days	M	N/A	30 Min
Cooling Coil Valve Position	AO	15 Minutes	12 hours	3 days	N/A		
Heating coil Valve Position	AO	15 Minutes	12 hours	3 days	N/A		
Fan Coil ON/OFF	DO	COV	12 hours	3 days	M	Status <> Command	30 min
2-Pipe Fan Coil Unit Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Space Temperature	AI	15 Minutes	12 hours	3 days	P	±5°F from SP	10 min
SA Temperature	AI	15 Minutes	12 hours	3 days	P	±5°F from SP	10 min
Pre-Filter Status	AI	None	None	None	M	> SP	1 hour
Water Sensor	DI	COV	12 hours	3 days	M	N/A	30 Min
Cooling Coil Valve Position	AO	15 Minutes	12 hours	3 days	N/A		
Fan Coil ON/OFF	DO	COV	12 hours	3 days	M	Status <> Command	30 min

Unit Heater Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Space Temperature	AI	15 Minutes	12 hours	3 days	P	±5°F from SP	10 min
Heating Valve Position	AO	15 Minutes	12 hours	3 days	N/A		
Unit Heater ON/OFF	DO	COV	12 hours	3 days	M	Status <> Command	30 min
Steam and Condensate Pumps Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Steam Flow (LB/HR)	AI	15 Minutes	12 hours	3 days	N/A		
Condensate Pump Run Hours	AI	15 Minutes	12 hours	3 days	N/A		
Water Meter (GPM)	AI	15 Minutes	12 hours	3 days	N/A		
Electric Meter (KW/H)	AI	15 Minutes	12 hours	3 days	N/A		
Irrigation Meter (GPM)	AI	15 Minutes	12 hours	3 days	N/A		
Chilled Water Flow (TONS)	AI	15 Minutes	12 hours	3 days	N/A		
Condensate Flow (GPM)	AI	15 Minutes	12 hours	3 days	N/A		
High Water Level Alarm	DI	COV	12 hours	3 days	C	True	5 Min
Condensate Pump Start/Stop	DO	COV	12 hours	3 days	P	Status <> Command	10 min
Domestic Hot Water Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Domestic HW Setpoint WH-1	AI	15 Minute	12 Hours	3 days	N/A		
Domestic HW Setpoint WH-2	AI	15 Minute	12 Hours	3 days	N/A		
Domestic HW Temperature	AI	15 Minute	12 Hours	3 days	C	> 135 oF	10 Min
Domestic HW Temperature	AI	15 Minute	12 Hours	3 days	P	±5°F from SP	10 Min

Dual-Path Air Handling Unit Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Dom. Circ. Pump #1 Status	DI	COV	12 Hours	3 days	M	Status <> Command	30 min
Dom. Circ. Pump #2 Status	DI	COV	12 Hours	3 days	M	Status <> Command	30 min
Dom. Circ. Pump #1 Start/Stop	DO	COV	12 Hours	3 days	N/A		
Dom. Circ. Pump #2 Start/Stop	DO	COV	12 Hours	3 days	N/A		
Domestic HW Start/Stop	DO	COV	12 Hours	3 days	N/A		
Hydronic Hot Water Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
System HWS Temperature	AI	15 min	12 hours	3 days	C	±5°F from SP	10 Min
System HWR Temperature	AI	15 min	12 hours	3 days	M	±15°F from SP	300 Min
HX-1 Entering Temperature	AI	15 min	12 hours	3 days	P	±5°F from SP	10 Min
HX-2 Entering Temperature	AI	15 min	12 hours	3 days	P	±5°F from SP	10 Min
HX-2 Leaving Temperature	AI	15 min	12 hours	3 days	P	±5°F from SP	10 Min
System Flow (GPM)	AI	15 min	12 hours	3 days	N/A		
System Differential Pressure	AI	15 min	12 hours	3 days	P	±10% from SP	8 Min
				3 days			
HW Pump 1 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
HW Pump 2 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
HW Pump 1 VFD Speed	AO	15 Min	12 Hours	3 days	N/A		
HW Pump 2 VFD Speed	AO	15 Min	12 Hours	3 days	N/A		
Steam Station #1 1/3 Control Valve Position	AO	15 Min	12 Hours	3 days	N/A		

Dual-Path Air Handling Unit Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Steam Station #1 2/3 Control Valve Position	AO	15 Min	12 Hours	3 days	N/A		
Steam Station #2 1/3 Control Valve Position	AO	15 Min	12 Hours	3 days	N/A		
Steam Station #2 2/3 Control Valve Position	AO	15 Min	12 Hours	3 days	N/A		
Steam Station Bypass Valve Position	AO	15 Min	12 Hours	3 days	N/A		
HW Pump 1 Start/Stop	DO	COV	12 Hours	3 days	N/A		
HW Pump 2 Start/Stop	DO	COV	12 Hours	3 days	N/A		
HWR #1 Valve	DO	COV	12 Hours	3 days	N/A		
HWR #2 Valve	DO	COV	12 Hours	3 days	N/A		

Chilled Water System Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Chiller 1 Entering Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 1 Leaving Temperature	AI	15 Minutes	12 Hours	3 days	P	±5°F from SP	10 Min
Chiller 1 Flow	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 1 Percent Load	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 1 KW Consumption	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 1 Tonnage	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 2 Entering Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 2 Leaving Temperature	AI	15 Minutes	12 Hours	3 days	P	±5°F from SP	10 Min
Chiller 2 Flow	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 2 Percent Load	AI	15 Minutes	12 Hours	3 days	N/A		
Chiller 2 KW Consumption	AI	15 Minutes	12 Hours	3 days	N/A		

Chilled Water System Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Chiller 2 Tonnage	AI	15 Minutes	12 Hours	3 days	N/A		
Primary Loop Decoupler Flow	AI	15 Minutes	12 Hours	3 days	N/A		
Primary Loop Flow	AI	15 Minutes	12 Hours	3 days	N/A		
Primary Loop Supply Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Secondary Loop Differential Pressure	AI	15 Minutes	12 Hours	3 days	P	±5% from SP	10 Min
Secondary Loop Flow	AI	15 Minutes	12 Hours	3 days	N/A		
Secondary Loop Supply Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Secondary Loop Return Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Secondary Loop Tonnage	AI	15 Minutes	12 Hours	3 days	N/A		
Primary Loop Pump 1 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Primary Loop Pump 2 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Secondary Loop Pump 1 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Secondary Loop Pump 2 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Chiller 1 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Chiller 1 Evaporator Iso-Valve	DI	COV	12 Hours	3 days	N/A		
Chiller 1 Evaporator Flow Switch	DI	COV	12 Hours	3 days	N/A		
Chiller 1 Unit Alarm	DI	COV	12 Hours	3 days	C	True	10 Min
Chiller 2 Status	DI	COV	12 Hours	3 days	C	Status <> Command	30 min
Chiller 2 Evaporator Iso-Valve	DI	COV	12 Hours	3 days	N/A		
Chiller 2 Evaporator Flow Switch	DI	COV	12 Hours	3 days	N/A		

Chilled Water System Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Chiller 2 Unit Alarm	DI	COV	12 Hours	3 days	C	True	10 Min
Refrigerant Detector	DI	COV	12 Hours	3 days	C	True	10 Min
Refrigerant Exhaust Fan Status	DI	COV	12 Hours	3 days	M	Status <> Command	30 min
Emergency Shutdown	DI	COV	12 Hours	3 days	P	True	1 Min
Primary Loop Pump 1 VFD Speed	AO	15 Minutes	12 Hours	3 days	N/A		
Primary Loop Pump 2 VFD Speed	AO	15 Minutes	12 Hours	3 days	N/A		
Secondary Loop Pump 1 VFD Speed	AO	15 Minutes	12 Hours	3 days	N/A		
Secondary Loop Pump 2 VFD Speed	AO	15 Minutes	12 Hours	3 days	N/A		
Primary Pump 1 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Primary Pump 2 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Secondary Pump 1 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Secondary Pump 2 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Chiller 1 Enable	DO	COV	12 Hours	3 days	N/A		
Chiller 1 Iso-Valve Command	DO	COV	12 Hours	3 days	N/A		
Chiller 2 Enable	DO	COV	12 Hours	3 days	N/A		
Chiller 2 Iso-Valve Command	DO	COV	12 Hours	3 days	N/A		
Refrigerant Exhaust Fan Start / Stop	DO	COV	12 Hours	3 days	N/A		

Hot Water Boiler System Trending and Alarms

Point	Type	Trend Interval	Operational Trend Duration	Testing Trend Duration	Alarm Type	Alarm Range	Alarm Delay
Outside Air Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 1 Fire Signal	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 1 Entering Water Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 1 Leaving Water Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 2 Fire Signal	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 2 Entering Water Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 2 Leaving Water Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Hot Water Supply Temperature	AI	15 Minutes	12 Hours	3 days	P	±5 oF from SP	10 Min
Hot Water Return Temperature	AI	15 Minutes	12 Hours	3 days	N/A		
Secondary Loop Differential Pressure	AI	15 Minutes	12 Hours	3 days	C	±5% from SP	10 Min
Lead Boiler	AI	15 Minutes	12 Hours	3 days	N/A		
Boiler 1 Enable	DI	COV	12 Hours	3 days	N/A		
Boiler 1 Status	DI	COV	12 Hours	3 days	P	Status <> Command	10 min
Boiler 1 Isolation Valve	DI	COV	12 Hours	3 days	N/A		
Boiler 1 on Fuel Oil	DI	COV	12 Hours	3 days	N/A		
Boiler 1 Alarm	DI	COV	12 Hours	3 days	C	True	1 Min
Boiler 2 Enable	DI	COV	12 Hours	3 days	N/A		
Boiler 2 Status	DI	COV	12 Hours	3 days	P	Status <> Command	10 min
Boiler 2 Isolation Valve	DI	COV	12 Hours	3 days	N/A		
Boiler 2 on Fuel Oil	DI	COV	12 Hours	3 days	N/A		
Boiler 2 Alarm	DI	COV	12 Hours	3 days	C	True	1 Min
Combustion Dampers Open	DI	COV	12 Hours	3 days	P	Status <> Command	10 min
Primary Pump 1 Status	DI	COV	12 Hours	3 days	P	Status <> Command	10 min
Primary Pump 2 Status	DI	COV	12 Hours	3 days	P	Status <> Command	10 min

Hot Water Boiler System Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
Secondary Pump 1 Status	DI	COV	12 Hours	3 days	P	Status <> Command	10 min
Secondary Pump 2 Status	DI	COV	12 Hours	3 days	P	Status <> Command	10 min
Primary Pump 1 VFD Speed	AO	COV	12 Hours	3 days	N/A		
Primary Pump 2 VFD Speed	AO	COV	12 Hours	3 days	N/A		
Secondary Pump 1 VFD Speed	AO	COV	12 Hours	3 days	N/A		
Secondary Pump 2 VFD Speed	AO	COV	12 Hours	3 days	N/A		
Hot Water System Enable	DO	COV	12 Hours	3 days	N/A		
Combustion Dampers Command	DO	COV	12 Hours	3 days	N/A		
Primary Pump 1 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Primary Pump 2 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Secondary Pump 1 Start / Stop	DO	COV	12 Hours	3 days	N/A		
Secondary Pump 2 Start / Stop	DO	COV	12 Hours	3 days	N/A		

E. The Contractor shall provide the following information prior to Systems Functional Performance Testing. Any documentation that is modified after submission shall be recorded and resubmitted to the COR and Commissioning Agent.
   1. Point-to-Point checkout documentation;
   2. Sensor field calibration documentation including system name, sensor/point name, measured value, DDC value, and Correction Factor.
   3. A sensor calibration table listing the referencing the location of procedures to following in the O&M manuals, and the frequency at which calibration should be performed for all sensors, separated by system, subsystem, and type. The calibration requirements shall be submitted both in the O&M manuals and separately in a standalone document containing all sensors for inclusion in the commissioning documentation. The following table is a sample that can be used as a template for submission.

SYSTEM		
Sensor	**Calibration Frequency**	**O&M Calibration Procedure Reference**
Discharge air temperature	Once a year	Volume I Section D.3.aa
Discharge static pressure	Every 6 months	Volume II Section A.1.c

3.6 LOOP TUNING DOCUMENTATION AND CONSTANTS FOR EACH LOOP OF THE BUILDING SYSTEMS. THE DOCUMENTATION SHALL BE SUBMITTED IN OUTLINE OR TABLE SEPARATED BY SYSTEM, CONTROL TYPE (E.G. HEATING VALVE TEMPERATURE CONTROL); PROPORTIONAL, INTEGRAL AND DERIVATIVE CONSTANTS, INTERVAL (AND BIAS IF USED) FOR EACH LOOP. SYSTEMS FUNCTIONAL PERFORMANCE TESTING

A. This paragraph applies to Systems Functional Performance Testing of systems for all referenced specification Divisions.

B. Objectives and Scope: The objective of Systems Functional Performance Testing is to demonstrate that each system is operating according to the Contract Documents. Systems Functional Performance Testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of noncompliant performance are identified and corrected, thereby improving the operation and functioning of the systems. In general, each system shall be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load, fire alarm and emergency power) where there is a specified system response. The Contractor shall verify each sequence in the sequences of operation. Proper responses to such modes and conditions as power failure, freeze condition, low oil pressure, no flow, equipment failure, etc. shall also be tested.

C. Development of Systems Functional Performance Test Procedures: Before Systems Functional Performance Test procedures are written, the Contractor shall submit all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters. Using the testing parameters and requirements found in the Contract Documents and approved submittals and shop drawings, the Commissioning Agent will develop specific Systems Functional Test Procedures to verify and document proper operation of each piece of equipment and system to be commissioned. The Contractor shall assist the Commissioning Agent in developing the Systems Functional Performance Test procedures as requested by the Commissioning Agent i.e. by answering questions about equipment, operation, sequences, etc. Prior to execution, the Commissioning Agent will provide a copy of the Systems Functional Performance Test procedures to the VA, the Architect/Engineer, and the Contractor, who shall review the tests for feasibility, safety, equipment and warranty protection.

D. Purpose of Test Procedures: The purpose of each specific Systems Functional Performance Test is to verify and document compliance with the stated criteria of acceptance given on the test form. Representative test formats and examples are found in the Commissioning Plan for this project. (The Commissioning Plan is issued as a separate document and is available for review.) The test procedure forms developed by the Commissioning Agent will include, but not be limited to, the following information:
   1. System and equipment or component name(s)
   2. Equipment location and ID number
   3. Unique test ID number, and reference to unique Pre-Functional Checklists and startup documentation, and ID numbers for the piece of equipment
   4. Date
   5. Project name
   6. Participating parties
   7. A copy of the specification section describing the test requirements
   8. A copy of the specific sequence of operations or other specified parameters being verified
   9. Formulas used in any calculations
   10. Required pretest field measurements
   11. Instructions for setting up the test.
   12. Special cautions, alarm limits, etc.

13. Specific step-by-step procedures to execute the test, in a clear, sequential and repeatable format
14. Acceptance criteria of proper performance with a Yes / No check box to allow for clearly marking whether or not proper performance of each part of the test was achieved.
15. A section for comments.
16. Signatures and date block for the Commissioning Agent. A place for the Contractor to initial to signify attendance at the test.

E. Test Methods: Systems Functional Performance Testing shall be achieved by manual testing (i.e. persons manipulate the equipment and observe performance) and/or by monitoring the performance and analyzing the results using the control system's trend log capabilities or by standalone data loggers. The Contractor and Commissioning Agent shall determine which method is most appropriate for tests that do not have a method specified.
1. Simulated Conditions: Simulating conditions (not by an overwritten value) shall be allowed, although timing the testing to experience actual conditions is encouraged wherever practical.
2. Overwritten Values: Overwriting sensor values to simulate a condition, such as overwriting the outside air temperature reading in a control system to be something other than it really is, shall be allowed, but shall be used with caution and avoided when possible. Such testing methods often can only test a part of a system, as the interactions and responses of other systems will be erroneous or not applicable. Simulating a condition is preferable. e.g., for the above case, by heating the outside air sensor with a hair blower rather than overwriting the value or by altering the appropriate setpoint to see the desired response. Before simulating conditions or overwriting values, sensors, transducers and devices shall have been calibrated.
3. Simulated Signals: Using a signal generator which creates a simulated signal to test and calibrate transducers and DDC constants is generally recommended over using the sensor to act as the signal generator via simulated conditions or overwritten values.
4. Altering Setpoints: Rather than overwriting sensor values, and when simulating conditions is difficult, altering setpoints to test a sequence is acceptable. For example, to see the Air Conditioning compressor lockout initiate at an outside air temperature below 12 C (54 F), when the outside air temperature is above 12 C (54 F), temporarily change the lockout setpoint to be 2 C (4 F) above the current outside air temperature.
5. Indirect Indicators: Relying on indirect indicators for responses or performance shall be allowed only after visually and directly verifying and documenting, over the range of the tested parameters, that the indirect readings through the control system represent actual conditions and responses. Much of this verification shall be completed during systems startup and initial checkout.

F. Setup: Each function and test shall be performed under conditions that simulate actual conditions as closely as is practically possible. The Contractor shall provide all necessary materials, system modifications, etc. to produce the necessary flows, pressures, temperatures, etc. necessary to execute the test according to the specified conditions. At completion of the test, the Contractor shall return all affected building equipment and systems, due to these temporary modifications, to their pretest condition.

G. Sampling: No sampling is allowed in completing Pre-Functional Checklists. Sampling is allowed for Systems Functional Performance Test Procedures execution. The Commissioning Agent will determine the sampling rate. If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the Commissioning Agent may stop the testing and require the Contractor to perform and document a checkout of the remaining units, prior to continuing with Systems Functional Performance Testing of the remaining units.

H. Cost of Retesting: The cost associated with expanded sample System Functional Performance Tests shall be solely the responsibility of the Contractor. Any required retesting by the Contractor shall not be considered a justified reason for a claim of delay or for a time extension by the Contractor.

I. Coordination and Scheduling: The Contractor shall provide a minimum of 7 days' notice to the Commissioning Agent and the VA regarding the completion schedule for the Pre-Functional Checklists and startup of all equipment and systems. The Commissioning Agent will schedule Systems Functional Performance Tests with the Contractor and VA. The Commissioning Agent will witness and document the Systems Functional Performance Testing of systems. The Contractor shall execute the tests in accordance with the Systems Functional Performance Test Procedure.

J. Testing Prerequisites: In general, Systems Functional Performance Testing will be conducted only after Pre-Functional Checklists have been satisfactorily completed. The control system shall be sufficiently tested and approved by the Commissioning Agent and the VA before it is used to verify performance of other components or systems. The air balancing and water balancing shall be completed before Systems Functional Performance Testing of air-related or water-related equipment or systems are scheduled. Systems Functional Performance Testing will proceed from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems will be checked.

K. Problem Solving: The Commissioning Agent will recommend solutions to problems found, however the burden of responsibility to solve, correct and retest problems is with the Contractor.

3.7 DOCUMENTATION, NONCONFORMANCE AND APPROVAL OF TESTS

A. Documentation: The Commissioning Agent will witness, and document the results of all Systems Functional Performance Tests using the specific procedural forms developed by the Commissioning Agent for that purpose. Prior to testing, the Commissioning Agent will provide these forms to the VA and the Contractor for review and approval. The Contractor shall include the filled out forms with the O&M manual data.

B. Nonconformance: The Commissioning Agent will record the results of the Systems Functional Performance Tests on the procedure or test form. All items of nonconformance issues will be noted and reported to the VA on Commissioning Field Reports and/or the Commissioning Master Issues Log.

1. Corrections of minor items of noncompliance identified may be made during the tests. In such cases, the item of noncompliance and resolution shall be documented on the Systems Functional Test Procedure.
2. Every effort shall be made to expedite the systems functional Performance Testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the Commissioning Agent shall not be pressured into overlooking noncompliant work or loosening acceptance criteria to satisfy scheduling or cost issues, unless there is an overriding reason to do so by direction from the VA.
3. As the Systems Functional Performance Tests progresses and an item of noncompliance is identified, the Commissioning Agent shall discuss the issue with the Contractor and the VA.
4. When there is no dispute on an item of noncompliance, and the Contractor accepts responsibility to correct it:
   a. The Commissioning Agent will document the item of noncompliance and the Contractor's response and/or intentions. The Systems Functional Performance Test then continues or proceeds to another test or sequence. After the day's work is complete, the Commissioning Agent will submit a Commissioning Field Report to the VA. The Commissioning Agent will also note items of noncompliance and the Contractor's response in the Master Commissioning Issues Log. The Contractor shall correct the item of noncompliance and report completion to the VA and the Commissioning Agent.
   b. The need for retesting will be determined by the Commissioning Agent. If retesting is required, the Commissioning Agent and the Contractor shall reschedule the test and the test shall be repeated.

5. If there is a dispute about item of noncompliance, regarding whether it is an item of noncompliance, or who is responsible:
   a. The item of noncompliance shall be documented on the test form with the Contractor's response. The item of noncompliance with the Contractor's response shall also be reported on a Commissioning Field Report and on the Master Commissioning Issues Log.
   b. Resolutions shall be made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive and acceptance authority is with the Department of Veterans Affairs.
   c. The Commissioning Agent will document the resolution process.
   d. Once the interpretation and resolution have been decided, the Contractor shall correct the item of noncompliance, report it to the Commissioning Agent. The requirement for retesting will be determined by the Commissioning Agent. If retesting is required, the Commissioning Agent and the Contractor shall reschedule the test. Retesting shall be repeated until satisfactory performance is achieved.

C. Cost of Retesting: The cost to retest a System Functional Performance Test shall be solely the responsibility of the Contractor. Any required retesting by the Contractor shall not be considered a justified reason for a claim of delay or for a time extension by the Contractor.

D. Failure Due to Manufacturer Defect: If 10%, or three, whichever is greater, of identical pieces (size alone does not constitute a difference) of equipment fail to perform in compliance with the Contract Documents (mechanically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance specifications, all identical units may be considered unacceptable by the VA. In such case, the Contractor shall provide the VA with the following:
   1. Within one week of notification from the VA, the Contractor shall examine all other identical units making a record of the findings. The findings shall be provided to the VA within two weeks of the original notice.
   2. Within two weeks of the original notification, the Contractor shall provide a signed and dated, written explanation of the problem, cause of failures, etc. and all proposed solutions which shall include full equipment submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation.
   3. The VA shall determine whether a replacement of all identical units or a repair is acceptable.
   4. Two examples of the proposed solution shall be installed by the Contractor and the VA shall be allowed to test the installations for up to one week, upon which the VA will decide whether to accept the solution.
   5. Upon acceptance, the Contractor shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.

E. Approval: The Commissioning Agent will note each satisfactorily demonstrated function on the test form. Formal approval of the Systems Functional Performance Test shall be made later after review by the Commissioning Agent and by the VA. The Commissioning Agent will evaluate each test and report to the VA using a standard form. The VA will give final approval on each test using the same form, and provide signed copies to the Commissioning Agent and the Contractor.

3.8 DEFERRED TESTING

A. Unforeseen Deferred Systems Functional Performance Tests: If any Systems Functional Performance Test cannot be completed due to the building structure, required occupancy condition or other conditions, execution of the Systems Functional Performance Testing may be delayed upon approval of the VA. These Systems Functional Performance Tests shall be conducted in the same manner as the seasonal tests as soon as possible. Services of the

Contractor to conduct these unforeseen Deferred Systems Functional Performance Tests shall be negotiated between the VA and the Contractor.

B. Deferred Seasonal Testing: Deferred Seasonal Systems Functional Performance Tests are those that must be deferred until weather conditions are closer to the systems design parameters. The Commissioning Agent will review systems parameters and recommend which Systems Functional Performance Tests should be deferred until weather conditions more closely match systems parameters. The Contractor shall review and comment on the proposed schedule for Deferred Seasonal Testing. The VA will review and approve the schedule for Deferred Seasonal Testing. Deferred Seasonal Systems Functional Performances Tests shall be witnessed and documented by the Commissioning Agent. Deferred Seasonal Systems Functional Performance Tests shall be executed by the Contractor in accordance with these specifications.

3.9 OPERATION AND MAINTENANCE TRAINING REQUIREMENTS

A. Training Preparation Conference: Before operation and maintenance training, the Commissioning Agent will convene a training preparation conference to include VA's COR, VA's Operations and Maintenance personnel, and the Contractor. The purpose of this conference will be to discuss and plan for Training and Demonstration of VA Operations and Maintenance personnel.

B. The Contractor shall provide training and demonstration as required by other Division 21, Division 22, Division 23, Division 26, Division 27, Division 28, and Division 31 sections. The Training and Demonstration shall include, but is not limited to, the following:
   1. Review the Contract Documents.
   2. Review installed systems, subsystems, and equipment.
   3. Review instructor qualifications.
   4. Review instructional methods and procedures.
   5. Review training module outlines and contents.
   6. Review course materials (including operation and maintenance manuals).
   7. Review and discuss locations and other facilities required for instruction.
   8. Review and finalize training schedule and verify availability of educational materials, instructors, audiovisual equipment, and facilities needed to avoid delays.
   9. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

C. Training Module Submittals: The Contractor shall submit the following information to the VA and the Commissioning Agent:
   1. Instruction Program: Submit two copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module. At completion of training, submit two complete training manuals for VA's use.
   2. Qualification Data: Submit qualifications for facilitator and/or instructor.
   3. Attendance Record: For each training module, submit list of participants and length of instruction time.
   4. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.
   5. Demonstration and Training Recording:
      a. General: Engage a qualified commercial photographer to record demonstration and training. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice. At beginning of each training module, record each chart containing learning objective and lesson outline.
      b. Video Format: Provide high quality color DVD color on standard size DVD disks.

c. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.
d. Narration: Describe scenes on video recording by audio narration by microphone while demonstration and training is recorded. Include description of items being viewed. Describe vantage point, indicating location, direction (by compass point), and elevation or story of construction.
e. Submit two copies within seven days of end of each training module.

6. Transcript: Prepared on 8-1/2-by-11-inch paper, punched and bound in heavy-duty, 3-ring, vinyl-covered binders. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding videotape. Include name of Project and date of videotape on each page.

D. Quality Assurance:
a. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
b. Instructor Qualifications: A factory authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.
c. Photographer Qualifications: A professional photographer who is experienced photographing construction projects.

E. Training Coordination:
1. Coordinate instruction schedule with VA's operations. Adjust schedule as required to minimize disrupting VA's operations.
2. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
3. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by the VA.

F. Instruction Program:
1. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:
a. Fire protection systems, including fire alarm, fire pumps, and fire suppression systems.
b. Intrusion detection systems.
c. Conveying systems, including elevators, wheelchair lifts, escalators, and automated materials handling systems.
d. Medical equipment, including medical gas equipment and piping.
e. Laboratory equipment, including laboratory air and vacuum equipment and piping.
f. Heat generation, including boilers, feedwater equipment, pumps, steam distribution piping, condensate return systems, heating hot water heat exchangers, and heating hot water distribution piping.
g. Refrigeration systems, including chillers, cooling towers, condensers, pumps, and distribution piping.
h. HVAC systems, including air handling equipment, air distribution systems, and terminal equipment and devices.
i. HVAC instrumentation and controls.
j. Electrical service and distribution, including switchgear, transformers, switchboards, panelboards, uninterruptible power supplies, and motor controls.
k. Packaged engine generators, including synchronizing switchgear/switchboards, and transfer switches.
l. Lighting equipment and controls.

m. Communication systems, including intercommunication, surveillance, nurse call systems, public address, mass evacuation, voice and data, and entertainment television equipment.
n. Site utilities including lift stations, condensate pumping and return systems, and storm water pumping systems.

G. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participants are expected to master. For each module, include instruction for the following:
1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
   a. System, subsystem, and equipment descriptions.
   b. Performance and design criteria if Contractor is delegated design responsibility.
   c. Operating standards.
   d. Regulatory requirements.
   e. Equipment function.
   f. Operating characteristics.
   g. Limiting conditions.
   h. Performance curves.
2. 2. Documentation: Review the following items in detail:
   a. Emergency manuals.
   b. Operations manuals.
   c. Maintenance manuals.
   d. Project Record Documents.
   e. Identification systems.
   f. Warranties and bonds.
   g. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
   a. Instructions on meaning of warnings, trouble indications, and error messages.
   b. Instructions on stopping.
   c. Shutdown instructions for each type of emergency.
   d. Operating instructions for conditions outside of normal operating limits.
   e. Sequences for electric or electronic systems.
   f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Control sequences.
   f. Safety procedures.
   g. Instructions on stopping.
   h. Normal shutdown instructions.
   i. Operating procedures for emergencies.
   j. Operating procedures for system, subsystem, or equipment failure.
   k. Seasonal and weekend operating instructions.
   l. Required sequences for electric or electronic systems.
   m. Special operating instructions and procedures.
5. Adjustments: Include the following:
   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.
   d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures.
7. Maintenance: Include the following:

a. Inspection procedures.
b. Types of cleaning agents to be used and methods of cleaning.
c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. Repairs: Include the following:
   a. Diagnosis instructions.
   b. Repair instructions.
   c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   d. Instructions for identifying parts and components.
   e. Review of spare parts needed for operation and maintenance.

H. Training Execution:
1. Preparation: Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual. Set up instructional equipment at instruction location.
2. Instruction:
   a. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Department of Veterans Affairs for number of participants, instruction times, and location.
   b. Instructor: Engage qualified instructors to instruct VA's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
      1) The Commissioning Agent will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
      2) The VA will furnish an instructor to describe VA's operational philosophy.
      3) The VA will furnish the Contractor with names and positions of participants.
3. Scheduling: Provide instruction at mutually agreed times. For equipment that requires seasonal operation, provide similar instruction at start of each season. Schedule training with the VA and the Commissioning Agent with at least seven days' advance notice.
4. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of an oral, or a written, performance-based test.
5. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

I. Demonstration and Training Recording:
1. General: Engage a qualified commercial photographer to record demonstration and training. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice. At beginning of each training module, record each chart containing learning objective and lesson outline.
2. Video Format: Provide high quality color DVD color on standard size DVD disks.
3. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.
4. Narration: Describe scenes on videotape by audio narration by microphone while demonstration and training is recorded. Include description of items being viewed. Describe vantage point, indicating location, direction (by compass point), and elevation or story of construction.

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SECTION 02 41 00

DEMOLITION

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies demolition and removal of buildings, portions of buildings, utilities, other structures and debris from trash dumps shown.

1.2 RELATED WORK:

A. Demolition and removal of roads, walks, curbs, and on-grade slabs outside buildings to be demolished: Section 31 20 11, EARTH MOVING (SHORT FORM).

B. Safety Requirements: Section 01 35 26 Safety Requirements Article, ACCIDENT PREVENTION PLAN (APP).

C. Disconnecting utility services prior to demolition: Section 01 00 00, GENERAL REQUIREMENTS.

D. Reserved items that are to remain the property of the Government: Section 01 00 00, GENERAL REQUIREMENTS.

E. Asbestos Removal: Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT.

F. Lead Paint: Section 02 83 33.13, LEAD-BASED PAINT REMOVAL AND DISPOSAL.

G. Environmental Protection: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

H. Construction Waste Management: Section 01 74 19 CONSTRUCTION WASTE MANAGEMENT.

I. Infectious Control: Section 01 35 26, SAFETY REQUIREMENTS.

1.3 PROTECTION:

A. Perform demolition in such manner as to eliminate hazards to persons and property; to minimize interference with use of adjacent areas, utilities and structures or interruption of use of such utilities; and to provide free passage to and from such adjacent areas of structures. Comply with requirements of GENERAL CONDITIONS Article, ACCIDENT PREVENTION.

B. Provide safeguards, including warning signs, barricades, temporary fences, warning lights, and other similar items that are required for protection of all personnel during demolition and removal operations. Comply with requirements of Section 01 00 00, GENERAL REQUIREMENTS, Article PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES AND IMPROVEMENTS.

C. Maintain fences, barricades, lights, and other similar items around exposed excavations until such excavations have been completely filled.

D. Provide enclosed dust chutes with control gates from each floor to carry debris to truck beds and govern flow of material into truck. Provide overhead bridges of tight board or prefabricated metal construction at dust chutes to protect persons and property from falling debris.

E. Prevent spread of flying particles and dust. Sprinkle rubbish and debris with water to keep dust to a minimum. Do not use water if it results in hazardous or objectionable condition such as, but not limited to; ice, flooding, or pollution. Vacuum and dust the work area daily.

F. In addition to previously listed fire and safety rules to be observed in performance of work, include following:
   1. No wall or part of wall shall be permitted to fall outwardly from structures.

2. Maintain at least one stairway in each structure in usable condition. Keep stairway free of obstructions and debris.
3. Wherever a cutting torch or other equipment that might cause a fire is used, provide and maintain fire extinguishers nearby ready for immediate use. Instruct all possible users in use of fire extinguishers.
4. Keep hydrants clear and accessible at all times. Prohibit debris from accumulating within a radius of 4500 mm (15 feet) of fire hydrants.

G. Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The contractor shall take necessary precautions to avoid damages to existing items to remain in place, to be reused, or to remain the property of the Medical Center; any damaged items shall be repaired or replaced as approved by the Resident Engineer. The Contractor shall coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract. Do not overload structural elements. Provide new supports and reinforcement for existing construction weakened by demolition or removal works. Repairs, reinforcement, or structural replacement must have Resident Engineer's approval.

H. The work shall comply with the requirements of Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

I. The work shall comply with the requirements of Section 01 00 00, GENERAL REQUIREMENTS and Section 01 35 26, SAFETY REQUIREMENTS.

1.4 UTILITY SERVICES:

A. Demolish and remove outside utility service lines shown to be removed.

B. Remove abandoned outside utility lines that would interfere with installation of new utility lines and new construction.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 DEMOLITION:

A. Completely demolish and remove structures, including all appurtenances related or connected thereto, as noted below:
1. As required for installation of new utility service lines.
2. To full depth within an area defined by hypothetical lines located 1500 mm (5 feet) outside building lines of new structures.

B. Debris, including brick, concrete, stone, metals and similar materials shall become property of Contractor and shall be disposed of by him daily, off the Medical Center to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the COR. Break up concrete slabs below grade that do not require removal from present location into pieces not exceeding 600 mm (24 inches) square to permit drainage. Contractor shall dispose debris in compliance with applicable federal, state or local permits, rules and/or regulations.

C. In removing buildings and structures of more than two stories, demolish work story by story starting at highest level and progressing down to third floor level. Demolition of first and second stories may proceed simultaneously.

D. Remove and legally dispose of all materials, other than earth to remain as part of project work, from any trash dumps shown. Materials removed shall become property of contractor and shall

be disposed of in compliance with applicable federal, state or local permits, rules and/or regulations. All materials in the indicated trash dump areas, including above surrounding grade and extending to a depth of 1500mm (5feet) below surrounding grade, shall be included as part of the lump sum compensation for the work of this section. Materials that are located beneath the surface of the surrounding ground more than 1500 mm (5 feet), or materials that are discovered to be hazardous, shall be handled as unforeseen. The removal of hazardous material shall be referred to Hazardous Materials specifications.

E. Remove existing utilities as indicated or uncovered by work and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Resident Engineer. When Utility lines are encountered that are not indicated on the drawings, the Resident Engineer shall be notified prior to further work in that area.

3.2 CLEAN-UP:

A. On completion of work of this section and after removal of all debris, leave site in clean condition satisfactory to Resident Engineer. Clean-up shall include off the Medical Center disposal of all items and materials not required to remain property of the Government as well as all debris and rubbish resulting from demolition operations.

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SECTION 02 82 11

TRADITIONAL ASBESTOS ABATEMENT

PART 1 - **GENERAL**

1.1 SUMMARY OF THE WORK

A. Contract Documents and Related Requirements: Drawings, general provisions of the contract, including general and supplementary conditions and other Division 01 specifications, shall apply to the work of this section. The contract documents show or describe the work to be done under the contract and related requirements and conditions impacting the project. Related requirements and conditions include applicable codes and regulations, notices and permits, existing site conditions and restrictions on use of the site, requirements for partial owner occupancy during the work, coordination with other work and the phasing of the work. In the event the Asbestos Abatement Contractor discovers a conflict in the contract documents and/or requirements or codes, the conflict must be brought to the immediate attention of the Contracting Officer for resolution. Whenever there is a conflict or overlap in the requirements, the most stringent shall apply. Any actions taken by the Contractor without obtaining guidance from the Contracting Officer shall become the sole risk and responsibility of the Asbestos Abatement Contractor. All costs incurred due to such action are also the responsibility of the Asbestos Abatement Contractor.

B. Extent of Work:

1. Below is a brief description of the estimated quantities of asbestos containing materials to be abated. These quantities are for informational purposes only and are based on the best information available at the time of the specification preparation. The Contractor shall satisfy themselves of the actual quantities to be abated. Nothing in this section may be interpreted as limiting the extent of work otherwise required by this contract and related documents. Contractor shall field verify quantities prior to abatement. Any variation greater than 10% shall require / be confirmed by VA representative. All work shall be performed in accordance with NYS ICR 56.
2. Removal, clean-up and disposal of asbestos containing materials (ACM) and asbestos/waste contaminated elements or debris in an appropriate regulated area for the following approximate quantities;
   a) (40) linear feet of ACM Non-PCB Exterior Window Caulk
   b) (3000) linear feet of PACM steam pipe insulation of 25 – 75 mm (1 - 3 inches) in diameter
   c) (760) PACM steam pipe fittings of 25-75 mm (1 - 3 inches) in diameter
   d) (1200) linear feet of PACM pipe insulation of 12.5 mm to 100 mm (1/2 – 4 inches) in diameter.
   e) (400) PACM pipe fittings of 12.5-100 mm (1/2 – 4 inches) in diameter.
   f) (120) linear feet of non-ACM pipe insulation of 50 - 150 mm (2 - 6 inches) in diameter
   g) (3) non-ACM fittings of 50 - 150 mm (2 - 6 inches) in diameter.

HA #	Material Description Containing <1% Asbestos	Material Location	Estimated Quantity
13	Pipe Fitting Insulation	Room 130	3 LF
17	Pipe Insulation	Room 128A	120 LF

It should be noted that non-ACM listed above will be abated as ACM due to high quantity of PACM..

Exterior Renovation Areas			
HA No.	**ACM Description**	**Material Locations**	**Estimated Quantity**
9	Exterior Gray Window Caulk (Non-PCB)	North Stairwell, Exterior Window	**~ 8 Total Square Feet (SF)** **~20 Total Linear Feet (LF)** **2 Window Openings**
10	Exterior Black Window Caulk (Non-PCB)	North Stairwell, Exterior Window (Header)	**~ 8 Total LF** **~20 Total Linear Feet (LF)** **2 Window Openings**

C. Related Work:
   1. Section 07 84 00, FIRESTOPPING
   2. Section 02 41 00, DEMOLITION
   3. Division 09, FINISHES
   4.

D. Tasks:
   1. The work tasks are summarized briefly as follows:
      a. Pre-abatement activities including pre-abatement meeting(s), inspection(s), notifications, permits, submittal approvals, regulated area preparations, emergency procedures arrangements, and standard operating procedures for asbestos abatement work.
      b. Abatement activities including removal, /encapsulation , enclosure, clean-up and disposal of ACM waste, recordkeeping, security, monitoring, and inspections.
      c. Cleaning and decontamination activities including final visual inspection, air monitoring and certification of decontamination.

E. Contractors Use of Premises:
   1. The Contractor and Contractor's personnel shall cooperate fully with the VA representative/consultant to facilitate efficient use of buildings and areas within buildings. The Contractor shall perform the work in accordance with the VA specifications, drawings, phasing plan and in compliance with any/all applicable Federal, State and Local regulations and requirements.
   2. The Contractor shall use the existing facilities in the building strictly within the limits indicated in contract documents as well as the approved VA Design and Construction Procedures. VA Design and Construction Procedures drawings of partially occupied

buildings will show the limits of regulated areas; the placement of decontamination facilities; the temporary location of bagged waste ACM; the path of transport to outside the building; and the temporary waste storage area for each building/regulated area. Any variation from the arrangements shown on drawings shall be secured in writing from the VA representative through the pre-abatement plan of action. The following limitations of use shall apply to existing facilities shown on drawings:

1.2 VARIATIONS IN QUANTITY

A. The quantities and locations of ACM as indicated on the drawings and the extent of work included in this section are estimated which are limited by the physical constraints imposed by occupancy of the buildings and accessibility to ACM. Accordingly, minor variations (+/- 10 percent) in quantities of ACM within the regulated area are considered as having no impact on contract price and time requirements of this contract. Where additional work is required beyond the above variation, the contractor shall provide unit prices for newly discovered ACM and those prices shall be used for additional work required under the contractor.

1.3 STOP ASBESTOS REMOVAL

A. If the Contracting Officer; their field representative; the facility Safety Officer/Manager or their designee, or the VA Professional Industrial Hygienist/Certified Industrial Hygienist (VPIH/CIH) presents a verbal **Stop Asbestos Removal Order**, the Contractor/Personnel shall immediately stop all asbestos removal and maintain HEPA filtered negative pressure air flow in the containment and adequately wet any exposed ACM. If a verbal Stop Asbestos Removal Order is issued, the VA shall follow-up with a written order to the Contractor as soon as it is practicable. The Contractor shall not resume any asbestos removal activity until authorized to do so in writing by the VA Contracting Officer. A stop asbestos removal order may be issued at any time the VA Contracting Officer determines abatement conditions/activities are not within VA specification, regulatory requirements or that an imminent hazard exists to human health or the environment. Work stoppage will continue until conditions have been corrected to the satisfaction of the VA. Standby time and costs for corrective actions will be borne by the Contractor, including the VPIH/CIH time. The occurrence of any of the following events shall be reported immediately by the Contractor's competent person to the VA Contracting Office or field representative using the most expeditious means (e.g., verbal or telephonic), followed up with written notification to the Contracting Officer as soon as practical. The Contractor shall immediately stop asbestos removal/disturbance activities and initiate fiber reduction activities if:
   1. Airborne PCM analysis results equal to or greater than 0.01 f/cc above background levels inside the building but outside the regulated area;
   2. breach or break in regulated area containment barrier(s);
   3. less than –0.02 inch WCG pressure in the regulated area;
   4. serious injury/death at the site;
   5. fire/safety emergency at the site;
   6. respiratory protection system failure;
   7. power failure or loss or inadequate use of wetting agent;
   8. any visible emissions observed outside the regulated area; or
   9. failure to follow project specification requirements.

1.4 DEFINITIONS

A. General: Definitions and explanations here are neither complete nor exclusive of all terms used in the contract documents, but are general for the work to the extent they are not stated more explicitly in another element of the contract documents. Drawings must be recognized as diagrammatic in nature and not completely descriptive of the requirements indicated therein.

B. Glossary:

Abatement - Procedures to control fiber release from asbestos-containing materials. Includes removal, encapsulation, enclosure, demolition, and renovation activities related to asbestos containing materials (ACM).

Adequately wet - Sufficiently mixed or penetrated with liquid to prevent the release of particulates. If visible emissions are observed coming from the ACM, then that material has not been adequately wetted.
Aerosol - Solid or liquid particulate suspended in air.
Aggressive method - Removal or disturbance of building material by sanding, abrading, grinding, or other method that breaks, crumbles, or disintegrates intact ACM.
Aggressive air sampling - EPA AHERA defined clearance sampling method using air moving equipment such as fans and leaf blowers to aggressively disturb and maintain in the air residual fibers after abatement.
AHERA - Asbestos Hazard Emergency Response Act. Asbestos regulations for schools issued in 1987.
Aircell - Pipe or duct insulation made of corrugated cardboard which contains asbestos.
Air monitoring - The process of measuring the fiber content of a known volume of air collected over a specified period of time. The NIOSH 7400 Method, Issue 3, Fifth Edition is used to determine the fiber levels in air. For personal samples, area air samples and clearance air testing using Phase Contrast Microscopy (PCM) analysis, the NIOSH Method 7402 (Issue 2, Fourth Edition) can be used when it is necessary to confirm fibers counted by PCM as being asbestos. The AHERA TEM analysis may be used for background, area samples and clearance samples when required by this specification, or at the discretion of the VPIH/CIH as appropriate.
Air sample filter - The filter used to collect fibers which are then counted. The filter is made of mixed cellulose ester (MCE) membrane for PCM (Phase Contrast Microscopy, 25 mm, 3-piece with 2 inches Static Extension Cowl, 0.8 micron pore size) and MCE for TEM (Transmission Electron Microscopy, 25 mm, 3-piece with 2 inches Static Extension Cowl, 0.45 micron pore size).
Amended water - Water to which a surfactant (wetting agent) has been added to increase the penetrating ability of the liquid.
Asbestos - Includes chrysotile, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, actinolite asbestos, and any of these minerals that have been chemically treated or altered. Asbestos also includes PACM, as defined below.
Asbestos Hazard Abatement Plan (AHAP) - Asbestos work procedures required to be submitted by the contractor before work begins.
Asbestos-containing material (ACM) - Any material containing more than one percent of asbestos.
Asbestos contaminated elements (ACE) - Building elements such as ceilings, walls, lights, or ductwork that are contaminated with asbestos.
Asbestos-contaminated soil (ACS) – Soil found in the work area or in adjacent areas such as crawlspaces or pipe tunnels which is contaminated with asbestos-containing material debris and cannot be easily separated from the material.
Asbestos-containing waste (ACW) material - Asbestos-containing material or asbestos contaminated objects requiring disposal.
Asbestos Project Monitor – Some states require that any person conducting asbestos abatement air sampling, clearance inspections and clearance air sampling be licensed as an asbestos project monitor.
Asbestos waste decontamination facility - A system consisting of drum/bag washing facilities and a temporary storage area for cleaned containers of asbestos waste. Used as the exit for waste and equipment leaving the regulated area. In an emergency, it may be used to evacuate personnel.
Authorized person - Any person authorized by the VA, the Contractor, or government agency and required by work duties to be present in regulated areas.
Authorized visitor - Any person approved by the VA; the contractor; or any government agency representative having jurisdiction over the regulated area (e.g., OSHA, Federal and State EPA).
Barrier - Any surface that isolates the regulated area and inhibits fiber migration from the regulated area.
Containment Barrier - An airtight barrier consisting of walls, floors, and/or ceilings of sealed plastic sheeting which surrounds and seals the outer perimeter of the regulated area.
Critical Barrier - The barrier responsible for isolating the regulated area from adjacent spaces, typically constructed of 2-layers of 6-mil independently installed plastic sheeting (Polyethylene)

secured in place at openings such as doors, windows, penetrations or any other opening into the regulated area.
Primary Barrier – Plastic barriers placed over critical barriers and exposed directly to abatement work or to secondary barrier.
Secondary Barrier - Any additional plastic barriers used to isolate and provide protection from debris during abatement work.
Breathing zone - The hemisphere forward of the shoulders with a radius of about 150 - 225 mm (6 - 9 inches) from the worker's nose.
Bridging encapsulant - An encapsulant that forms a layer on the surface of the ACM.
Building/facility owner - The legal entity, including a lessee, which exercises control over management and recordkeeping functions relating to a building and/or facility in which asbestos activities take place.
Bulk testing - The collection and analysis of suspect asbestos containing materials.
Certified Industrial Hygienist (CIH) - A person certified in the comprehensive practice of industrial hygiene by the American Board of Industrial Hygiene.
Class I asbestos work - Activities involving the removal of Thermal System Insulation (TSI) and surfacing ACM and Presumed Asbestos Containing Material (PACM).
Class II asbestos work - Activities involving the removal of ACM which is not thermal system insulation or surfacing material. This includes, but is not limited to, the removal of asbestos-containing wallboard, floor tile and sheeting, roofing and siding shingles, and construction mastic.
Clean room/Changing room - An uncontaminated room having facilities for the storage of employee's street clothing and uncontaminated materials and equipment.
Clearance sample - The final air sample taken after all asbestos work has been done and visually inspected. Performed by the VA's professional industrial hygiene consultant/Certified Industrial Hygienist (VPIH/CIH).
Closely resemble - The major workplace conditions which have contributed to the levels of historic asbestos exposure, are no more protective than conditions of the current workplace.
Competent person - In addition to the definition in 29 CFR 1926.32(f), one who is capable of identifying existing asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure, who has the authority to take prompt corrective measures to eliminate them, as specified in 29 CFR 1926.32(f); in addition, for Class I and II work who is specially trained in a training course which meets the criteria of EPA's Model Accreditation Plan (40 CFR 763) for supervisor.
Contractor's Professional Industrial Hygienist (CPIH/CIH) - The asbestos abatement contractor's industrial hygienist. The industrial hygienist must meet the qualification requirements of a PIH and may report to a certified industrial hygienist (CIH).
Count - Refers to the fiber count or the average number of fibers greater than five microns in length with a length-to-width (aspect) ratio of at least 3 to 1, per cubic centimeter of air.
Crawlspace – An area which can be found either in or adjacent to the work area. This area has limited access and egress and may contain asbestos materials and/or asbestos contaminated soil.
Decontamination area/unit - An enclosed area adjacent to and connected to the regulated area and consisting of an equipment room, shower room, and clean room, which is used for the decontamination of workers, materials, and equipment that are contaminated with asbestos.
Demolition - The wrecking or taking out of any load-supporting structural member and any related razing, removing, or stripping of asbestos products.
Disposal bag - Typically 6-mil thick sift-proof, dustproof, leak-tight container used to package and transport asbestos waste from regulated areas to the approved landfill. Each bag/container must be labeled/marked in accordance with EPA, OSHA and DOT requirements.
Disturbance – Asbestos Operations and Maintenance Activities (OSHA Class III) that disrupt the matrix of ACM or PACM, crumble or pulverize ACM or PACM, or generate visible debris from ACM or PACM. Disturbance includes cutting away small amounts of ACM or PACM, no greater than the amount that can be contained in one standard sized glove bag or waste bag in order to access a building component. In no event shall the amount of ACM or PACM so disturbed exceed that which can be contained in one glove bag or disposal bag, which shall not exceed 60 inches in length or width.

Drum - A rigid, impermeable container made of cardboard fiber, plastic, or metal which can be sealed in order to be sift-proof, dustproof, and leak-tight.
Employee exposure - The exposure to airborne asbestos that would occur if the employee were not wearing respiratory protection equipment.
Encapsulant - A material that surrounds or embeds asbestos fibers in an adhesive matrix and prevents the release of fibers.
Encapsulation - Treating ACM with an encapsulant.
Enclosure - The construction of an air tight, impermeable, permanent barrier around ACM to control the release of asbestos fibers from the material and also eliminate access to the material.
Equipment room - A contaminated room located within the decontamination area that is supplied with impermeable bags or containers for the disposal of contaminated protective clothing and equipment.
Fiber - A particulate form of asbestos, 5 microns or longer, with a length to width (aspect) ratio of at least 3 to 1.
Fibers per cubic centimeter (f/cc) - Abbreviation for fibers per cubic centimeter, used to describe the level of asbestos fibers in air.
Filter - Media used in respirators, vacuums, or other machines to remove particulate from air.
Firestopping - Material used to close the open parts of a structure in order to prevent a fire from spreading.
Friable asbestos containing material - Any material containing more than one (1) percent asbestos as determined using the method specified in 40 CFR 763, Polarized Light Microscopy, that, when dry, can be crumbled, pulverized, or reduced to powder by hand pressure.
Glovebag - Not more than a 60 x 60 inch impervious plastic bag-like enclosure affixed around an asbestos-containing material, with glove-like appendages through which materials and tools may be handled.
High efficiency particulate air (HEPA) filter – An ASHRAE MERV 17 filter capable of trapping and retaining at least 99.97 percent of all mono-dispersed particles of 0.3 micrometers in diameter.
HEPA vacuum - Vacuum collection equipment equipped with a HEPA filter system capable of collecting and retaining asbestos fibers.
Homogeneous area - An area of surfacing, thermal system insulation or miscellaneous ACM that is uniform in color, texture and date of application.
HVAC - Heating, Ventilation and Air Conditioning
Industrial hygienist (IH) - A professional qualified by education, training, and experience to anticipate, recognize, evaluate and develop controls for occupational health hazards. Meets definition requirements of the American Industrial Hygiene Association (AIHA).
Industrial hygienist technician (IH Technician) - A person working under the direction of an IH or CIH who has special training, experience, certifications and licenses required for the industrial hygiene work assigned. Some states require that an industrial hygienist technician conducting asbestos abatement air sampling, clearance inspection and clearance air sampling be licensed as an asbestos project monitor.
Intact - The ACM has not crumbled, been pulverized, or otherwise deteriorated so that the asbestos is no longer likely to be bound with its matrix.
Lockdown - Applying encapsulant, after a final visual inspection, on all abated surfaces at the conclusion of ACM removal prior to removal of critical barriers.
National Emission Standards for Hazardous Air Pollutants (NESHAP) - EPA's rule to control emissions of asbestos to the environment (40 CFR part 61, Subpart M).
Negative initial exposure assessment - A demonstration by the employer which complies with the criteria in 29 CFR 1926.1101 (f)(2)(iii), that employee exposure during an operation is expected to be consistently below the PEL or Excursion Limit (EL).
Negative pressure - Air pressure which is lower than the surrounding area, created by exhausting air from a sealed regulated area through HEPA equipped filtration units. OSHA requires maintaining -0.02 inch water column gauge inside the negative pressure enclosure.
Negative pressure respirator - A respirator in which the air pressure inside the facepiece is negative during inhalation relative to the air pressure outside the respirator facepiece.

Non-friable ACM - Material that contains more than 1 percent asbestos but cannot be crumbled, pulverized, or reduced to powder by hand pressure.
Organic vapor cartridge - The type of cartridge used on air purifying respirators to remove organic vapor hazardous air contaminants.
Outside air - The air outside buildings and structures, including, but not limited to, the air under a bridge or in an open ferry dock.
Owner/operator - Any person who owns, leases, operates, controls, or supervises the facility being demolished or renovated or any person who owns, leases, operates, controls, or supervises the demolition or renovation operation, or both.
Penetrating encapsulant - Encapsulant that is absorbed into the ACM matrix without leaving a surface layer.
Permissible exposure limit (PEL) - The level of exposure OSHA allows for as an eight (8) hour time-weighted average (TWA). For asbestos fibers, the eight (8) hour time-weighted average PEL is 0.1 fibers per cubic centimeter (0.1 f/cc) of air and the 30-minute Excursion Limit (EL) is 1.0 fibers per cubic centimeter (1 f/cc).
Personal protective equipment (PPE) – equipment designed to protect user from injury and/or specific job hazard. Such equipment may include protective clothing, hard hats, safety glasses, fall protection, and respirators.
Personal sampling/monitoring - Representative air samples obtained in the breathing zone for one or more workers within the regulated area using a filter cassette and a calibrated air sampling pump to determine asbestos exposure.
Pipe tunnel – An area, typically located adjacent to mechanical spaces or boiler rooms in which the pipes servicing the heating system in the building are routed to allow the pipes to access heating elements. These areas may contain asbestos pipe insulation, asbestos fittings, debris or asbestos-contaminated soil.
Polarized light microscopy (PLM) - Light microscopy using dispersion staining techniques and refractive indices to identify and quantify the type of asbestos present in a bulk sample.
Polyethylene sheeting - Strong plastic barrier material 4 to 6-mils thick, semi-transparent, flame retardant per NFPA 241.
Positive/negative fit check - A method of verifying the seal of a facepiece respirator by temporarily occluding the filters and breathing in (inhaling) and then temporarily occluding the exhalation valve and breathing out (exhaling) while checking for inward or outward leakage of the respirator, respectively.
Presumed ACM (PACM) - Thermal system insulation, surfacing, and flooring material installed in buildings prior to 1981. If the building owner has actual knowledge, or should have known through the exercise of due diligence that other materials are ACM, they too must be treated as PACM. The designation of PACM may be rebutted pursuant to 29 CFR 1926.1101 (k)(5).
Professional IH - An IH who meets the definition requirements of AIHA; meets the definition requirements of OSHA as a "Competent Person" at 29 CFR 1926.1101 (b); has completed two specialized EPA approved courses on management and supervision of asbestos abatement projects; has formal training in respiratory protection and waste disposal; and has a minimum of four projects of similar complexity with this project of which at least three projects serving as the supervisory IH. The PIH may be either the VA's PIH (VPIH/CIH) or Contractor's PIH (CPIH/CIH).
Project designer - A person who has successfully completed the training requirements for an asbestos abatement project designer as required by 40 CFR 763 Subpart E, Appendix C, Part I; (B)(5).
Assigned protection factor - A value assigned by OSHA/NIOSH to indicate the expected protection provided by each respirator class, when the respirator is properly selected and worn correctly. The number indicates the reduction of exposure level from outside to inside the respirator facepiece.
Qualitative fit test (QLFT) - A fit test using a challenge material that can be sensed by the wearer if leakage in the respirator occurs.
Quantitative fit test (QNFT) - A fit test using a challenge material which is quantified outside and inside the respirator thus allowing the determination of the actual fit factor.
Regulated area - An area established by the employer to demarcate where Class I, II, III asbestos work is conducted, and any adjoining area where debris and waste from such asbestos

work may accumulate; and a work area within which airborne concentrations of asbestos exceed, or there is a reasonable possibility they may exceed the PEL.
Regulated ACM (RACM) - Friable ACM; Category I non-friable ACM that has become friable; Category I non-friable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading or; Category II non-friable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces expected to act on the material in the course of the demolition or renovation operation.
Removal - All operations where ACM, PACM and/or RACM is taken out or stripped from structures or substrates, including demolition operations.
Renovation - Altering a facility or one or more facility components in any way, including the stripping or removal of asbestos from a facility component which does not involve demolition activity.
Repair - Overhauling, rebuilding, reconstructing, or reconditioning of structures or substrates, including encapsulation or other repair of ACM or PACM attached to structures or substrates.
Shower room - The portion of the PDF where personnel shower before leaving the regulated area.
Supplied air respirator (SAR) - A respiratory protection system that supplies minimum Grade D respirable air per ANSI/Compressed Gas Association Commodity Specification for Air, G-7.1-2018.
Surfacing ACM - A material containing more than 1 percent asbestos that is sprayed, troweled on or otherwise applied to surfaces for acoustical, decorative, fireproofing and other purposes.
Surfactant - A chemical added to water to decrease water's surface tension thus making it more penetrating into ACM.
Thermal system ACM - A material containing more than 1 percent asbestos applied to pipes, fittings, boilers, breeching, tanks, ducts, or other structural components to prevent heat loss or gain.
Transmission electron microscopy (TEM) - A microscopy method that can identify and count asbestos fibers.
VA Professional Industrial Hygienist (VPIH/CIH) – The Department of Veterans Affairs Professional Industrial Hygienist must meet the qualifications of a PIH, and may report to a Certified Industrial Hygienist (CIH).
VA Representative - The VA official responsible for on-going project work.
VA Total – means a building or substantial part of the building is completely removed, torn or knocked down, bulldozed, flattened, or razed, including removal of building debris.
Visible emissions - Any emissions, which are visually detectable without the aid of instruments, coming from ACM/PACM/RACM/ACS or ACM waste material.
Waste/Equipment decontamination facility (W/EDF) – The area in which equipment is decontaminated before removal from the regulated area.
Waste generator - Any owner or operator whose act or process produces asbestos-containing waste material.
Waste shipment record - The shipping document, required to be originated and signed by the waste generator, used to track and substantiate the disposition of asbestos-containing waste material.
Wet cleaning - The process of thoroughly eliminating, by wet methods, any asbestos contamination from surfaces or objects.

C. Referenced Standards Organizations: See Section 01 42 19 REFERENCED STANDARDS.

1.5 APPLICABLE CODES AND REGULATIONS

A. General Applicability of Codes, Regulations, and Standards:
   1. All work under this contract shall be done in strict accordance with all applicable Federal, State, and Local regulations, standards and codes governing asbestos abatement, and any other trade work done in conjunction with the abatement. All applicable codes, regulations and standards are adopted into this specification and will have the same force and effect as this specification.

2. The most recent edition of any relevant regulation, standard, document or code shall be in effect. Where conflict among the requirements or with these specifications exists, the most stringent requirement(s) shall be utilized.
3. Copies of all standards, regulations, codes and other applicable documents, including this specification and those listed in Section 1.5 shall be available at the worksite in the clean change area of the worker decontamination system and/or the Contractor's on-site Field Office. These standards, regulations, codes and other applicable documents, including this specification and those listed in Section 1.5 may be made available electronically.

B. Asbestos Abatement Contractor Responsibility: The Asbestos Abatement Contractor (Contractor) shall assume full responsibility and liability for compliance with all applicable Federal, State and Local regulations related to any and all aspects of the asbestos abatement project. The Contractor is responsible for providing and maintaining training, accreditations, medical exams, medical records, personal protective equipment (PPE), respiratory protection, and respirator fit testing, as required by applicable Federal, State and Local regulations. The Contractor shall hold the VA and VPIH/CIH consultants harmless for any Contractor's failure to comply with any applicable work, packaging, transporting, disposal, safety, health, or environmental requirement on the part of himself, his employees, or his subcontractors. The Contractor will incur all costs of the CPIH/CIH, including all sampling/analytical costs to assure compliance with OSHA/EPA/State/Local requirements related to failure to comply with the regulations applicable to the work.

C. Federal Requirements:
1. Federal requirements which govern asbestos abatement include, but are not limited to, the following regulations:
   a. Occupational Safety and Health Administration **(OSHA)**
      1) Title 29 CFR 1926.1101 - Construction Standard for Asbestos
      2) Title 29 CFR 1926 Subpart E - Personal Protective Equipment and Life Saving Equipment
      3) Title 29 CFR 1910.134 - Respiratory Protection
      4) Title 29 CFR 1926 - Construction Industry Standards
      5) Title 29 CFR 1926.33 - Access to Employee Exposure and Medical Records
      6) Title 29 CFR 1926.59 same as 1910.1200 - Hazard Communication
      7) Title 29 CFR 1926 Subpart C – General Safety and Health Provisions and Subpart D – Occupational Health and Environmental Controls
   b. Environmental Protection Agency **(EPA)**:
      1) 40 CFR 61 Subpart M - National Emission Standard for Hazardous Air Pollutants - Asbestos.
      2) 40 CFR 763 - Asbestos Hazard Emergency Response Act (AHERA) and Asbestos Hazard Abatement Reauthorization Act (ASHARA)
   c. Department of Transportation **(DOT)**
      1) Title 49 CFR 171 - 180 – Transportation

D. State Requirements:
1. State requirements that apply to the asbestos abatement work, disposal, clearance, etc., include, but are not limited to, the following:

A. New York State Department of Health (NYSDOH)

1. 10 NYCRR, Part 73, "Asbestos Safety Program Requirements"

B. New York State Department of Labor (NYSDOL)

1. 12 NYCRR, Part 56, "Asbestos"-Industrial Code Rule 56

C. New York State Department of Environmental Conservation (NYSDEC)

PART 2 - 6 NYCRR, Part 360 “Solid Waste Management Facilities”

PART 3 - 6 NYCRR, Part 364 “Waste Transporter Permits”

PART 4 - 6 NYCRR, Part 372 “Hazardous Waste Manifest System and Related

Standards for Generators, Transporters and Facilities 3

E. Local Requirements:
1. If local requirements are more stringent than federal or state standards, the local standards are to be followed.

D Standards:
2. Standards which govern asbestos abatement activities include, but are not limited to, the following:
   a. American National Standards Institute (ANSI)/ASSP Z9.2-2018 - Fundamentals Governing the Design and Operation of Local Exhaust Systems and ANSI/ASSE Z88.2-2015 - Practices for Respiratory Protection.
   b. Underwriters Laboratories (UL) 586-2009 - UL Standard for Safety of HEPA Filter Units, 9th Edition; ANSI Approval 2017-12-19.
3. Standards which govern encapsulation work include, but are not limited to the following:
   a. American Society for Testing and Materials International (ASTM)
4. Standards which govern the fire and safety concerns in abatement work include, but are not limited to, the following:
   a. National Fire Protection Association (NFPA) 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations.
   b. NFPA 701 - Standard Methods for Fire Tests for Flame Resistant Textiles and Film.
   c. NFPA 101 - Life Safety Code

F. EPA Guidance Documents:
1. EPA guidance documents which discuss asbestos abatement work activities are listed below. These documents are made part of this section by reference.
2. Guidance for Controlling ACM in Buildings (Purple Book) EPA 560/5-85-024
3. Asbestos Waste Management Guidance EPA 530-SW-85-007
4. A Guide to Respiratory Protection for the Asbestos Abatement Industry EPA-560-OPTS-86-001
5. Guide to Managing Asbestos in Place (Green Book) TS 799 20T July 1990

G. Notices:
1. State and Local agencies: Send written notification as required by State and Local regulations prior to beginning any work on ACM as follows:
2. Copies of notifications shall be submitted to the VA for the facility's records in the same time frame notification are given to EPA, State, and Local authorities.

H. Permits/Licenses: The contractor shall apply for and have all required permits and licenses to perform asbestos abatement work as required by Federal, State, and Local regulations.

I. Posting and Filing of Regulations: Maintain two (2) copies of applicable Federal, State, and Local regulations. Post one copy of each in the clean room at the regulated area where workers will have daily access to the regulations and keep another hard copy or electronic copy in the Contractor's office.

J. VA Responsibilities prior to commencement of work:

1. Notify occupants adjacent to regulated areas of project dates and requirements for relocation, if needed. Arrangements must be made prior to starting work for relocation of desks, files, equipment, and personal possessions to avoid unauthorized access into the regulated area. **Note: Notification of adjacent personnel is required by OSHA in 29 CFR 1926.1101 (k) to prevent unnecessary or unauthorized access to the regulated area**.
2. Submit to the Contractor results of background air sampling; including location of samples, person who collected the samples, equipment utilized, calibration data and method of analysis. During abatement, submit to the Contractor, results of bulk material analysis and air sampling data collected during the course of the abatement. This information shall not release the Contractor from any responsibility for OSHA compliance.

K. Emergency Action Plan and Arrangements:
1. An Emergency Action Plan shall be developed prior to commencing abatement activities and shall be agreed to by the Contractor and the VA. The Plan shall meet the requirements of 29 CFR 1926, Subpart C, Standard 1926.35 Employee Emergency Action Plans.
2. Emergency procedures shall be in written form and prominently posted in the clean room and equipment room of the decontamination unit. Everyone, prior to entering the regulated area, must read and sign these procedures to acknowledge understanding of the regulated area layout, location of emergency exits and emergency procedures.
3. Emergency planning shall include written notification of police, fire, and emergency medical personnel of planned abatement activities; work schedule; layout of regulated area; and access to the regulated area, particularly barriers that may affect response capabilities.
4. Emergency planning shall include consideration of fire, explosion, hazardous atmospheres, electrical hazards, slips/trips and falls, confined spaces, and heat stress illness. Written procedures for response to emergency situations shall be developed and employee training in procedures shall be provided.
5. Employees shall be trained in regulated area/site evacuation procedures in the event of workplace emergencies.
   a. For non-life-threatening situations - employees injured or otherwise incapacitated shall be decontaminated following normal procedures with assistance from fellow workers, if necessary, before exiting the regulated area to obtain proper medical treatment.
   b. For life-threatening injury or illness, worker decontamination shall take least priority after measures to stabilize the injured worker, medical personnel shall remove them from the regulated area if back or neck injury is present, and secure proper medical treatment.
6. Telephone numbers of any/all emergency response personnel shall be prominently posted in the clean room, along with the location of the nearest telephone.
7. The Contractor shall provide verification of first aid/CPR training for personnel responsible for providing first aid/CPR. OSHA requires medical assistance within 3-4 minutes of a life-threatening injury/illness. Bloodborne Pathogen training shall also be verified for those personnel required to provide first aid/CPR.
8. The Emergency Action Plan shall provide for a Contingency Plan in the event that an incident occurs that may require the modification of the standard operating procedures during abatement. Such incidents include, but are not limited to, fire; accident; power failure; negative pressure failure; and supplied air system failure. The Contractor shall detail procedures to be followed in the event of an incident assuring that asbestos abatement work is stopped and wetting is continued until correction of the problem.

L. Pre-Construction Meeting:
1. Prior to commencing the work, the Contractor shall meet with the contractor employed, VA Certified Industrial Hygienist (VPIH/CIH) to present and review, as appropriate, the items following this paragraph. The Contractor's Competent Person(s) who will be on-site shall participate in the pre-start meeting. The pre-start meeting is to discuss and

determine procedures to be used during the project. At this meeting, the Contractor shall provide:

a. Proof of Contractor licensing.
b. Proof the Competent Person(s) is trained and accredited and approved for working in this State. Verification of the experience of the Competent Person(s) shall also be presented.
c. A list of all workers who will participate in the project, including experience and verification of training and accreditation.
d. A list of and verification of training for all personnel who have current first-aid/CPR training. A minimum of one person per shift must have adequate training.
e. Current medical written opinions for all personnel working on-site meeting the requirements of 29 CFR 1926.1101 (m).
f. Current fit-tests for all personnel wearing respirators on-site meeting the requirements of 29 CFR 1926.1101 (h) and Appendix C.
g. A copy of the Contractor's Asbestos Hazard Abatement Plan. In these procedures, the following information must be detailed, specific for this project.
    1) Regulated area preparation procedures;
    2) Notification requirements procedure of Contractor as required in 29 CFR 1926.1101 (d) Multi-Employer Worksites;
    3) Decontamination area set-up/layout and decontamination procedures for employees;
    4) Abatement methods/procedures and equipment to be used;
    5) Personal protective equipment to be used.
h. At this meeting the Contractor shall provide all submittals as required.
i. Procedures for handling, packaging and disposal of asbestos waste.
j. Emergency Action Plan and Contingency Plan Procedures.

1.6 PROJECT COORDINATION

A. The following are the minimum administrative and supervisory personnel necessary for coordination of the work.

1. Personnel:
    a. Administrative and supervisory personnel shall consist of a qualified Competent Person(s) as defined by OSHA in the Construction Standards and the Asbestos Construction Standard; Contractor Professional Industrial Hygienist and Industrial Hygiene Technicians. These employees are the Contractor's representatives responsible for compliance with these specifications and all other applicable requirements.
    b. Non-supervisory personnel shall consist of an adequate number of qualified personnel to meet the schedule requirements of the project. Personnel shall meet required qualifications. Personnel utilized on-site shall be pre-approved by the VA representative. A request for approval shall be submitted for any person to be employed during the project giving the person's name; last four digits of social security number; qualifications; accreditation card with color picture, if required by state; Certificate of Worker's Acknowledgment; and Affidavit of Medical Surveillance and Respiratory Protection and current Respirator Fit Test.
    c. Minimum qualifications for Contractor and assigned personnel are:
        1) The Contractor has conducted within the last three (3) years, three (3) projects of similar complexity and dollar value as this project; has not been cited and penalized for serious violations of Federal (and State or Local as applicable) EPA and OSHA asbestos regulations in the past three (3) years; has adequate liability/occurrence insurance for asbestos work as required by the state; is licensed in applicable state; has adequate and qualified personnel available to complete the work; has comprehensive standard operating procedures for asbestos work; has adequate materials, equipment and supplies to perform the work.

2) The Competent Person has four (4) years of abatement experience of which two (2) years were as the Competent Person on the project; meets the OSHA definition of a Competent Person; has been the Competent Person on two (2) projects of similar size and complexity as this project within the past three (3) years; has completed EPA AHERA/OSHA/State/Local training requirements/accreditation(s) and refreshers; and has all required OSHA documentation related to medical and respiratory protection.
3) The Contractor Professional Industrial Hygienist/CIH (CPIH/CIH) shall have five (5) years of monitoring experience and supervision of asbestos abatement projects; has participated as senior IH on five (5) abatement projects, three (3) of which are similar in size and complexity as this project; has specialized EPA AHERA/OSHA training in asbestos abatement management, respiratory protection, waste disposal and asbestos inspection; has completed the NIOSH 582 Course or equivalent, Contractor/Supervisor course; and has appropriate medical/respiratory protection records/documentation.
4) The Abatement Personnel shall have completed the EPA AHERA/OSHA abatement worker course; have training on the standard operating procedures of the Contractor; has one year of asbestos abatement experience within the past three (3) years of similar size and complexity; has applicable medical and respiratory protection documentation; has certificate of training/current refresher and State accreditation/license.

d. All personnel shall be in compliance with OSHA construction safety training as applicable and submit certification.

1.7 RESPIRATORY PROTECTION

A. General - Respiratory Protection Program: The Contractor shall develop and implement a written Respiratory Protection Program (RPP) which is in compliance with OSHA requirements found at 29 CFR 1926.1101 and 29 CFR 1910.134. ANSI Standard Z88.2-2015 provides excellent guidance for developing a respiratory protection program. All respirators used must be NIOSH approved for asbestos abatement activities. The written RPP shall, at a minimum, contain the basic requirements found at 29 CFR 1910.134 (c) - Respiratory Protection Program.

B. Respiratory Protection Program Coordinator: The Respiratory Protection Program Coordinator (RPPC) must be identified and shall have two (2) years of experience coordinating RPP of similar size and complexity. The RPPC must submit a signed statement attesting to the fact that the program meets the above requirements.

C. Selection and Use of Respirators: The procedure for the selection and use of respirators must be submitted to the VA as part of the Contractor's qualifications. The procedure must be written clearly enough for workers to understand. A copy of the Respiratory Protection Program must be available in the clean room of the decontamination unit or in the onsite Contractor’s office, for reference by employees or authorized visitors.

D. Minimum Respiratory Protection: Shall be a ½-mask negative pressure air purifying respirator equipped with P100 filters, provided personal air samples in the workplace remain at or below 0.1 f/cc, determined as an 8-hour TWA. Full face powered air purifying respirator equipped with P100 filters shall be required until Contractor demonstrates that personal air samples are at or below 0.1 f/cc, determined as an 8-hour TWA. A higher level of respiratory protection shall be required, if fiber levels exceed 1 f/cc as an 8-hour TWA, inside the regulated work area. Respirator selection shall meet the requirements of 29 CFR 1926.1101 (h) and 29 CFR 1910.134 (d)(3)(i)(A) Table 1, except as indicated in this paragraph. Abatement personnel must have a respirator for their exclusive use.

E. Medical Written Opinion: No employee shall be allowed to wear a respirator unless a physician or other licensed health care professional has provided a written determination they are medically qualified to wear the class of respirator to be used on the project while wearing whole body impermeable garments and subjected to heat or cold stress.

F. Respirator Fit Test: All personnel wearing respirators shall have a current qualitative/quantitative fit test which was conducted in accordance with 29 CFR 1910.134 (f) and Appendix A. Quantitative fit tests shall be done for PAPRs which have been put into a motor/blower failure mode.

G. Respirator Fit Check: The Competent Person shall assure that the positive/negative pressure user seal check is done each time the respirator is donned by an employee. Head coverings must cover respirator head straps. Any situation that prevents an effective facepiece to face seal as evidenced by failure of a user seal check shall preclude that person from entering the regulated area until resolution of the problem.

H. Maintenance and Care of Respirators: The Respiratory Protection Program Coordinator shall submit evidence and documentation showing compliance with 29 CFR 1910.134 (h) Maintenance and Care of Respirators.

I. Supplied Air Systems: If a supplied air system is used, the system shall meet all requirements of 29 CFR 1910.134 and the ANSI/Compressed Gas Association (CGA) Commodity Specification for Air current requirements for Type 1 - Grade D breathing air. Low pressure systems are not allowed to be used on asbestos abatement projects. Supplied Air respirator use shall be in accordance with EPA/NIOSH publication EPA-560-OPTS-86-001 "A Guide to Respiratory Protection for the Asbestos Abatement Industry". The competent person on site will be responsible for the supplied air system to ensure the safety of the worker.

1.8 WORKER PROTECTION

A. Training of Abatement Personnel: Prior to beginning any abatement activity, all personnel shall be trained in accordance with OSHA 29 CFR 1926.1101 (k)(9) and any additional State/Local requirements. Training must include, at a minimum, the elements listed at 29 CFR 1926.1101 (k)(9)(viii). Training shall have been conducted by a third party, EPA/State approved trainer meeting the requirements of EPA 40 CFR 763 Appendix C (AHERA MAP). Initial training certificates and current refresher and accreditation proof must be submitted for each person working at the site.

B. Medical Examinations: Medical examinations meeting the requirements of 29 CFR 1926.1101 (m) shall be provided for all personnel working in the regulated area, regardless of exposure levels. A current physician's written opinion as required by 29 CFR 1926.1101 (m)(4) shall be provided for each person and shall include in the medical opinion that the person has been evaluated for working in a heat and cold stress environment while wearing personal protective equipment (PPE) and is able to perform the work without risk of material health impairment.

C. Regulated Area Entry Procedure: The Competent Person shall ensure that each time workers enter the regulated area; they remove ALL street clothes in the clean room of the decontamination unit and put on new disposable coveralls, head coverings, a clean respirator, and then proceed through the shower room to the equipment room where they put on non-disposable required personal protective equipment.

D. Decontamination Procedure: The Competent Person shall require all personnel to adhere to following decontamination procedures whenever they leave the regulated area.
   1. When exiting the regulated area, remove disposable coveralls, and ALL other clothes, disposable head coverings, and foot coverings or boots in the equipment room.
   2. Still wearing the respirator and completely naked, proceed to the shower. Showering is MANDATORY. Care must be taken to follow reasonable procedures in removing the respirator to avoid inhaling asbestos fibers while showering. The following procedure is required as a minimum:
      a. Thoroughly wet body including hair and face. If using a PAPR hold blower above head to keep filters dry.
      b. With respirator still in place, thoroughly decontaminate body, hair, respirator face piece, and all other parts of the respirator except the blower and battery pack on a PAPR. Pay particular attention to cleaning the seal between the face and respirator facepiece and under the respirator straps.

c. Take a deep breath, hold it and/or exhale slowly, completely wetting hair, face, and respirator. While still holding breath, remove the respirator and hold it away from the face before starting to breathe.

3. Carefully decontaminate the facepiece of the respirator inside and out. If using a PAPR, shut down using the following sequence: a) first cap inlets to filters; b) turn blower off to keep debris collected on the inlet side of the filter from dislodging and contaminating the outside of the unit; c) thoroughly decontaminate blower and hoses; d) carefully decontaminate battery pack with a wet rag being cautious of getting water in the battery pack thus preventing destruction. **(THIS PROCEDURE IS NOT A SUBSTITUTE FOR RESPIRATOR CLEANING!)**
4. Shower and wash body completely with soap and water. Rinse thoroughly.
5. Rinse shower room walls and floor to drain prior to exiting.
6. Proceed from shower to clean room; dry off and change into street clothes or into new disposable work clothing.

E. Regulated Area Requirements: The Competent Person shall meet all requirements of 29 CFR 1926.1101 (o) and assure that all requirements for regulated areas at 29 CFR 1926.1101 (e) are met. All personnel in the regulated area shall not be allowed to eat, drink, smoke, chew tobacco or gum, apply cosmetics, or in any way interfere with the fit of their respirator.

1.9 DECONTAMINATION FACILITIES

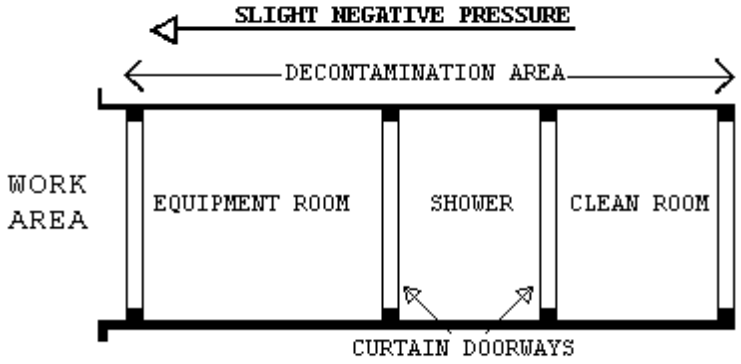
A. Description: Provide each regulated area with separate personnel decontamination facilities (PDF) and waste/equipment decontamination facilities (W/EDF). Ensure that the PDF are the only means of ingress and egress to the regulated area and that all equipment, bagged waste, and other material exit the regulated area only through the W/EDF.

B. General Requirements: All personnel entering or exiting a regulated area must go through the PDF and shall follow the requirements at 29 CFR 1926.1101 (j)(1) and these specifications. All waste, equipment and contaminated materials must exit the regulated area through the W/EDF and be decontaminated in accordance with these specifications. Walls and ceilings of the PDF and W/EDF must be constructed of a minimum of 3 layers of 6-mil opaque fire retardant polyethylene sheeting and be securely attached to existing building components and/or an adequate temporary framework. A minimum of 3 layers of 6-mil poly shall also be used to cover the floor under the PDF and W/EDF units. Construct doors so that they overlap and secure to adjacent surfaces. Weight inner doorway sheets with layers of duct tape or approved equivalent so that they close quickly after release. Put arrows on sheets so they show direction of travel and overlap. If the building adjacent area is occupied, construct a solid barrier on the occupied side(s) to protect the sheeting and reduce potential for non-authorized personnel entering the regulated area.

C. Temporary Facilities to the PDF and W/EDF: The Competent Person shall provide temporary water service connections to the PDF and W/EDF. Backflow prevention must be provided at the point of connection to the VA system. Water supply must be of adequate pressure and meet requirements of 29 CFR 1910.141(d)(3). Provide adequate temporary overhead electric power with ground fault circuit interruption (GFCI) protection. Provide a sub-panel equipped with GFCI protection for all temporary power in the clean room. Provide adequate lighting to provide a minimum of 50 foot candles in the PDF and W/EDF. Provide temporary heat, if needed, to maintain 70 degrees F throughout the PDF and W/EDF.

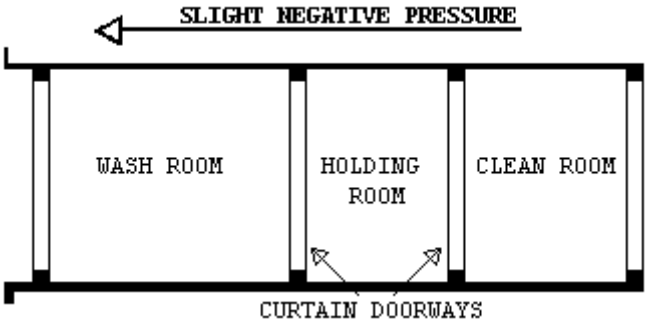
D. Personnel Decontamination Facility (PDF): The Competent Person shall provide a PDF consisting of shower room which is contiguous to a clean room and equipment room which is connected to the regulated area. The PDF must be sized to accommodate the number of personnel scheduled for the project. The shower room, located in the center of the PDF, shall be fitted with as many portable showers as necessary to ensure all employees can complete the entire decontamination procedure within 15 minutes. The PDF shall be constructed of opaque poly for privacy. The PDF shall be constructed to eliminate any parallel routes of egress without showering.

1. Clean Room: The clean room must be physically and visually separated from the rest of the building to protect the privacy of personnel changing clothes. The clean room shall be constructed of at least 3 layers of 6-mil opaque fire retardant poly to provide an air tight room. Provide a minimum of 2 - 900 mm (3 foot) wide 6-mil poly opaque fire retardant doorways. One doorway shall be the entry from outside the PDF and the second doorway shall be to the shower room of the PDF. The floor of the clean room shall be maintained in a clean, dry and sanitary condition. Shower overflow shall not be allowed into the clean room. Provide 1 storage locker per person. A portable fire extinguisher, minimum 10 pounds capacity, Type ABC, shall be provided in accordance with OSHA and NFPA Standard 10. All persons entering the regulated area shall remove all street clothing in the clean room and dress in disposable protective clothing and respiratory protection. Any person entering the clean room does so either from the outside with street clothing on or is coming from the shower room completely naked and thoroughly washed. Male/Females required to enter the regulated area shall be ensured of their privacy throughout the entry/exit process by posting guards at both entry points to the PDF so no male/female can enter or exit the PDF during his/her stay in the PDF.
2. Shower Room: The Competent Person shall assure that the shower room is a completely water tight compartment to be used for the movement of all personnel from the clean room to the equipment room and for the showering of all personnel going from the equipment room to the clean room. Each shower shall be constructed so water runs down the walls of the shower and into a drip pan. Install a freely draining smooth floor on top of the shower pan. The shower room shall be separated from the rest of the building and from the clean room and equipment room using air tight walls made from at least 3 layers of 6-mil opaque fire retardant poly. The shower shall be equipped with a shower head and controls, hot and cold water, drainage, soap dish and continuous supply of soap, and shall be maintained in a sanitary condition throughout its use. The controls shall be arranged so an individual can shower without assistance. Provide a flexible hose shower head, hose bibs and all other items shown on Shower Schematic. Waste water will be pumped to a drain after being filtered through a minimum of a 100 micron sock in the shower drain; a 20 micron filter; and a final 5 micron filter. Filters will be changed a minimum of daily or more often as needed. Filter changes must be done in the shower to prevent loss of contaminated water. Hose down all shower surfaces after each shift and clean any debris from the shower pan. Residue is to be disposed of as asbestos waste.
3. Equipment Room: The Competent Person shall provide an equipment room which shall be an air tight compartment for the storage of work equipment/tools, reusable personal protective equipment, except for a respirator and for use as a gross decontamination area for personnel exiting the regulated area. The Competent Person shall ensure that most gross contamination is removed from the outside of PPE, suits and respirators in the regulated work area, prior to entering the Equipment Room. The equipment room shall be separated from the regulated area by a minimum 3 foot wide door made with 2 layers of 6-mil opaque fire retardant poly. The equipment room shall be separated from the regulated area, the shower room and the rest of the building by air tight walls and ceiling constructed of a minimum of 3 layers of 6-mil opaque fire retardant poly. Damp wipe all surfaces of the equipment room after each shift change. Provide an additional loose layer of 6-mil fire retardant poly per shift change and remove this layer after each shift. If needed, provide a temporary electrical sub-panel equipped with GFCI in the equipment room to accommodate any equipment required in the regulated area.
4. The PDF shall be as follows: Clean room at the entrance followed by a shower room followed by an equipment room leading to the regulated area. Each doorway in the PDF shall be a minimum of 2 layers of 6-mil opaque fire retardant poly.



E. Waste/Equipment Decontamination Facility (W/EDF):

1. The Competent Person shall provide a W/EDF consisting of a wash room, holding room, and clean room for removal of waste, equipment and contaminated material from the regulated area. Personnel shall not enter or exit the W/EDF except in the event of an emergency. Clean debris and residue in the W/EDF daily. All surfaces in the W/EDF shall be wiped/hosed down after each shift and all debris shall be cleaned from the shower pan. The W/EDF shall consist of the following:
   a. Wash Down Station: Provide an enclosed shower unit in the regulated area just outside the Wash Room as an equipment bag and container cleaning station.
   b. Wash Room: Provide a wash room for cleaning of bagged or containerized asbestos containing waste materials passed from the regulated area. Construct the wash room using 50 x 100 mm (2 inches x 4 inches) wood framing or approved equivalent and 3 layers of 6-mil fire retardant poly. Locate the wash room so that packaged materials, after being wiped clean, can be passed to the Holding Room. Doorways in the wash room shall be constructed of 2 layers of 6-mil fire retardant poly.
   c. Holding Room: Provide a holding room as a drop location for bagged materials passed from the wash room. Construct the holding room using 50 x 100 mm (2 inches x 4 inches) wood framing or approved equivalent and 3 layers of 6-mil fire retardant poly. The holding room shall be located so that bagged material cannot be passed from the wash room to the clean room unless it goes through the holding room. Doorways in the holding room shall be constructed of 2 layers of 6-mil fire retardant poly.
   d. Clean Room: Provide a clean room to isolate the holding room from the exterior of the regulated area. Construct the clean room using 2 inches x 4 inches wood framing or approved equivalent and 2 layers of 6-mil fire retardant poly. The clean room shall be located so as to provide access to the holding room from the building exterior. Doorways to the clean room shall be constructed of 2 layers of 6-mil fire retardant poly. When a negative pressure differential system is used, a rigid enclosure separation between the W/EDF clean room and the adjacent areas shall be provided.
   e. The W/EDF shall be as follows: Wash Room leading to a Holding Room followed by a Clean Room leading to outside the regulated area. See diagram.



F. Waste/Equipment Decontamination Procedures: At the washdown station in the regulated area, thoroughly wet clean contaminated equipment and/or sealed polyethylene bags and pass into Wash Room after visual inspection. When passing anything into the Wash Room, close all doorways of the W/EDF, other than the doorway between the washdown station and the Wash Room. Keep all outside personnel clear of the W/EDF. Once inside the Wash Room, wet clean the equipment and/or bags. After cleaning and inspection, pass items into the Holding Room. Close all doorways except the doorway between the Holding Room and the Clean Room. Workers from the Clean Room/Exterior shall enter the Holding Room and remove the decontaminated/cleaned equipment/bags for removal and disposal. At no time shall personnel from the clean side be allowed to enter the Wash Room.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. General Requirements: Prior to the start of work, the contractor shall provide and maintain a sufficient quantity of materials and equipment to assure continuous and efficient work throughout the duration of the project. Work shall not start unless the following items have been delivered to the site and the CPIH/CIH has submitted verification to the VA's representative.

1. All materials shall be delivered in their original package, container or bundle bearing the name of the manufacturer and the brand name (where applicable).
2. Store all materials subject to damage off the ground, away from wet or damp surfaces and under cover sufficient enough to prevent damage or contamination. Flammable and combustible materials cannot be stored inside buildings. Replacement materials shall be stored outside of the regulated area until abatement is completed.
3. The Contractor shall not block or hinder use of buildings by patients, staff, and visitors to the VA in partially occupied buildings by placing materials/equipment in any unauthorized location.
4. The Competent Person shall inspect for damaged, deteriorating or previously used materials. Such materials shall not be used and shall be removed from the worksite and disposed of properly.
5. Polyethylene sheeting for walls in the regulated area shall be a minimum of 4-mils. For floors and all other uses, sheeting of at least 6-mil shall be used in widths selected to minimize the frequency of joints. Fire retardant poly shall be used throughout.
6. The method of attaching polyethylene sheeting shall be agreed upon in advance by the Contractor and the VA and selected to minimize damage to equipment and surfaces. Method of attachment may include any combination of moisture resistant duct tape, poly tape, furring strips, spray glue, staples, nails, screws, lumber and plywood for enclosures or approved equivalent procedures capable of sealing polyethylene to dissimilar finished or unfinished surfaces under both wet and dry conditions.
7. Polyethylene sheeting utilized for the PDF shall be opaque white or black in color, 6-mil fire retardant poly.

8. Installation and plumbing hardware, showers, hoses, drain pans, sump pumps and waste water filtration system shall be provided by the Contractor.
9. An adequate number of HEPA vacuums, scrapers, sprayers, nylon brushes, brooms, disposable mops, rags, sponges, staple guns, shovels, ladders and scaffolding of suitable height and length as well as meeting OSHA requirements, fall protection devices, water hose to reach all areas in the regulated area, airless spray equipment, and any other tools, materials or equipment required to conduct the abatement project. All electrically operated hand tools, equipment, electric cords shall be connected to GFCI protection.
10. Special protection for objects in the regulated area shall be detailed (e.g., plywood over carpeting or hardwood floors to prevent damage from scaffolds, water and falling material).
11. Disposal bags – 2 layers of 6-mil poly for asbestos waste shall be pre-printed with labels, markings and address as required by OSHA, EPA and DOT regulations.
12. The VA shall be provided an advance copy of the Safety Data Sheets (SDS) as required for all hazardous chemicals under OSHA 29 CFR 1910.1200 - Hazard Communication in the pre-start meeting submittal. Chlorinated compounds shall not be used with any spray adhesive, mastic remover or other product. Appropriate encapsulant(s) shall be provided.
13. OSHA DANGER demarcation signs, as many and as required by OSHA 29 CFR 1926.1101(k)(7) shall be provided and placed by the Competent Person. All other posters and notices required by Federal and State regulations shall be posted in the Clean Room.
14. Adequate and appropriate PPE for the project and number of personnel/shifts shall be provided. All personal protective equipment issued must be based on a written hazard assessment conducted under 29 CFR 1910.132(d).

2.2 MONITORING, INSPECTION AND TESTING

A. General:

1. Perform throughout abatement work monitoring, inspection and testing inside and around the regulated area in accordance with the OSHA requirements and these specifications. OSHA requires that the employee exposure to asbestos must not exceed 0.1 fiber per cubic centimeter (f/cc) of air, averaged over an 8-hour work shift. The CPIH/CIH is responsible for and shall inspect and oversee the performance of the Contractor IH Technician. The IH Technician shall continuously inspect and monitor conditions inside the regulated area to ensure compliance with these specifications. In addition, the CPIH/CIH shall personally manage air sample collection, analysis, and evaluation for personnel, regulated area, and adjacent area samples inside the building, but outside the regulated area. Inside the building, but outside the regulated area air samples shall be collected in the Clean Room of the PDF, at the approximate location of HEPA exhaust discharge, and at a minimum of three (3) locations in areas immediately outside the regulated work area to satisfy this specification. Additional inspection and testing requirements are also indicated in other parts of this specification.
2. The VA will employ an independent industrial hygienist (VPIH/CIH) consultant and/or use its own IH to perform various services on behalf of the VA. The VPIH/CIH will perform the necessary monitoring, inspection, testing, and other support services to ensure that VA patients, employees, and visitors will not be adversely affected by the abatement work, and that the abatement work proceeds in accordance with these specifications, that the abated areas or abated buildings have been successfully decontaminated. The work of the VPIH/CIH consultant in no way relieves the Contractor from their responsibility to perform the work in accordance with contract/specification requirements, to perform continuous inspection, monitoring and testing for the safety of their employees, and to perform other such services as specified. The cost of the VPIH/CIH and their services will be borne by the VA except for any repeat of final inspection and testing that may be required due to unsatisfactory initial results. Any repeated final inspections and/or testing, if required, will be paid for by the Contractor.

3. If fibers counted by the VPIH/CIH during abatement work, either inside or outside the regulated area, utilizing the NIOSH 7400 air monitoring method, exceed the specified respective limits, the Contractor shall stop work. The Contractor may request confirmation of the results by analysis of the samples by TEM. Request must be in writing and submitted to the VA's representative. Cost for the confirmation of results will be borne by the Contractor for both the collection and analysis of samples and for the time delay that may/does result for this confirmation. Confirmation sampling and analysis will be the responsibility of the CPIH/CIH with review and approval of the VPIH/CIH. An agreement between the CPIH/CIH and the VPIH/CIH shall be reached on the exact details of the confirmation effort, in writing, including such things as the number of samples, location, collection, quality control on-site, analytical laboratory, interpretation of results and any follow-up actions. This written agreement shall be co-signed by the IH's and delivered to the VA's representative.

B. Scope of Services of the VPIH/CIH Consultant:
1. The purpose of the work of the VPIH/CIH is to: assure quality; adherence to the specification; resolve problems; prevent the spread of contamination beyond the regulated area; and assure clearance at the end of the project. In addition, their work includes performing the final inspection and testing to determine whether the regulated area or building has been adequately decontaminated. All air monitoring is to be done utilizing PCM/TEM. The VPIH/CIH will perform the following tasks:
   a. Task 1: Establish background levels before abatement begins by collecting background samples. Retain samples for possible TEM analysis.
   b. Task 2: Perform representative air monitoring, inspection, and testing outside the regulated area during actual abatement work to detect any faults in the regulated area isolation and any adverse impact on the surroundings from regulated area activities.
   c. Task 3: Perform unannounced visits to spot check overall compliance of work with contract/specifications. These visits may include any inspection, monitoring, and testing inside and outside the regulated area and all aspects of the operation except personnel monitoring.
   d. Task 4: Provide support to the VA representative such as evaluation of submittals from the Contractor, resolution of conflicts, interpret data, etc.
   e. Task 5: Perform, in the presence of the VA representative, final inspection and testing of a decontaminated regulated area at the conclusion of the abatement to certify compliance with all regulations and VA requirements/specifications.
   f. Task 6: Issue certificate of decontamination for each regulated area and project report.
2. All documentation, inspection results and testing results generated by the VPIH/CIH will be available to the Contractor for information and consideration. The Contractor shall cooperate with and support the VPIH/CIH for efficient and smooth performance of their work.
3. The monitoring and inspection results of the VPIH/CIH will be used by the VA to issue any Stop Removal orders to the Contractor during abatement work and to accept or reject a regulated area or building as decontaminated.

C. Monitoring, Inspection and Testing by Contractor CPIH/CIH: The Contractor’s CPIH/CIH is responsible for managing all monitoring, inspections, and testing required by these specifications, as well as any and all regulatory requirements adopted by these specifications. The CPIH/CIH is responsible for the continuous monitoring of all subsystems and procedures which could affect the health and safety of the Contractor’s personnel. Safety and health conditions and the provision of those conditions inside the regulated area for all persons entering the regulated area is the exclusive responsibility of the Contractor/Competent Person. The person performing the personnel and area air monitoring inside the regulated area shall be an IH Technician, who shall be trained and shall have specialized field experience in sampling and analysis. The IH Technician shall have successfully completed a NIOSH 582 Course or equivalent and provide documentation. The IH Technician shall participate in the AIHA

Asbestos Analysis Registry or participate in the Proficiency Analytical Testing program of AIHA for fiber counting quality control assurance. The IH Technician shall also be an accredited EPA AHERA/State Contractor/Supervisor and Building Inspector. The IH Technician shall have participated in five abatement projects collecting personal and area samples and have experience in substantially similar projects in size and scope. The analytical laboratory used by the Contractor to analyze the samples shall be AIHA accredited for asbestos PAT and approved by the VA prior to start of the project. A daily log shall be maintained by the CPIH/CIH or IH Technician, documenting all OSHA requirements for personal and area air monitoring for asbestos in 29 CFR 1926.1101(f), (g) and Appendix A. This log shall be made available to the VA representative and the VPIH/CIH upon request. The log will contain, at a minimum, information on personnel or area samples, other persons represented by the sample, the date of sample collection, start and stop times for sampling, sample volume, flow rate, and fibers/cc. The CPIH/CIH shall collect and analyze samples for each representative job being done in the regulated area, i.e., removal, wetting, clean-up, and load-out. No fewer than two (2) personal air samples or 25 percent of representative workforce per shift shall be collected, whichever is greater, in the regulated area; a minimum of three (3) area air samples at locations inside the building but immediately outside the regulated work area; one (1) area air sample shall be collected daily in the Clean Room of the PDF; and one (1) area air sample shall be collected daily at the approximate location of HEPA exhaust discharge. In addition to the continuous monitoring required, the CPIH/CIH will perform inspection and testing at the final stages of abatement for each regulated area as specified in the CPIH/CIH responsibilities. Additionally, the CPIH/CIH will monitor and record pressure readings within the containment daily with a minimum of two readings at the beginning and at the end of a shift, and submit the data in the daily report.

2.3 ASBESTOS HAZARD ABATEMENT PLAN

A. The Contractor shall have an established an Asbestos Hazard Abatement Plan (AHAP) in printed form and loose leaf folder consisting of simplified text, diagrams, sketches, and pictures that establish and explain clearly the procedures to be followed during all phases of the work by the Contractor's personnel. The AHAP must be modified as needed to address specific requirements of this project and the specifications. The AHAP shall be submitted for review and approval to the VA prior to the start of any abatement work. The minimum topics and areas to be covered by the AHAPs are:

1. Minimum Personnel Qualifications
2. Emergency Action Plan/Contingency Plans and Arrangements
3. Security and Safety Procedures
4. Respiratory Protection/Personal Protective Equipment Program and Training
5. Medical Surveillance Program and Recordkeeping
6. Regulated Area Requirements - Containment Barriers/Isolation of Regulated Area
7. Decontamination Facilities and Entry/Exit Procedures (PDF and W/EDF)
8. Negative Pressure Systems Requirements
9. Monitoring, Inspections, and Testing
10. Removal Procedures for ACM
11. Removal of Contaminated Soil (if applicable)
12. Encapsulation Procedures for ACM
13. Disposal of ACM waste/equipment
14. Regulated Area Decontamination/Clean-up
15. Regulated Area Visual and Air Clearance
16. Project Completion/Closeout

2.4 SUBMITTALS

A. Pre-Start Meeting Submittals:

1. Submit to the VA a minimum of 14 days prior to the pre-start meeting the following for review and approval. Meeting this requirement is a prerequisite for the pre-start meeting for this project:

a. Submit a detailed work schedule for the entire project reflecting contract documents and the phasing/schedule requirements from the CPM chart.
b. Submit a staff organization chart showing all personnel who will be working on the project and their capacity/function. Provide their qualifications, training, accreditations, and licenses, as appropriate. Provide a copy of the "Certificate of Worker's Acknowledgment" and the "Affidavit of Medical Surveillance and Respiratory Protection" for each person.
c. Submit Asbestos Hazard Abatement Plan developed specifically for this project, incorporating the requirements of the specifications, prepared, signed and dated by the CPIH/CIH.
d. Submit the specifics of the materials and equipment to be used for this project with manufacturer names, model numbers, performance characteristics, pictures/diagrams, and number available for the following:
    1) Supplied air system, negative air machines, HEPA vacuums, air monitoring pumps, calibration devices, pressure differential monitoring device and emergency power generating system.
    2) Waste water filtration system, shower system, containment barriers.
    3) Encapsulants, surfactants, hand held sprayers, airless sprayers, glovebags, and fire extinguishers.
    4) Respirators, protective clothing, fall protection and other required personal protective equipment.
    5) Fire safety equipment to be used in the regulated area.
e. Submit the name, location, and phone number of the approved landfill; proof/verification the landfill is approved for ACM disposal; the landfill's requirements for ACM waste; the type of vehicle to be used for transportation; and name, address, and phone number of subcontractor, if used. Proof of asbestos training for transportation personnel shall be provided.
f. Submit required notifications and arrangements made with regulatory agencies having regulatory jurisdiction and the specific contingency/emergency arrangements made with local health, fire, ambulance, hospital authorities and any other notifications/arrangements.
g. Submit the name, location and verification of the laboratory and/or personnel to be used for analysis of air and/or bulk samples. Personal air monitoring must be done in accordance with OSHA 29 CFR 1926.1101(f) and Appendix A. Area or clearance air monitoring shall be conducted in accordance with EPA AHERA protocols.
h. Submit qualifications verification: Submit the following evidence of qualifications. Make sure that all references are current and verifiable by providing current phone numbers and documentation.
    1) Asbestos Abatement Company: Project experience within the past 3 years; listing projects first most similar to this project: Project Name; Type of Abatement; Duration; Cost; Reference Name/Phone Number; Final Clearance; Completion Date
    2) List of project(s) halted by owner, A/E, IH, regulatory agency in the last 3 years: Project Name; Reason; Date; Reference Name/Number; Resolution
    3) List asbestos regulatory citations (e.g., OSHA), notices of violations (e.g., Federal and state EPA), penalties, and legal actions taken against the company including the company’s officers (including damages paid) in the last 3 years. Provide copies and all information needed for verification.
i. Submit information on personnel: Provide a resume; address each item completely; copies of certificates, accreditations, and licenses. Submit an affidavit signed by the CPIH/CIH stating that all personnel submitted below have medical records in accordance with OSHA 29 CFR 1926.1101(m) and that the company has implemented a medical surveillance program and written respiratory protection program, and maintains recordkeeping in accordance with the above regulation. Submit the phone number and doctor/clinic/hospital used for medical evaluations.

1) CPIH/CIH and IH Technician: Name; years of abatement experience; list of projects similar to this one; certificates, licenses, accreditations for proof of AHERA/OSHA specialized asbestos training; professional affiliations; medical opinion; and current respirator fit test.
2) Competent Person(s)/Supervisor(s): Number; names; last four digits of social security numbers; years of abatement experience as Competent Person/Supervisor; list of similar projects in size/complexity as Competent Person/Supervisor; as a worker; certificates, licenses, accreditations; proof of AHERA/OSHA specialized asbestos training; maximum number of personnel supervised on a project; medical opinion (asbestos surveillance and respirator use); and current respirator fit test.
3) Workers: Numbers; names; last four digits of social security numbers; years of abatement experience; certificates, licenses, accreditations; training courses in asbestos abatement and respiratory protection; medical opinion (asbestos surveillance and respirator use); and current respirator fit test.

j. Submit copies of State license for asbestos abatement; copy of insurance policy, including exclusions with a letter from agent stating in plain language the coverage provided and the fact that asbestos abatement activities are covered by the policy; copy of AHAPs incorporating the requirements of this specification; information on who provides your training, how often; who provides medical surveillance, how often; who performs and how is personal air monitoring of abatement workers conducted; a list of references of independent laboratories/IH's familiar with your air monitoring and standard operating procedures; and copies of monitoring results of the five referenced projects listed and analytical methods used.

k. Rented equipment must be decontaminated prior to returning to the rental agency.

l. Submit, before the start of work, the manufacturer's technical data for all types of encapsulants, all SDS and application instructions.

B. Submittals During Abatement:

1. The Competent Person shall maintain and submit a daily log at the regulated area documenting the dates and times of the following: purpose, attendees and summary of meetings; all personnel entering/exiting the regulated area; document and discuss the resolution of unusual events such as barrier breeching, equipment failures, emergencies, and any cause for stopping work; and representative air monitoring and results/TWA's/EL's. Submit this information daily to the VA's representative.
2. The CPIH/CIH shall document and maintain the inspection and approval of the regulated area preparation prior to start of work and daily during work.
   a. Removal of any poly barriers.
   b. Visual inspection/testing by the CPIH/CIH or IH Technician prior to application of lockdown encapsulant.
   c. Packaging and removal of ACM waste from regulated area.
   d. Disposal of ACM waste materials; copies of Waste Shipment Records/landfill receipts to the VA's representative on a weekly basis.

C. Submittals at Completion of Abatement: The CPIH/CIH shall submit a project report consisting of the daily log book requirements and documentation of events during the abatement project including Waste Shipment Records signed by the landfill's agent. It will also include information on the containment and transportation of waste from the containment with applicable Chain of Custody forms. The report shall include a certificate of completion, signed and dated by the CPIH/CIH, in accordance with Attachment #1. All clearance and perimeter area samples must be submitted. The VA representative will retain the abatement report after completion of the project and provide copies of the abatement report to VAMC Office of Engineer and the Safety Office.

2.5 ENCAPSULANTS

A. Types of Encapsulants:

1. The following four types of encapsulants, if used, must comply with performance requirements as stated in paragraph 2.5.2:
   a. Removal encapsulant - used as a wetting agent to remove ACM.
   b. Bridging encapsulant - provides a tough, durable coating on ACM.
   c. Penetrating encapsulant - penetrates/encapsulates ACM at least 13 mm (1/2 inches).
   d. Lockdown encapsulant - seals microscopic fibers on surfaces after ACM removal.

B. Performance Requirements:
1. Encapsulants shall meet the latest requirements of EPA; shall not contain toxic or hazardous substances; or solvents; and shall comply with the following performance requirements:
   a. General Requirements for all Encapsulants:
      1) ASTM E84: Flame spread of 25; smoke emission of 50.
      2) University of Pittsburgh Protocol: Combustion Toxicity; zero mortality.
      3) ASTM C732: Accelerated Aging Test; Life Expectancy - 20 years.
      4) ASTM E96: Permeability - minimum of 0.4 perms.
   b. Bridging/Penetrating Encapsulants:
      1) ASTM E736: Cohesion/Adhesion Test - 24 kPa (50 pounds/square foot).
      2) ASTM E119: Fire Resistance - 3 hours (Classified by UL for use on fibrous/cementitious fireproofing).
      3) ASTM D2794: Gardner Impact Test; Impact Resistance - minimum 11.5 kg-mm (43 in/lb).
      4) ASTM D522: Mandrel Bend Test; Flexibility - no rupture or cracking.
   c. Lockdown Encapsulants:
      1) ASTM E119: Fire resistance - 3 hours (tested with fireproofing over encapsulant applied directly to steel member).
      2) ASTM E736: Bond Strength - 48 kPa (100 pounds/square foot) (test compatibility with cementitious and fibrous fireproofing).
      3) In certain situations, encapsulants may have to be applied to hot pipes/equipment. The encapsulant must be able to withstand high temperatures without cracking or creating any noxious gaseous or vapors during or after application.

C. Certificates of Compliance: The Contractor shall submit to the VA representative certification from the manufacturer indicating compliance with performance requirements for encapsulants when applied according to manufacturer recommendations.

PART 3 - EXECUTION

3.1 REGULATED AREA PREPARATIONS

A. Site Security:
1. Regulated area access is to be restricted only to authorized, trained/accredited and protected personnel. These may include the Contractor's employees, employees of Subcontractors, VA employees and representatives, State and Local inspectors, and any other designated individuals. A list of authorized personnel shall be established prior to commencing the project and be posted in the clean room of the decontamination unit.
2. Entry into the regulated area by unauthorized individuals shall be reported immediately to the Competent Person by anyone observing the entry. The Competent Person shall immediately require any unauthorized person to leave the regulated area and then notify the VA Contracting Officer or VA Representative using the most expeditious means.
3. A log book shall be maintained in the clean room of the decontamination unit. Anyone who enters the regulated area must record their name, affiliation, time in, and time out for each entry.

4. Access to the regulated area shall be through a single decontamination unit. All other access (doors, windows, hallways, etc.) shall be sealed and demarcated as an asbestos regulated work area to prevent entry to or exit from the regulated area unless in the event of an emergency. The only exceptions for this requirement are the waste/equipment load-out area which shall be sealed except during the removal of containerized asbestos waste from the regulated area, and emergency exits. Emergency exits shall not be locked from the inside; however, they shall be sealed with poly sheeting and taped until needed. In any situation where exposure to high temperatures which may result in a flame hazard, fire retardant poly sheeting must be used.
5. The Contractor's Competent Person shall control site security during abatement operations in order to isolate work in progress and protect adjacent personnel. A 24-hour security system shall be provided at the entrance to the regulated area to assure that all entrants are logged in/out and that only authorized personnel are allowed entrance.
6. The Contractor will have the VA's assistance in notifying adjacent personnel of the presence, location and quantity of ACM in the regulated area and enforcement of restricted access by the VA's employees.
7. The regulated area shall be locked during non-working hours and secured by VA Representative or Competent Person. The VA Police shall be informed of asbestos abatement regulated areas to provide security checks during facility rounds and emergency response.

B. Signage and Power Management:
1. Post OSHA DANGER signs meeting the specifications of OSHA 29 CFR 1926.1101 at any location and approaches to the regulated area. Signs shall be posted at a distance sufficiently far enough away from the regulated area to permit any personnel to read the sign and take the necessary measures to avoid exposure. Additional signs will be posted following construction of the regulated area enclosure.
2. Shut down and lock out/tag out electric power to the regulated area. Provide temporary power and lighting. Ensure safe installation including GFCI of temporary power sources and equipment by compliance with all applicable electrical code and OSHA requirements for temporary electrical systems. Electricity shall be provided by the VA.
3. Shut down and lock out/tag out heating, cooling, and air conditioning system (HVAC) components that are in, supply or pass through the regulated area. Investigate the regulated area and agree on pre-abatement condition with the VA's representative. Seal all intake and exhaust vents in the regulated area with duct tape and 2 layers of independently installed 6-mil poly. Also, seal any seams in system components that pass through the regulated area. Remove all contaminated HVAC system filters and place in labeled 6-mil polyethylene disposal bags for staging and eventual disposal as asbestos waste.

C. Negative Pressure Filtration System:
1. The Contractor shall provide enough HEPA negative air machines to effect $\geq$ - 0.02 inch WCG pressure differential inside the regulated work area. The Competent Person shall determine the number of units needed for the regulated area by dividing the cubic feet in the regulated area by 15 and then dividing that result by the cubic feet per minute (CFM) for each unit to determine the number of units needed to effect $\geq$ - 0.02 inch WCG pressure inside the regulated work area. Provide standby units in the event of machine failure and/or emergency in an adjacent area. HEPA equipped negative air machines shall be discharged outside of the building a minimum of 30 feet from building make-up air, doors, open windows, patients, visitors and staff. Contractor shall provide “firewatch when negative machines are operational and there is no active abatement occurring.
2. NIOSH has done extensive studies and has determined that negative air machines typically operate at ~50 percent efficiency. The contractor shall consider this in their determination of number of units needed to provide $\geq$ - 0.02 inch WCG pressure differential inside the regulated work area. The contractor shall use double the number of machines, based on their calculations, or submit proof their machines operate at stated capacities, at a 2 inches pressure drop across the filters.

3. Design and Layout:
   a. Before start of work submit the design and layout of the regulated area and the negative air machines. The submittal shall indicate the number of, location of and size of negative air machines. The point(s) of exhaust, air flow within the regulated area, anticipated negative pressure differential, and supporting calculations for sizing shall be provided. In addition, submit the following:
      1) Method of supplying power to the units and designation/location of the panels.
      2) Description of testing method(s) for correct air volume and pressure differential.
      3) If auxiliary power supply is to be provided for the negative air machines, provide a schematic diagram of the power supply and manufacturer's data on the generator and switch.
4. Negative Air Machines (Hepa Units):
   a. Negative Air Machine Cabinet: The cabinet shall be constructed of steel or other durable material capable of withstanding potential damage from rough handling and transportation. The width of the cabinet shall be less than 30 inches in order to fit in standard doorways. The cabinet must be factory sealed to prevent asbestos fibers from being released during use, transport, or maintenance. Any access to and replacement of filters shall be from the inlet end. The unit must be on casters or wheels.
   b. Negative Air Machine Fan: The rating capacity of the fan must indicate the CFM under actual operating conditions. Manufacturer's typically use "free-air" (no resistance) conditions when rating fans. The fan must be a centrifugal type fan.
   c. Negative Air Machine Final Filter: The final filter shall be a HEPA filter. The filter media must be completely sealed on all edges within a structurally rigid frame. The filter shall align with a continuous flexible gasket material in the negative air machine housing to form an air tight seal. Each HEPA filter shall be certified by the manufacturer to have an efficiency of not less than 99.97 percent. Testing shall have been done in accordance with Military Standard MIL-STD-282 and Army Instruction Manual 136-300-175A. Each filter must bear a UL586 label to indicate ability to perform under specified conditions. Each filter shall be marked with the name of the manufacturer, serial number, air flow rating, efficiency and resistance, and the direction of test air flow.
   d. Negative Air Machine Pre-filters: The pre-filters, which protect the final HEPA filter by removing larger particles, are required to prolong the operating life of the HEPA filter. Two stages of pre-filtration are required. A first stage pre-filter shall be a low efficiency type for particles 10 µm or larger. A second stage pre-filter shall have a medium efficiency effective for particles down to 5 µm or larger. Pre-filters shall be installed either on or in the intake opening of the NAM and the second stage filter must be held in place with a special housing or clamps.
   e. Negative Air Machine Instrumentation: Each unit must be equipped with a gauge to measure the pressure drop across the filters and to indicate when filters have become loaded and need to be changed. A table indicating the cfm for various pressure readings on the gauge shall be affixed near the gauge for reference or the reading shall indicate at what point the filters shall be changed, noting cfm delivery. The unit must have an elapsed time meter to show total hours of operation.
   f. Negative Air Machine Safety and Warning Devices: An electrical/ mechanical lockout must be provided to prevent the fan from being operated without a HEPA filter. Units must be equipped with an automatic shutdown device to stop the fan in the event of a rupture in the HEPA filter or blockage in the discharge of the fan. Warning lights are required to indicate normal operation; too high a pressure drop across filters; or too low of a pressure drop across filters.
   g. Negative Air Machine Electrical: All electrical components shall be approved by the National Electrical Manufacturer's Association (NEMA) and Underwriters

Laboratories (UL). Each unit must be provided with overload protection and the motor, fan, fan housing, and cabinet must be grounded.

h. It is essential that replacement HEPA filters be tested using an “in-line” testing method, to ensure the seal around the periphery was not damaged during replacement. Damage to the outer HEPA filter seal could allow contaminated air to bypass the HEPA filter and be discharged to an inappropriate location. Contractor will provide written documentation of test results for negative air machine units with HEPA filters.

5. Pressure Differential: The fully operational negative air system within the regulated area shall continuously maintain a pressure differential ≥ - 0.02 inch WCG inside the regulated work area. Before any disturbance of any asbestos material, this shall be demonstrated to the VA by use of a pressure differential meter/manometer as required by OSHA 29 CFR 1926.1101(g)(5)(i). The Competent Person shall be responsible for providing, maintaining, and documenting the negative pressure and air changes as required by OSHA and this specification.
6. Monitoring: The pressure differential shall be continuously monitored and recorded between the regulated area and the area outside the regulated area with a monitoring device that incorporates a strip chart recorder. The strip chart recorder shall become part of the project log and shall indicate at least ≥ - 0.02 inch WCG pressure differential inside the regulated work area for the duration of the project.
7. Auxiliary Generator: If the building is occupied during abatement, provide an auxiliary gasoline/diesel generator located outside the building in an area protected from the weather. In the event of a power failure of the general power grid and the VAMC emergency power grid, the generator must automatically start and supply power to a minimum of 50 percent of the negative air machines in operation.
8. Supplemental Make-Up Air Inlets: Provide, as needed for proper air flow in the regulated area, in a location approved by the VA, openings in the plastic sheeting to allow outside air to flow into the regulated area. Auxiliary makeup air inlets must be located as far from the negative air machines as possible, off the floor near the ceiling, and away from the barriers that separate the regulated area from the occupied clean areas. Cover the inlets with weighted flaps which will seal in the event of failure of the negative pressure system.
9. Testing The System: The negative pressure system must be tested before any ACM is disturbed in any way. After the regulated area has been completely prepared, the decontamination units set up, and the negative air machines installed, start the units up one at a time. Demonstrate and document the operation and testing of the negative pressure system to the VA using smoke tubes and a negative pressure gauge. Verification and documentation of adequate negative pressure differential across each barrier must be done at the start of each work shift.
10. Demonstration of the Negative Pressure Filtration System:
    a. The demonstration of the operation of the negative pressure system to the VA shall include, but not be limited to, the following:
        1) Plastic barriers and sheeting move lightly in toward the regulated area.
        2) Curtains of the decontamination units move in toward regulated area.
        3) There is a noticeable movement of air through the decontamination units. Use the smoke tube to demonstrate air movement from the clean room to the shower room to the equipment room to the regulated area.
        4) Use smoke tubes to demonstrate air is moving across all areas in which work is to be done. Use a differential pressure gauge to indicate a negative pressure of at > - 0.02 inch across every barrier separating the regulated area from the rest of the building. Modify the system as necessary to meet the above requirements.
11. Use of the Negative Pressure Filtration System During Abatement Operations:
    a. Start units before beginning any disturbance of ACM occurs. After work begins, the units shall run continuously, maintaining 4 actual air changes per hour at a negative pressure differential of > - 0.02 inch water column gauge, for the duration

of the work until a final visual clearance and final air clearance has been successfully completed.

b. No negative air units shall be shut down at any time unless authorized by the VA Contracting Officer, verbally and in writing.

c. Pre-cleaning of ACM contaminated items shall be performed after the enclosure has been erected and negative pressure has been established in the work area. After items have been pre-cleaned and decontaminated, they may be removed from the work area for storage until the completion of abatement in the work area.

d. Abatement work shall begin at a location farthest from the units and proceed towards them. If an electric failure occurs, the Competent Person shall stop all abatement work and immediately begin wetting all exposed asbestos materials for the duration of the power outage. Abatement work shall not resume until power is restored and all units are operating properly again.

e. The negative air machines shall continue to run after all work is completed and until a final visual clearance and a final air clearance has been successfully completed for that regulated area.

12. Dismantling The System: After completion of the final visual and final air clearance has been obtained by the VPIH/CIH, the units may be shut down. The unit exterior surfaces shall have been completely decontaminated; pre-filters are not to be removed and the units inlet/outlet sealed with 2 layers of 6-mil poly immediately after shut down. No filter removal shall occur at the VA site following successful completion of site clearance. OSHA/EPA/DOT asbestos labels shall be attached to the units.

D. Containment Barriers and Coverings in the Regulated Area:

1. General: Seal off the perimeter to the regulated area to completely isolate the regulated area from adjacent spaces. All surfaces in the regulated area must be covered to prevent contamination and to facilitate clean-up. Should adjacent areas become contaminated as a result of the work, Contractor shall immediately stop work and clean up the contamination at no additional cost to the VA. Provide firestopping and identify all fire barrier penetrations due to abatement work as specified in Section 3.1.4.8; FIRESTOPPING.

2. Preparation Prior To Sealing: The Regulated Area: Place all tools, scaffolding, materials and equipment needed for working in the regulated area prior to erecting any plastic sheeting. All uncontaminated removable furniture, equipment and/or supplies shall be removed by the VA from the regulated area before commencing work. Any objects not scheduled for removal remaining in the regulated area shall be completely covered with 2 layers of 6-mil fire retardant poly sheeting and secured with duct tape. Lock out and tag out any HVAC/electrical systems in the regulated area.

3. Controlling Access to The Regulated Area: Access to the regulated area is allowed only through the personnel decontamination facility (PDF). All other means of access shall be eliminated and OSHA DANGER demarcation signs posted as required by OSHA. If the regulated area is adjacent to, or within view of an occupied area, provide a visual barrier of 6-mil opaque fire retardant poly to prevent building occupant observation. If the adjacent area is accessible to the public, the barrier must be solid and capable of withstanding the negative pressure.

4. Critical Barriers: Completely separate any operations in the regulated area from adjacent areas using 2 layers of 6-mil fire retardant poly and duct tape. Individually seal with 2 layers of 6-mil poly and duct tape all HVAC openings into the regulated area. Individually seal all lighting fixtures, clocks, doors, windows, convectors, speakers, or any other objects/openings in the regulated area. Heat must be shut off any objects covered with poly.

5. Primary Barriers:

a. Cover the regulated area with two layers of 6-mil fire retardant poly on the floors and two layers of 4 mil, fire retardant poly on the walls, unless otherwise directed in writing by the VA representative. Floor layers must form a right angle with the wall and turn up the wall at least 300 mm (12 inches). Seams must overlap at least

1800 mm (6 feet) and must be spray glued and taped. Install sheeting so that layers can be removed independently from each other. Carpeting shall be covered with three layers of 6-mil poly. Corrugated cardboard sheets must be placed between the bottom and middle layers of poly. Mechanically support and seal with duct tape and glue all wall layers.

b. If stairs and ramps are covered with 6-mil plastic, two layers must be used. Provide 19 mm (3/4 inch) exterior grade plywood treads held in place with duct tape/glue on the plastic. Do not cover rungs or rails with any isolation materials.

6. Secondary Barriers: A loose layer of 6-mil shall be used as a drop cloth to protect the primary layers from debris generated during the abatement. This layer shall be replaced as needed during the work.
7. Extension of the Regulated Area: If the enclosure of the regulated area is breached in any way that could allow contamination to occur, the affected area shall be included in the regulated area and constructed as per this section. Decontamination measures must be started immediately and continue until air monitoring indicates background levels are met.
8. Firestopping:
   a. Through penetrations caused by cables, cable trays, pipes, sleeves, conduits, etc. must be firestopped with a fire-rated firestop system providing an air tight seal.
   b. Firestop materials that are not equal to the wall or ceiling penetrated shall be brought to the attention of the VA Representative. The contractor shall list all areas of penetration, the type of sealant used, and whether or not the location is fire rated. Any discovery of penetrations during abatement shall be brought to the attention of the VA representative immediately. All walls, floors and ceilings are considered fire rated unless otherwise determined by the VA Representative or Fire Marshall.
   c. Any visible openings whether or not caused by a penetration shall be reported by the Contractor to the VA Representative for a sealant system determination. Firestops shall meet ASTM E814 and UL 1479 requirements for the opening size, penetrant, and fire rating needed.

E. Sanitary Facilities: The Contractor shall provide sanitary facilities for abatement personnel and maintain them in a clean and sanitary condition throughout the abatement project.

F. Personal Protective Equipment: Provide whole body clothing, head coverings, gloves and foot coverings and any other personal protective equipment as determined by conducting the hazard assessment required by OSHA at 29 CFR 1910.132 (d). The Competent Person shall ensure the integrity of personal protective equipment worn for the duration of the project. Duct tape shall be used to secure all suit sleeves to wrists and to secure foot coverings at the ankle.

G. Pre-Cleaning:
1. The VA will provide water for abatement purposes. The Contractor shall connect to the existing VA system. The service to the shower(s) shall be supplied with backflow prevention.
2. Pre-cleaning of ACM contaminated items shall be performed after the enclosure has been erected and negative pressure has been established in the work area. All workers performing pre-cleaning activities must don appropriate personal protective equipment (PPE), as specified throughout this document and as approved in the Contractor's work plan. After items have been pre-cleaned and decontaminated, they may be removed from the work area for storage until the completion of abatement in the work area.
3. Pre-clean all movable objects within the regulated area using a HEPA filtered vacuum and/or wet cleaning methods as appropriate. After cleaning, these objects shall be removed from the regulated area and carefully stored in an uncontaminated location. Drapes, clothing, upholstered furniture and other fabric items shall be disposed of as asbestos contaminated waste. Cleaning these asbestos contaminated items utilizing HEPA vacuum techniques and off-premises steam cleaning is very difficult and cannot guarantee decontamination. Carpeting will be disposed of prior to abatement if in the

regulated area. If ACM floor tile is attached to the carpet while the Contractor is removing the carpet that section of the carpet will be disposed of as asbestos waste.

4. Pre-clean all fixed objects in the regulated area using HEPA filtered vacuums and/or wet cleaning techniques as appropriate. Careful attention must be paid to machinery behind grills or gratings where access may be difficult but contamination may be significant. Also, pay particular attention to wall, floor and ceiling penetration behind fixed items. After pre-cleaning, enclose fixed objects with 2 layers of 6-mil poly and seal securely in place with duct tape. Objects (e.g., permanent fixtures, shelves, electronic equipment, laboratory tables, sprinklers, alarm systems, closed circuit TV equipment and computer cables) which must remain in the regulated area and that require special ventilation or enclosure requirements should be designated here along with specified means of protection. Contact the manufacturer for special protection requirements.
5. Pre-clean all surfaces in the regulated area using HEPA filtered vacuums and/or wet cleaning methods as appropriate. Do not use any methods that would raise dust such as dry sweeping or vacuuming with equipment not equipped with HEPA filters. Do not disturb asbestos-containing materials during this pre-cleaning phase.

H. Pre-Abatement Activities:

1. Pre-Abatement Meeting: The VA representative, upon receipt, review, and substantial approval of all pre-abatement submittals and verification by the CPIH/CIH that all materials and equipment required for the project are on the site, will arrange for a pre-abatement meeting between the Contractor, the CPIH/CIH, Competent Person(s), the VA representative(s), and the VPIH/CIH. The purpose of the meeting is to discuss any aspect of the submittals needing clarification or amplification and to discuss any aspect of the project execution and the sequence of the operation. The Contractor shall be prepared to provide any supplemental information/documentation to the VA's representative regarding any submittals, documentation, materials or equipment. Upon satisfactory resolution of any outstanding issues, the VA's representative will issue a written order to proceed to the Contractor. No abatement work of any kind described in the following provisions shall be initiated prior to the VA written order to proceed.
2. Pre-Abatement Construction and Operations:
   a. Perform all preparatory work for the first regulated area in accordance with the approved work schedule and with this specification.
   b. Upon completion of all preparatory work, the CPIH/CIH will inspect the work and systems and will notify the VA's representative when the work is completed in accordance with this specification. The VA's representative may inspect the regulated area and the systems with the VPIH/CIH and may require that upon satisfactory inspection, the Contractor's employees perform all major aspects of the approved AHAP(s), especially worker protection, respiratory systems, contingency plans, decontamination procedures, and monitoring to demonstrate satisfactory operation. The operational systems for respiratory protection and the negative pressure system shall be demonstrated for proper performance.
   c. The CPIH/CIH shall document the pre-abatement activities described above and deliver a copy to the VA's representative.
   d. Upon satisfactory inspection of the installation of and operation of systems, the VA's representative will notify the Contractor in writing to proceed with the asbestos abatement work in accordance with this specification and all applicable regulations.
3. Pre-Abatement Inspections and Preparations:
   a. Before any work begins on the construction of the regulated area, the Contractor will:
      1) Conduct a space-by-space inspection with an authorized VA representative and prepare a written inventory of all existing damage in those spaces where asbestos abatement will occur. Still or video photography may be used to supplement the written damage inventory. Document will be signed and certified as accurate by both parties.

2) A NESHAP (destructive) ACM inspection shall be conducted on all building structures that will be demolished. Ensure the following areas are inspected on the project: lay-in ceilings concealing ACM; ACM behind walls/windows from previous renovations; inside utility chases/walls; transite piping/ductwork/sheets; behind radiators; lab fume hoods; transite lab countertops; roofing materials; below window sills; water/sewer lines; electrical conduit coverings; crawlspaces (previous abatement contamination); flooring/mastic covered by carpeting/new flooring; exterior insulated wall panels; on underground fuel tanks; and steam line trench coverings. Verify during NESHAP survey that no other suspect ACM is present.
3) Ensure that all furniture, machinery, equipment, curtains, drapes, blinds, and other movable objects required to be removed from the regulated area have been cleaned and removed or properly protected from contamination.
4) If present and required, remove and dispose of carpeting from floors in the regulated area.
5) Inspect existing firestopping in the regulated area. Correct as needed.

3.2 REMOVAL OF ACM

A. Wetting ACM:
1. Use amended water for the wetting of ACM prior to removal. The Competent Person shall assure the wetting of ACM meets the definition of "adequately wet" in the EPA NESHAP regulation and OSHA's "wet methods" for the duration of the project. A removal encapsulant may be used instead of amended water with written approval of the VA's representative.
2. Amended Water: Provide water to which a surfactant has been added to wet the ACM and reduce the potential for fiber release during disturbance of ACM. The mixture must be equal to or greater than the wetting provided by water amended by a surfactant consisting of one ounce of 50 percent polyoxyethylene ester and 50 percent polyoxyethylene ether mixed with 5 gallons (19L) of water.
3. Removal Encapsulant: When authorized by VA, provide a removal encapsulant designed specifically for the removal of ACM. The material must, when used, result in adequate wetting of the ACM and retard fiber release during removal.

B. Secondary Barrier and Walkways:
1. Install as a drop cloth a 6-mil poly sheet at the beginning of each work shift where removal is to be done during that shift. Completely cover floors and any walls within 10 feet (3 meters) of the area where work is to done. Secure the secondary barrier with duct tape to prevent it from moving or debris from getting behind it. Remove the secondary barrier at the end of the shift or as work in the area is completed. Keep residue on the secondary barrier wetted. When removing, fold inward to prevent spillage and place in a disposal bag.
2. Install walkways using 6-mil black poly between the regulated area and the decontamination facilities (PDF and W/EDF) to protect the primary layers from contamination and damage. Install the walkways at the beginning of each shift and remove at the end of each shift.

C. Wet Removal of ACM:
1. Adequately and thoroughly wet the ACM to be removed prior to removal with amended water or when authorized by VA, removal encapsulant to reduce/prevent fiber release to the air. Adequate time must be allowed for the amended water or removal encapsulant to saturate the ACM. Abatement personnel must not disturb dry ACM. Use a fine spray of amended water or removal encapsulant. Saturate the material sufficiently to wet to the substrate without causing excessive dripping. The material must be sprayed repeatedly/continuously during the removal process in order to maintain adequately wet conditions. Removal encapsulants must be applied in accordance with the manufacturer's written instructions. Perforate or carefully separate, using wet methods,

an outer covering that is painted or jacketed in order to allow penetration and wetting of the material. Where necessary, carefully remove covering while wetting to minimize fiber release. **In no event shall dry removal occur except when authorized in writing by the VPIH/CIH and VA when a greater safety hazard (e.g., electricity) is present**.

2. If ACM does not wet well with amended water due to composition, coating or jacketing, remove as follows:
   a. Mist work area continuously with amended water whenever necessary to reduce airborne fiber levels.
   b. Remove saturated ACM in small sections. Do not allow material to dry out. As material is removed, bag material, while still wet into disposal bags. Twist the bag neck tightly, bend over (gooseneck) and seal with a minimum of three tight wraps of duct tape. Clean /decontaminate the outside of the bag of any residue and move to washdown station adjacent to W/EDF.
   c. Pipe/Pipe Fitting Insulation: Remove the outer layer of wrap while spraying with amended water in order to saturate the ACM. Spray ACM with a fine mist of amended water or removal encapsulant. Allow time to saturate the material to the substrate. Cut bands holding pre-formed pipe insulation sections. Slit jacketing at the seams, remove and hand place in a disposal bag. Do not allow dropping to the floor. Remove molded fitting insulation/mud in large pieces and hand place in a disposal bag. Remove any residue on pipe or fitting with a stiff bristle nylon brush. In locations where pipe fitting insulation is removed from fibrous glass or other non-asbestos insulated straight runs of pipe, remove fibrous material at least 6 inches from the point it contacts the ACM.
3.

3.3 LOCKDOWN ENCAPSULATION

A. General: Lockdown encapsulation is an integral part of the ACM removal. At the conclusion of ACM removal and before removal of the primary barriers, the contractor shall encapsulate all surfaces with a bridging encapsulant.

B. Delivery and Storage: Deliver materials to the job site in original, new and unopened containers bearing the manufacturer's name and label as well as the following information: name of material, manufacturer's stock number, date of manufacture, thinning instructions, application instructions and the SDS for the material.

C. Worker Protection: Before beginning work with any material for which an SDS has been submitted, provide workers with any required personal protective equipment. The required personal protective equipment shall be used whenever exposure to the material might occur. In addition to OSHA/specification requirements for respiratory protection, a paint pre-filter and an organic vapor cartridge, at a minimum, shall be used in addition to the HEPA filter when an organic solvent based encapsulant or other solvent is used. The CPIH/CIH shall be responsible for provision of adequate respiratory protection. Note: Flammable and combustible encapsulants or solvents shall not be used, unless authorized in writing by the VA.

D. Encapsulation of Piping:
   1. Apply two coats of lockdown encapsulant to the piping after all ACM has been removed. Apply in strict accordance with the manufacturer's instructions. Any deviation from the instructions must be approved by the VA's representative in writing prior to commencing the work.
   2. Apply the lockdown encapsulant with an airless sprayer at a pressure and using a nozzle orifice as recommended by the manufacturer. Apply the first coat while the scratch coat is still damp from the asbestos removal process, after passing the visual inspection. If the surface has been allowed to dry, wet wipe or HEPA vacuum prior to spraying with encapsulant. Apply a second coat over the first coat in strict conformance with the manufacturer's instructions. Color the lockdown encapsulant and contrast the color in the second coat so that visual confirmation of completeness and uniform coverage of each

coat is possible. Adhere to the manufacturer's instructions for coloring. At the completion of the encapsulation, the surface must be a uniform third color produced by the mixture.

E. Sealing Exposed Edges: Seal edges of ACM exposed by removal work which is inaccessible, such as a sleeve, wall penetration, etc., with two coats of bridging encapsulant. Prior to sealing, permit the exposed edges to dry completely to permit penetration of the bridging encapsulant. Apply in accordance with 3.3.4 (B).

3.4 DISPOSAL OF ACM WASTE MATERIALS

A. General: Dispose of waste ACM and debris which is packaged in accordance with these specifications, in accordance with OSHA, EPA, State, Local and DOT requirements. The landfill requirements for packaging must also be met. Transport will be in compliance with 49 CFR 171-180 regulations. Disposal shall be done at an approved landfill. Disposal of non-friable ACM shall be done in accordance with applicable regulations.

B. Procedures:
1. The VA must be notified at least 24 hours in advance of any waste removed from the containment.
2. Asbestos waste shall be packaged and moved through the W/EDF into a covered transport container in accordance with procedures is this specification. Waste shall be double-bagged and wetted with amended water prior to disposal. Wetted waste can be very heavy. Bags shall not be overfilled. Bags shall be evacuated with HEPA vacuum and securely sealed to prevent accidental opening and/or leakage. The top shall be tightly twisted and goose necked prior to tightly sealing with at least three wraps of duct tape. Ensure that unauthorized persons do not have access to the waste material once it is outside the regulated area. All transport containers must be covered at all times when not in use. NESHAP signs must be on containers during loading and unloading. Material shall not be transported in open vehicles. If drums are used for packaging, the drums shall be labeled properly and shall not be re-used.
3. Waste Load Out: Waste load out shall be done in accordance with the procedures in W/EDF Decontamination Procedures. Sealed waste bags shall be decontaminated on exterior surfaces by wet cleaning and HEPA vacuuming before being placed in the second waste bag and sealed, which then must also be wet wiped and HEPA vacuumed.
4. Asbestos waste with sharp edged components, i.e., nails, screws, lath, strapping, tin sheeting, jacketing, metal mesh, etc., which might tear poly bags shall be wrapped securely in burlap before packaging and, if needed, use a poly lined fiber drum as the second container, prior to disposal.

3.5 PROJECT DECONTAMINATION

A. General:
1. The entire work related to project decontamination shall be performed under the close supervision and monitoring of the CPIH/CIH.
2. If the asbestos abatement work is in an area which was contaminated prior to the start of abatement, the decontamination will be done by cleaning the primary barrier poly prior to its removal and cleanings of the surfaces of the regulated area after the primary barrier removal.
3. If the asbestos abatement work is in an area which was uncontaminated prior to the start of abatement, the decontamination will be done by cleaning the primary barrier poly prior to its removal, thus preventing contamination of the building when the regulated area critical barriers are removed.

B. Regulated Area Clearance: Clearance air testing and other requirements which must be met before release of the Contractor and re-occupancy of the regulated area space are specified in Final Testing Procedures.

C. Work Description: Decontamination includes the clearance air testing in the regulated area and the decontamination and removal of the enclosures/facilities installed prior to the abatement

work including primary/critical barriers, PDF and W/EDF facilities, and negative pressure systems.

D. Pre-Decontamination Conditions:
   1. Before decontamination starts, all ACM waste from the regulated area shall be collected and removed, and the loose 6-mil layer of poly removed while being adequately wetted with amended water and disposed of along with any gross debris generated by the work.
   2. At the start of decontamination, the following shall be in place:
      a. Primary barriers consisting of 2 layers of 6-mil poly on the floor and 4 mil poly on the walls.
      b. Critical barriers consisting of 2 layers of 6-mil poly which is the sole barrier between the regulated area and openings to the rest of the building or outside.
      c. Decontamination facilities for personnel and equipment in operating condition and the negative pressure system in operation.

E. First Cleaning: Carry out a first cleaning of all surfaces of the regulated area including items of remaining poly sheeting, tools, scaffolding, ladders/staging by wet methods and HEPA vacuuming. Do not use dry dusting/sweeping/air blowing methods. Use each surface of a wetted cleaning cloth one time only and then dispose of as contaminated waste. Continue this cleaning until there is no visible residue from abated surfaces or poly or other surfaces. Remove all filters in the air handling system and dispose of as ACM waste in accordance with these specifications. The negative pressure system shall remain in operation during this time. Additional cleaning(s) may be needed as determined by the CPIH/VPIH/CIH.

F. Pre-Clearance Inspection and Testing: The CPIH/CIH and VPIH/CIH will perform a thorough and detailed visual inspection at the end of the cleaning to determine whether there is any visible residue in the regulated area. If the visual inspection is acceptable, the CPIH/CIH will perform pre-clearance sampling using aggressive clearance as detailed in 40 CFR 763 Subpart E (AHERA) Appendix A (III)(B)(7)(d). If the sampling results show values below 0.01 f/cc, then the Contractor shall notify the VA's representative of the results with a brief report from the CPIH/CIH documenting the inspection and sampling results and a statement verifying that the regulated area is ready for lockdown encapsulation. The VA reserves the right to utilize their own VPIH/CIH to perform a pre-clearance inspection and testing for verification.

G. Lockdown Encapsulation of Abated Surfaces: With the express written permission of the VA's representative, perform lockdown encapsulation of all surfaces from which asbestos was abated in accordance with the procedures in this specification. Negative pressure shall be maintained in the regulated area during the lockdown application.

3.6 FINAL VISUAL INSPECTION AND AIR CLEARANCE TESTING

A. General: Notify the VA representative 24 hours in advance for the performance of the final visual inspection and testing. The final visual inspection and testing will be performed by the VPIH/CIH starting after the final cleaning.

B. Final Visual Inspection: Final visual inspection will include the entire regulated area, the PDF, all poly sheeting, seals over HVAC openings, doorways, windows, and any other openings. If any debris, residue, dust or any other suspect material is detected, the final cleaning shall be repeated at no additional cost to the VA. Dust/material samples may be collected and analyzed at no additional cost to the VA at the discretion of the VPIH/CIH to confirm visual findings. When the regulated area is visually clean the final testing can be done.

C. Final Air Clearance Testing:
   1. After an acceptable final visual inspection by the VPIH/CIH and VA Representative, the VPIH/CIH will perform the final clearance testing. Air samples will be collected and analyzed in accordance with procedures for AHERA in this specification. If work is less than 260 lf/160 sf/35 cf, 5 PCM samples shall be collected for clearance and a minimum of two field blank. If work is equal to or more than 260 lf/160 sf/35 cf, AHERA TEM sampling shall be performed for clearance. TEM analysis shall be done in accordance with procedures for EPA AHERA presented in this specification. If the release criteria are

not met, the Contractor shall repeat the final cleaning and continue decontamination procedures until clearance is achieved. **All Additional inspection and testing costs will be borne by the Contractor**.

2. If release criteria are met, proceed to perform the abatement closeout and to issue the certificate of completion in accordance with these specifications.

D. Final Air Clearance Procedures:

1. Contractor's Release Criteria: Work in a regulated area is complete when the regulated area is visually clean and airborne fiber levels have been reduced to or below 0.01 f/cc as measured by the AHERA PCM protocol and < 70 AHERA asbestos structures per square millimeter (s/mm2) by AHERA TEM. No averaging of results will be used for this project. All five (5) TEM samples inside the regulated area shall be at or below 70 asbestos s/mm2 to satisfy the project final clearance criteria.
2. Air Monitoring and Final Clearance Sampling: To determine if the elevated airborne fiber counts encountered during abatement operations have been reduced to the specified level, the VPIH/CIH will secure samples and analyze them according to the following procedures:
   a. Fibers Counted: “Fibers” referred to in this section shall be either all fibers regardless of composition as counted in the NIOSH 7400 PCM method or asbestos fibers counted using the AHERA TEM method.
   b. Aggressive Sampling: All final air testing samples shall be collected using aggressive sampling techniques except where soil is not encapsulated or enclosed. Samples will be collected on 0.8⌠ MCE filters for PCM analysis and 0.45⌠ MCE for TEM. A minimum of 3850 Liters of air using calibrated sampling pumps shall be collected for PCM samples and a minimum of 1200 Liters of air using calibrated sampling pumps shall be collected for TEM clearance samples. Before pumps are started, initiate aggressive air mixing sampling as detailed in 40 CFR 763 Subpart E (AHERA) Appendix A (III)(B)(7)(d). Air samples will be collected in areas subject to normal air circulation away from corners, obstructed locations, and locations near windows, doors, or vents. After air sampling pumps have been shut off, circulating fans shall be shut off. The negative pressure system shall continue to operate.
   c.

E. Clearance Sampling Using PCM – Less than 260LF/160SF:

1. The VPIH/CIH will perform clearance samples as indicated by the specification.
2. The NIOSH 7400 PCM method will be used for clearance sampling with a minimum collection volume of 3850 Liters of air. A minimum of 5 PCM clearance samples shall be collected. All samples must be equal to or less than 0.01 f/cc to clear the regulated area.
3.

F. Clearance Sampling Using Tem – Equal to or more than 260LF/160SF: TEM

1. Clearance requires 13 samples be collected; 5 inside the regulated area; 5 outside the regulated area; and 3 field blanks.
2. The TEM method will be used for clearance sampling with a minimum collection volume of 1200 Liters of air. A minimum of 13 clearance samples shall be collected. All samples must be equal to or less than 70 AHERA structures per square millimeter (s/mm2) AHERA TEM, no averaging of results for this specific project.

G. Laboratory Testing of PCM Clearance Samples: The services of an AIHA accredited laboratory will be employed by the VA to perform analysis for the PCM air samples. The accredited laboratory shall be successfully participating in the AIHA Proficiency Analytical Testing (PAT) program. Samples will be sent daily by the VPIH/CIH so that verbal/faxed reports can be received within 24-36 hours. A complete record, certified by the laboratory, of all air monitoring tests and results will be furnished to the VA’s representative and the Contractor.

H. Laboratory Testing of TEMSamples: Samples shall be sent by the VPIH/CIH to a NIST NVLAP accredited laboratory for analysis by TEM. The laboratory shall be successfully participating in

the NIST Airborne Asbestos Analysis (TEM) program. Verbal/faxed results from the laboratory shall be available within 24-36 hours after receipt of the samples. A complete record, certified by the laboratory, of all TEM results shall be furnished to the VA's representative and the Contractor.

I. Laboratory Testing of Bulk Samples: Samples shall be sent by the VPIH/CIH or CPIH/CIH to a NIST NVLAP accredited laboratory for analysis by PLM. The laboratory shall successfully participate in the NIST NVLAP Bulk Asbestos Analysis (PLM) program. Verbal/faxed results from the laboratory shall be available within 24-36 hours after receipt of the samples. A complete record, certified by the laboratory, of all PLM and/or TEM results shall be furnished to the VA's representative and the Contractor.

3.7 ABATEMENT CLOSEOUT AND CERTIFICATE OF COMPLIANCE

A. Completion of Abatement Work:
   1. After thorough decontamination, seal negative air machines with 2 layers of 6-mil poly and duct tape to form a tight seal at the intake/outlet ends before removal from the regulated area. Complete asbestos abatement work upon meeting the regulated area visual and air clearance criteria and fulfilling the following:
      a. Remove all equipment and materials from the project area.
      b. Dispose of all packaged ACM waste as required.
      c. Repair or replace all interior finishes damaged during the abatement work, as required.
      d. Fulfill other project closeout requirements as required in this specification.

B. Certificate of Completion By Contractor: The CPIH/CIH shall complete and sign the "Certificate of Completion" in accordance with Attachment 1 at the completion of the abatement and decontamination of the regulated area.

C. Work Shifts: All work shall generally be done during administrative hours (8:00 AM to 4:30 PM) Monday - Friday excluding Federal Holidays. Any change in the work schedule must be approved in writing by the VA Representative.

D. Re-Insulation: If required as part of the contract, replace all asbestos containing insulation/fire-proofing with suitable non-asbestos material. Provide SDS’s for all replacement materials in advance of installation for VA approval. Refer to Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION.

ATTACHMENT #1
CERTIFICATE OF COMPLETION

DATE: _____ VA Project #:_____
PROJECT NAME:_____ Abatement Contractor:_____
VAMC/ADDRESS:_____

1. I certify that I have personally inspected, monitored and supervised the abatement work of (specify regulated area or Building):
   which took place from / / to / /
2. That throughout the work all applicable requirements/regulations and the VA's specifications were met.
3. That any person who entered the regulated area was protected with the appropriate personal protective equipment and respirator and that they followed the proper entry and exit procedures and the proper operating procedures for the duration of the work.
4. That all employees of the Abatement Contractor engaged in this work were trained in respiratory protection, were experienced with abatement work, had proper medical surveillance documentation, were fit-tested for their respirator, and were not exposed at any time during the work to asbestos without the benefit of appropriate respiratory protection.
5. That I performed and supervised all inspection and testing specified and required by applicable regulations and VA specifications.
6. That the conditions inside the regulated area were always maintained in a safe and healthy condition and the maximum fiber count never exceeded 0.5 f/cc, except as described below.
7. That all abatement work was done in accordance with OSHA requirements and the manufacturer's recommendations.

CPIH/CIH Signature/Date:_____

CPIH/CIH Print Name:_____

Abatement Contractor Signature/Date:_____

Abatement Contractor Print Name:_____

ATTACHMENT #2
CERTIFICATE OF WORKER'S ACKNOWLEDGMENT

PROJECT NAME:_____DATE:_____
PROJECT ADDRESS:_____
ABATEMENT CONTRACTOR'S NAME:_____

WORKING WITH ASBESTOS CAN BE HAZARDOUS TO YOUR HEALTH. INHALING ASBESTOS HAS BEEN LINKED WITH VARIOUS TYPES OF CANCERS. IF YOU SMOKE AND INHALE ASBESTOS FIBERS, YOUR CHANCES OF DEVELOPING LUNG CANCER IS GREATER THAN THAT OF THE NON-SMOKING PUBLIC.

Your employer's contract with the owner for the above project requires that: You must be supplied with the proper personal protective equipment including an adequate respirator and be trained in its use. You must be trained in safe and healthy work practices and in the use of the equipment found at an asbestos abatement project. You must receive/have a current medical examination for working with asbestos. These things shall be provided at no cost to you. By signing this certificate of worker's acknowledgement you are indicating to the owner that your employer has met these obligations.

RESPIRATORY PROTECTION: I have been trained in the proper use of respirators and have been informed of the type of respirator to be used on the above indicated project. I have a copy of the written Respiratory Protection Program issued by my employer. I have been provided for my exclusive use, at no cost, with a respirator to be used on the above indicated project.

TRAINING COURSE: I have been trained by a third party, State/EPA accredited trainer in the requirements for an AHERA/OSHA Asbestos Abatement Worker training course, 32-hours minimum duration. I currently have a valid State accreditation certificate. The topics covered in the course include, as a minimum, the following:

Physical Characteristics and Background Information on Asbestos
Potential Health Effects Related to Exposure to Asbestos
Employee Personal Protective Equipment
Establishment of a Respiratory Protection Program
State of the Art Work Practices
Personal Hygiene
Additional Safety Hazards
Medical Monitoring
Air Monitoring
Relevant Federal, State and Local Regulatory Requirements, Procedures, and Standards
Asbestos Waste Disposal

MEDICAL EXAMINATION: I have had a medical examination within the past 12 months which was paid for by my employer. This examination included: health history, occupational history, pulmonary function test, and may have included a chest x-ray evaluation. The physician issued a positive written opinion after the examination.

Signature:_____
Printed Name:_____
Social Security Number:_____
Witness:_____

ATTACHMENT #3
AFFIDAVIT OF MEDICAL SURVEILLANCE, RESPIRATORY PROTECTION AND TRAINING/ACCREDITATION

VA PROJECT NAME AND NUMBER:_____
VA MEDICAL FACILITY:_____
ABATEMENT CONTRACTOR'S NAME AND ADDRESS:_____

1. I verify that the following individual

Name:_____ Social Security Number:_____
who is proposed to be employed in asbestos abatement work associated with the above project by the named Abatement Contractor, is included in a medical surveillance program in accordance with 29 CFR 1926.1101(m), and that complete records of the medical surveillance program as required by 29 CFR 1926.1101(m)(n) and 29 CFR 1910.20 are kept at the offices of the Abatement Contractor at the following address.

Address:_____

2. I verify that this individual has been trained, fit-tested and instructed in the use of all appropriate respiratory protection systems and that the person is capable of working in safe and healthy manner as expected and required in the expected work environment of this project.

3. I verify that this individual has been trained as required by 29 CFR 1926.1101(k). This individual has also obtained a valid State accreditation certificate. Documentation will be kept on-site.

4. I verify that I meet the minimum qualifications criteria of the VA specifications for a CPIH.

Signature of CPIH/CIH:_____ Date:_____

Printed Name of CPIH/CIH:_____

Signature of Contractor:_____ Date:_____

Printed Name of Contractor:_____

ATTACHMENT #4
ABATEMENT CONTRACTOR/COMPETENT PERSON(S) REVIEW AND ACCEPTANCE OF THE VA'S ASBESTOS SPECIFICATIONS

VA Project Location:_____
VA Project #:_____
VA Project Description:_____

1. This form shall be signed by the Asbestos Abatement Contractor Owner and the Asbestos Abatement Contractor's Competent Person(s) prior to any start of work at the VA related to this Specification. If the Asbestos Abatement Contractor's/Competent Person(s) has not signed this form, they shall not be allowed to work on-site.

2 I, the undersigned, have read VA's Asbestos Specification regarding the asbestos abatement requirements. I understand the requirements of the VA's Asbestos Specification and agree to follow these requirements as well as all required rules and regulations of OSHA/EPA/DOT and State/Local requirements. I have been given ample opportunity to read the VA's Asbestos Specification and have been given an opportunity to ask any questions regarding the content and have received a response related to those questions. I do not have any further questions regarding the content, intent and requirements of the VA's Asbestos Specification.

3. At the conclusion of the asbestos abatement, I will certify that all asbestos abatement work was done in accordance with the VA's Asbestos Specification and all ACM was removed properly and no fibrous residue remains on any abated surfaces.

Abatement Contractor Owner's Signature_____Date_____

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SECTION 02 82 13.13

TENT / GLOVEBAG ASBESTOS ABATEMENT

PART 1 - GENERAL

1.1 SUMMARY OF WORK

A. Contract Documents and Related Requirements: Drawings, general provisions of the contract, including general and supplementary conditions and other Division 01 specifications, shall apply to the work of this section. The contract documents show the work to be done under the contract and related requirements and conditions impacting the project. Related requirements and conditions include applicable codes and regulations, notices and permits, existing site conditions and restrictions on use of the site, requirements for partial owner occupancy during the work, coordination with other work and the phasing of the work. In the event the Asbestos Abatement Contractor discovers a conflict in the contract documents and/or requirements or codes, the conflict must be brought to the immediate attention of the Contracting Officer for resolution. Whenever there is a conflict or overlap in the requirements, the most stringent shall apply. Any actions taken by the Contractor without obtaining guidance from the Contracting Officer shall become the sole risk and responsibility of the Asbestos Abatement Contractor. All costs incurred due to such action are also the responsibility of the Asbestos Abatement Contractor. Contractor to field verify and confirm quantities with VAMC representative prior to abatement.

B. Extent of Work: Below is a brief description of the estimated quantities of asbestos containing materials to be abated by the Tent / Glovebag method in accordance with NYS ICR 56 Special Conditions. These quantities are for informational purposes only and are based on the best information available at the time of the specification preparation. The Contractor shall satisfy himself as to the actual quantities to be abated. Nothing in this section may be interpreted as limiting the extent of work otherwise required by this contract and related documents.
   1. Removal, clean-up and disposal of ACM piping and fittings and asbestos contaminated elements in an appropriate regulated area in the following approximate quantities:
      a) (40) linear feet of ACM Non-PCB Exterior Window Caulk
      b) (3000) linear feet of PACM steam pipe insulation of 25 – 75 mm (1 - 3 inches) in diameter
      c) (760) PACM steam pipe fittings of 25-75 mm (1 - 3 inches) in diameter
      d) (1200) linear feet of PACM pipe insulation of 12.5 mm to 100 mm (1/2 – 4 inches) in diameter.
      e) (400) PACM pipe fittings of 12.5-100 mm (1/2 – 4 inches) in diameter.
      f) (120) linear feet of non-ACM pipe insulation of 50 - 150 mm (2 - 6 inches) in diameter
      g) (3) non-ACM fittings of 50 - 150 mm (2 - 6 inches) in diameter.

C. Related Work:
   1. Section 07 84 00, FIRESTOPPING
   2. Section 02 41 00, DEMOLITION
   3. Division 09, FINISHES
   4.

D. TASKS:
   a. The work tasks are summarized briefly as follows:
   b. Pre-abatement activities including pre-abatement meeting(s), inspection(s), notifications, permits, submittal approvals, work-site preparations, emergency procedures arrangements, and Asbestos Hazard Abatement Plans for Glovebag asbestos abatement work.
   c. Abatement activities including removal, clean-up and disposal of ACM waste, recordkeeping, security, monitoring, and inspections.

d. Cleaning and decontamination activities including final visual inspection, air monitoring and certification of decontamination.

E. Abatement Contractor Use of Premises:

F. The Contractor and Contractor's personnel shall cooperate fully with the VA Representative/consultant to facilitate efficient use of buildings and areas within buildings. The Contractor shall perform the work in accordance with the VA specifications, drawings, phasing plan and in compliance with any/all applicable Federal, State and Local regulations and requirements.

G. The Contractor shall use the existing facilities in the building strictly within the limits indicated in contract documents as well as the approved VA Design and Construction Procedures. VA Design and Construction Procedures drawings of partially occupied buildings will show the limits of regulated areas; the placement of decontamination facilities; the temporary location of bagged waste ACM; the path of transport to outside the building; and the temporary waste storage area for each building/regulated area. Any variation from the arrangements shown on drawings shall be secured in writing from the VA Representative through the pre-abatement plan of action. The following limitations of use shall apply to existing facilities shown on drawings.

1.2 VARIATIONS IN QUANTITY

A. The quantities and locations of ACM as indicated on the drawings and the extent of work included in this section are estimated, which are limited by the physical constraints imposed by occupancy of the buildings and accessibility to ACM. Accordingly, minor variations (+/- 10 percent) in quantities of ACM within the regulated area are considered as having no impact on contract price and time requirements of this contract. Where additional work is required beyond the above variation, the contractor shall provide unit prices for newly discovered ACM and those prices shall be used for additional work required under the contractor.

1.3 STOP ASBESTOS REMOVAL

A. If the Contracting Officer; their field representative; the facility Safety Officer/Manager or their designee, or the VA Professional Industrial Hygienist/Certified Industrial Hygienist (VPIH/CIH) presents a verbal Stop Asbestos Removal Order, the Contractor/Personnel shall immediately stop all asbestos removal and maintain HEPA filtered negative pressure air flow in the containment and adequately wet any exposed ACM. If a verbal Stop Asbestos Removal Order is issued, the VA shall follow-up with a written order to the Contractor as soon as it is practicable. The Contractor shall not resume any asbestos removal activity until authorized to do so in writing by the VA Contracting Officer. A stop asbestos removal order may be issued at any time the VA Contracting Officer determines abatement conditions/activities are not within VA specification, regulatory requirements or that an imminent hazard exists to human health or the environment. Work stoppage will continue until conditions have been corrected to the satisfaction of the VA. Standby time and costs for corrective actions will be borne by the Contractor, including the VPIH/CIH time. The occurrence of any of the following events shall be reported immediately by the Contractor’s competent person to the VA Contracting Office or field representative using the most expeditious means (e.g., verbal or telephonic), followed up with written notification to the Contracting Officer as soon as practical. The Contractor shall immediately stop asbestos removal/disturbance activities and initiate fiber reduction activities if:

1. Airborne PCM analysis results equal to or greater than 0.01 f/cc above background levels inside the building but outside the regulated area;
2. breach or break in regulated area containment barrier(s);
3. less than –0.02 inch WCG pressure in the regulated area;
4. serious injury/death at the site;
5. fire/safety emergency at the site;
6. respiratory protection system failure;
7. power failure or loss or inadequate use of wetting agent; or
8. any visible emissions observed outside the regulated area; or

9. failure to follow project specification requirements.

1.4 **DEFINITIONS**

A. General: Definitions and explanations here are neither complete nor exclusive of all terms used in the contract documents, but are general for the work to the extent they are not stated more explicitly in another element of the contract documents. Drawings must be recognized as diagrammatic in nature and not completely descriptive of the requirements indicated therein.

B. Glossary:

Abatement - Procedures to control fiber release from asbestos-containing materials. Includes removal, encapsulation, enclosure, demolition, and renovation activities related to asbestos containing materials (ACM).

Aerosol - Solid or liquid particulate suspended in air.

Adequately wet - Sufficiently mixed or penetrated with liquid to prevent the release of particulates. If visible emissions are observed coming from the ACM, then that material has not been adequately wetted.

Aggressive method - Removal or disturbance of building material by sanding, abrading, grinding, or other method that breaks, crumbles, or disintegrates intact ACM.

Aggressive air sampling - EPA AHERA defined clearance sampling method using air moving equipment such as fans and leaf blowers to aggressively disturb and maintain in the air residual fibers after abatement.

AHERA - Asbestos Hazard Emergency Response Act. Asbestos regulations for schools issued in 1987.

Aircell - Pipe or duct insulation made of corrugated cardboard which contains asbestos.

Air monitoring - The process of measuring the fiber content of a known volume of air collected over a specified period of time. The NIOSH 7400 Method, Issue 3, Fifth Edition is used to determine the fiber levels in air. For personal samples, area air samples and clearance air testing using Phase Contrast Microscopy (PCM) analysis, the NIOSH Method 7402 Issue 2, Fourth Edition) can be used when it is necessary to confirm fibers counted by PCM as being asbestos. The AHERA TEM analysis may be used for background, area samples and clearance samples when required by this specification, or at the discretion of the VPIH/CIH as appropriate.

Air sample filter - The filter used to collect fibers which are then counted. The filter is made of mixed cellulose ester membrane (MCE) for PCM (Phase Contrast Microscopy, 25 mm, 3-piece with 2 inches Static Extension Cowl, 0.8 micron pore size) and MCE for TEM (Transmission Electron Microscopy, 25 mm, 3-piece with 2 inches Static Extension Cowl, 0.45 micron pore size).

Amended water - Water to which a surfactant (wetting agent) has been added to increase the penetrating ability of the liquid.

Asbestos - Includes chrysotile, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, actinolite asbestos, and any of these minerals that have been chemically treated or altered. Asbestos also includes PACM, as defined below.

Asbestos Hazard Abatement Plan (AHAP) - Asbestos work procedures required to be submitted by the contractor before work begins.

Asbestos-containing material (ACM) - Any material containing more than one percent of asbestos.

Asbestos contaminated elements (ACE) - Building elements such as ceilings, walls, lights, or ductwork that are contaminated with asbestos.

Asbestos-contaminated soil (ACS) – Soil found in the work area or in adjacent areas such as crawlspaces or pipe tunnels which is contaminated with asbestos-containing material debris and cannot be easily separated from the material.

Asbestos-containing waste (ACW) material - Asbestos-containing material or asbestos contaminated objects requiring disposal.

Asbestos Project Monitor – Some States require that any person conducting asbestos abatement air sampling, clearance inspections and clearance air sampling be licensed as an asbestos project monitor.

Asbestos waste decontamination facility - A system consisting of drum/bag washing facilities and a temporary storage area for cleaned containers of asbestos waste. Used as the exit for

waste and equipment leaving the regulated area. In an emergency, it may be used to evacuate personnel.
Authorized person - Any person authorized by the VA, the Contractor, or government agency and required by work duties to be present in regulated areas.
Authorized visitor - Any person approved by the VA; the contractor; or any government agency representative having jurisdiction over the regulated area (e.g., OSHA, Federal and State EPA).
Barrier - Any surface that isolates the regulated area and inhibits fiber migration from the regulated area.
Containment Barrier - An airtight barrier consisting of walls, floors, and/or ceilings of sealed plastic sheeting which surrounds and seals the outer perimeter of the regulated area.
Critical Barrier - The barrier responsible for isolating the regulated area from adjacent spaces, typically constructed of 2-layers of 6-mil independently installed plastic sheeting (Polyethylene) secured in place at openings such as doors, windows, penetrations or any other opening into the regulated area.
Primary Barrier – Plastic barriers placed over critical barriers and exposed directly to abatement work or to secondary barrier.
Secondary Barrier - Any additional plastic barriers used to isolate and provide protection from debris during abatement work.
Breathing zone - The hemisphere forward of the shoulders with a radius of about 150 - 225 mm (6 - 9 inches) from the worker's nose.
Bridging encapsulant - An encapsulant that forms a layer on the surface of the ACM.
Building/facility owner - The legal entity, including a lessee, which exercises control over management and recordkeeping functions relating to a building and/or facility in which asbestos activities take place.
Bulk testing - The collection and analysis of suspect asbestos containing materials.
Certified Industrial Hygienist (CIH) - A person certified in the comprehensive practice of industrial hygiene by the American Board of Industrial Hygiene.
Class I asbestos work - Activities involving the removal of Thermal System Insulation (TSI) and surfacing ACM and Presumed Asbestos Containing Material (PACM).
Class II asbestos work - Activities involving the removal of ACM which is not thermal system insulation or surfacing material. This includes, but is not limited to, the removal of asbestos-containing wallboard, floor tile and sheeting, roofing and siding shingles, and construction mastic.
Clean room/Changing room - An uncontaminated room having facilities for the storage of employee's street clothing and uncontaminated materials and equipment.
Clearance sample - The final air sample taken after all asbestos work has been done and visually inspected. Performed by the VA's Professional Industrial Hygiene Consultant/Certified Industrial Hygienist (VPIH/CIH).
Closely resemble - The major workplace conditions which have contributed to the levels of historic asbestos exposure, are no more protective than conditions of the current workplace.
Competent person - In addition to the definition in 29 CFR 1926.32(f), one who is capable of identifying existing asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure, who has the authority to take prompt corrective measures to eliminate them, as specified in 29 CFR 1926.32(f); in addition, for Class I and II work who is specially trained in a training course which meets the criteria of EPA's Model Accreditation Plan (40 CFR 763) for supervisor.
Contractor's Professional Industrial Hygienist (CPIH/CIH) - The asbestos abatement contractor's industrial hygienist. The industrial hygienist must meet the qualification requirements of a PIH and may report to a certified industrial hygienist (CIH).
Count - Refers to the fiber count or the average number of fibers greater than five microns in length with a length-to-width (aspect) ratio of at least 3 to 1, per cubic centimeter of air.
Crawlspace – An area which can be found either in or adjacent to the work area. This area has limited access and egress and may contain asbestos materials and/or asbestos contaminated soil.
Decontamination area/unit - An enclosed area adjacent to and connected to the regulated area and consisting of an equipment room, shower room, and clean room, which is used for the decontamination of workers, materials, and equipment that are contaminated with asbestos.

Demolition - The wrecking or taking out of any load-supporting structural member and any related razing, removing, or stripping of asbestos products.
Disposal bag - Typically 6-mil thick sift-proof, dustproof, leak-tight container used to package and transport asbestos waste from regulated areas to the approved landfill. Each bag/container must be labeled/marked in accordance with EPA, OSHA and DOT requirements.
Disturbance - Asbestos Operations and Maintenance Activities (OSHA Class III) that disrupt the matrix of ACM or PACM, crumble or pulverize ACM or PACM, or generate visible debris from ACM or PACM. Disturbance includes cutting away small amounts of ACM or PACM, no greater than the amount that can be contained in one standard sized glove bag or waste bag, in order to access a building component. In no event shall the amount of ACM or PACM so disturbed exceed that which can be contained in one glove bag or disposal bag, which shall not exceed 60 inches in length or width.
Drum - A rigid, impermeable container made of cardboard fiber, plastic, or metal which can be sealed in order to be sift-proof, dustproof, and leak-tight.
Employee exposure - The exposure to airborne asbestos that would occur if the employee were not wearing respiratory protection equipment.
Encapsulant - A material that surrounds or embeds asbestos fibers in an adhesive matrix and prevents the release of fibers.
Encapsulation - Treating ACM with an encapsulant.
Enclosure - The construction of an air tight, impermeable, permanent barrier around ACM to control the release of asbestos fibers from the material and also eliminate access to the material.
Equipment room - A contaminated room located within the decontamination area that is supplied with impermeable bags or containers for the disposal of contaminated protective clothing and equipment.
Fiber - A particulate form of asbestos, 5 microns or longer, with a length to width (aspect) ratio of at least 3 to 1.
Fibers per cubic centimeter (f/cc) - Abbreviation for fibers per cubic centimeter, used to describe the level of asbestos fibers in air.
Filter - Media used in respirators, vacuums, or other machines to remove particulate from air.
Firestopping - Material used to close the open parts of a structure in order to prevent a fire from spreading.
Friable asbestos containing material - Any material containing more than one (1) percent asbestos as determined using the method specified 40 CFR 763, Polarized Light Microscopy, that, when dry, can be crumbled, pulverized, or reduced to powder by hand pressure.
Glovebag - Not more than a 60 x 60 inch impervious plastic bag-like enclosure affixed around an asbestos-containing material, with glove-like appendages through which materials and tools may be handled.
High efficiency particulate air (HEPA) filter – An ASHRAE MERV 17 filter capable of trapping and retaining at least 99.97 percent of all mono-dispersed particles of 0.3 micrometers in diameter.
HEPA vacuum - Vacuum collection equipment equipped with a HEPA filter system capable of collecting and retaining asbestos fibers.
Homogeneous area - An area of surfacing, thermal system insulation or miscellaneous ACM that is uniform in color, texture and date of application.
HVAC - Heating, Ventilation and Air Conditioning
Industrial hygienist (IH) - A professional qualified by education, training, and experience to anticipate, recognize, evaluate and develop controls for occupational health hazards. Meets definition requirements of the American Industrial Hygiene Association (AIHA).
Industrial hygienist technician (IH Technician) - A person working under the direction of an IH or CIH who has special training, experience, certifications and licenses required for the industrial hygiene work assigned. Some States require that an industrial hygienist technician conducting asbestos abatement air sampling, clearance inspection and clearance air sampling be licensed as an asbestos project monitor.
Intact - The ACM has not crumbled, been pulverized, or otherwise deteriorated so that the asbestos is no longer likely to be bound with its matrix.

Lockdown - Applying encapsulant, after a final visual inspection, on all abated surfaces at the conclusion of ACM removal prior to removal of critical barriers.
National Emission Standards for Hazardous Air Pollutants (NESHAP) - EPA's rule to control emissions of asbestos to the environment (40 CFR Part 61, Subpart M).
Negative initial exposure assessment - A demonstration by the employer which complies with the criteria in 29 CFR 1926.1101 (f)(2)(iii), that employee exposure during an operation is expected to be consistently below the PEL or Excursion Limit (EL).
Negative pressure - Air pressure which is lower than the surrounding area, created by exhausting air from a sealed regulated area through HEPA equipped filtration units. OSHA requires maintaining -0.02 inch water column gauge inside the negative pressure enclosure.
Negative pressure respirator - A respirator in which the air pressure inside the facepiece is negative during inhalation relative to the air pressure outside the respirator facepiece.
Non-friable ACM - Material that contains more than 1 percent asbestos but cannot be crumbled, pulverized, or reduced to powder by hand pressure.
Organic vapor cartridge - The type of cartridge used on air purifying respirators to remove organic vapor hazardous air contaminants.
Outside air - The air outside buildings and structures, including, but not limited to, the air under a bridge or in an open ferry dock.
Owner/operator - Any person who owns, leases, operates, controls, or supervises the facility being demolished or renovated or any person who owns, leases, operates, controls, or supervises the demolition or renovation operation, or both.
Penetrating encapsulant - Encapsulant that is absorbed into the ACM matrix without leaving a surface layer.
Permissible exposure limit (PEL) - The level of exposure OSHA allows for an 8-hour time weighted average. For asbestos fibers, the eight (8) hour time-weighted average PEL is 0.1 fibers per cubic centimeter (0.1 f/cc) of air and the 30-minute Excursion Limit (EL) is 1.0 fibers per cubic centimeter (1 f/cc).
Personal protective equipment (PPE) – equipment designed to protect user from injury and/or specific job hazard. Such equipment may include protective clothing, hard hats, safety glasses, fall protection, and respirators.
Personal sampling/monitoring - Representative air samples obtained in the breathing zone for one or more workers within the regulated area using a filter cassette and a calibrated air sampling pump to determine asbestos exposure.
Pipe tunnel – An area, typically located adjacent to mechanical spaces or boiler rooms in which the pipes servicing the heating system in the building are routed to allow the pipes to access heating elements. These areas may contain asbestos pipe insulation, asbestos fittings, debris or asbestos-contaminated soil.
Polarized light microscopy (PLM) - Light microscopy using dispersion staining techniques and refractive indices to identify and quantify the type of asbestos present in a bulk sample.
Polyethylene sheeting - Strong plastic barrier material 4 to 6-mils thick, semi-transparent, flame retardant per NFPA 241.
Positive/negative fit check - A method of verifying the seal of a facepiece respirator by temporarily occluding the filters and breathing in (inhaling) and then temporarily occluding the exhalation valve and breathing out (exhaling) while checking for inward or outward leakage of the respirator respectively.
Presumed ACM (PACM) - Thermal system insulation, surfacing, and flooring material installed in buildings prior to 1981. If the building owner has actual knowledge, or should have known through the exercise of due diligence that other materials are ACM, they too must be treated as PACM. The designation of PACM may be rebutted pursuant to 29 CFR 1926.1101 (k)(5).
Professional IH - An IH who meets the definition requirements of AIHA; meets the definition requirements of OSHA as a "Competent Person" at 29 CFR 1926.1101 (b); has completed two specialized EPA approved courses on management and supervision of asbestos abatement projects; has formal training in respiratory protection and waste disposal; and has a minimum of four projects of similar complexity with this project of which at least three projects serving as the supervisory IH. The PIH may be either the VA's PIH (VPIH/CIH) or Contractor's PIH (CPIH/CIH).

Project designer - A person who has successfully completed the training requirements for an asbestos abatement project designer as required by 40 CFR 763 Subpart E, Appendix C, Part I; (B)(5).
Assigned Protection factor - A value assigned by OSHA/NIOSH to indicate the expected protection provided by each respirator class, when the respirator is properly selected and worn correctly. The number indicates the reduction of exposure level from outside to inside the respirator facepiece.
Qualitative fit test (QLFT) - A fit test using a challenge material that can be sensed by the wearer if leakage in the respirator occurs.
Quantitative fit test (QNFT) - A fit test using a challenge material which is quantified outside and inside the respirator thus allowing the determination of the actual fit factor.
Regulated area - An area established by the employer to demarcate where Class I, II, III asbestos work is conducted, and any adjoining area where debris and waste from such asbestos work may accumulate; and a work area within which airborne concentrations of asbestos exceed, or there is a reasonable possibility they may exceed the PEL.
Regulated ACM (RACM) - Friable ACM; Category I non-friable ACM that has become friable; Category I non-friable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading or; Category II non-friable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces expected to act on the material in the course of the demolition or renovation operation.
Removal - All operations where ACM, PACM and/or RACM is taken out or stripped from structures or substrates, including demolition operations.
Renovation - Altering a facility or one or more facility components in any way, including the stripping or removal of asbestos from a facility component which does not involve demolition activity.
Repair - Overhauling, rebuilding, reconstructing, or reconditioning of structures or substrates, including encapsulation or other repair of ACM or PACM attached to structures or substrates.
Shower room - The portion of the PDF where personnel shower before leaving the regulated area.
Supplied air respirator (SAR) - A respiratory protection system that supplies minimum Grade D respirable air per ANSI/Compressed Gas Association Commodity Specification for Air, G-7.1-2018.
Surfacing ACM - A material containing more than 1 percent asbestos that is sprayed, troweled on or otherwise applied to surfaces for acoustical, decorative, fireproofing and other purposes.
Surfactant - A chemical added to water to decrease water's surface tension thus making it more penetrating into ACM.
Thermal system ACM - A material containing more than 1 percent asbestos applied to pipes, fittings, boilers, breeching, tanks, ducts, or other structural components to prevent heat loss or gain.
Transmission electron microscopy (TEM) - A microscopy method that can identify and count asbestos fibers.
VA Professional Industrial Hygienist (VPIH/CIH) – The Department of Veterans Affairs Professional Industrial Hygienist must meet the qualifications of a PIH, and may report to a Certified Industrial Hygienist (CIH).
VA Representative - The VA official responsible for on-going project work.
VA Total – means a building or substantial part of the building is completely removed, torn or knocked down, bulldozed, flattened, or razed, including removal of building debris.
Visible emissions - Any emissions, which are visually detectable without the aid of instruments, coming from ACM/PACM/RACM/ACS or ACM waste material.
Waste/Equipment decontamination facility (W/EDF) – The area in which equipment is decontaminated before removal from the regulated area.
Waste generator - Any owner or operator whose act or process produces asbestos-containing waste material.
Waste shipment record - The shipping document, required to be originated and signed by the waste generator, used to track and substantiate the disposition of asbestos-containing waste material.

Wet cleaning - The process of thoroughly eliminating, by wet methods, any asbestos contamination from surfaces or objects.

C. Referenced Standards Organizations: See Section 01 42 19 REFERENCED STANDARDS.

1.5 APPLICABLE CODES AND REGULATIONS

A. General Applicability of Codes, Regulations, and Standards:
1. All work under this contract shall be done in strict accordance with all applicable Federal, State, and Local regulations, standards and codes governing asbestos abatement, and any other trade work done in conjunction with the abatement. All applicable codes, regulations and standards are adopted into this specification and will have the same force and effect as this specification.
2. The most recent edition of any relevant regulation, standard, document or code shall be in effect. Where conflict among the requirements or with these specification, exists, the most stringent requirement(s) shall be utilized.
3. Copies of all standards, regulations, codes and other applicable documents, including this specification and those listed in Section 1.5 shall be available at the worksite in the clean change area of the worker decontamination system and/or the Contractor's on-site Field Office. These standards, regulations, codes and other applicable documents, including this specification and those listed in Section 1.5 may be made available electronically.

B. Asbestos Abatement Contractor Responsibility: The Asbestos Abatement Contractor (Contractor) shall assume full responsibility and liability for compliance with all applicable Federal, State and Local regulations related to any and all aspects of the asbestos abatement project. The Contractor is responsible for providing and maintaining training, accreditations, medical exams, medical records, personal protective equipment (PPE), respiratory protection, and respirator fit testing, as required by applicable Federal, State and Local regulations. The Contractor shall hold the VA and VPIH/CIH consultants harmless for any Contractor's failure to comply with any applicable work, packaging, transporting, disposal, safety, health, or environmental requirement on the part of himself, his employees, or his subcontractors. The Contractor will incur all costs of the CPIH/CIH, including all sampling/analytical costs to assure compliance with OSHA/EPA/State/Local requirements related to failure to comply with the regulations applicable to the work.

C. Federal Requirements: Federal requirements which govern some aspect of asbestos abatement include, but are not limited to, the following regulations.
1. Occupational Safety and Health Administration **(OSHA)**
   a. Title 29 CFR 1926.1101 - Construction Standard for Asbestos
   b. Title 29 CFR 1926 Subpart E - Personal Protective Equipment and Life Saving Equipment
   c. Title 29 CFR 1910.134 - Respiratory Protection
   d. Title 29 CFR 1926 - Construction Industry Standards
   e. Title 29 CFR 1926.33 - Access to Employee Exposure and Medical Records
   f. Title 29 CFR 1926.59 same as 1910.1200 - Hazard Communication
   g. Title 29 CFR 1926 Subpart C – General Safety and Health Provisions and Subpart D – Occupational Health and Environmental Controls
2. Environmental Protection Agency **(EPA)**
   a. 1. 40 CFR 61 Subpart M - National Emission Standard for Hazardous Air Pollutants - Asbestos
   b. 2. 40 CFR 763.80 - Asbestos Hazard Emergency Response Act (AHERA) and Asbestos Hazard Abatement Reauthorization Act (ASHARA)
3. Department of Transportation **(DOT)**
   a. Title 49 CFR 171 - 180 – Transportation

D. State Requirements:
1. State requirements that apply to the asbestos abatement work, disposal, clearance, etc., include, but are not limited to, the following:

A. New York State Department of Health (NYSDOH)

1. 10 NYCRR, Part 73, “Asbestos Safety Program Requirements”

B. New York State Department of Labor (NYSDOL)

1. 12 NYCRR, Part 56, “Asbestos”-Industrial Code Rule 56

C. New York State Department of Environmental Conservation (NYSDEC)

PART 2 - 6 NYCRR, Part 360 “Solid Waste Management Facilities”

PART 3 - 6 NYCRR, Part 364 “Waste Transporter Permits”

PART 4 - 6 NYCRR, Part 372 “Hazardous Waste Manifest System and Related Standards for Generators, Transporters and Facilities 3

E. Local Requirements:
1. If Local requirements are more stringent than Federal or State standards, the local standards are to be followed.

F. Standards:

G. Standards which govern asbestos abatement activities include, but are not limited to, the following:
a. American National Standards Institute (ANSI/ASSP) Z9.2-2018 - Fundamentals Governing the Design and Operation of Local Exhaust Systems and ANSI/ASSE Z88.2-2015 - Practices for Respiratory Protection.

H. Underwriters Laboratories (UL) 586-2009 - UL Standard for Safety of HEPA filter Units, 9th Edition; ANSI Approval 2017-12-19.
1. Standards which govern encapsulation work include, but are not limited to, the following:
a. American Society for Testing and Materials International (ASTM).
2. Standards which govern the fire and safety concerns in abatement work include, but are not limited to, the following:
3. National Fire Protection Association (NFPA) 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations.
4. NFPA 701 - Standard Methods for Fire Tests for Flame Resistant Textiles and Film.
5. NFPA 101 - Life Safety Code.
6. EPA Guidance Documents:
7. EPA guidance documents which discuss asbestos abatement work activities are listed below. These documents are made part of this section by reference. Guidance for Controlling ACM in Buildings (Purple Book) EPA 560/5-85-024.
8. Asbestos Waste Management Guidance EPA 530-SW-85-007.
9. A Guide to Respiratory Protection for the Asbestos Abatement Industry EPA-560-OPTS-86-001.
10. Guide to Managing Asbestos in Place (Green Book) TS 799 20T July 1990.

I. Notices:

J. State and Local agencies: Send written notification as required by state and local regulations including the local fire department prior to beginning any work on ACM as follows:

K. Copies of notifications shall be submitted to the VA for the facility's records in the same time frame notification are given to EPA, State, and Local authorities.

L. Permits/Licenses: The contractor shall apply for and have all required permits and licenses to perform asbestos abatement work as required by Federal, State, and Local regulations prior to beginning any work on ACM as follows.

M. Posting and Filing of Regulations: Maintain two (2) copies of applicable Federal, State, and Local regulations. Post one copy of each at the regulated area where workers will have daily access to the regulations and keep another copy in the Contractor's office.

N. VA Responsibilities Prior to Commencement of Work:
1. Notify occupants adjacent to regulated areas of project dates and requirements for relocation, if needed. Arrangements must be made prior to starting work for relocation of desks, files, equipment, and personal possessions to avoid unauthorized access into the regulated area. Note: **Notification of adjacent personnel is required by OSHA in 29 CFR 1926.1101 (k) to prevent unnecessary or unauthorized access to the regulated area.**

O. Submit to the Contractor results of background air sampling; including location of samples, person who collected the samples, equipment utilized, calibration data and method of analysis. During abatement, submit to the Contractor, results of bulk material analysis and air sampling data collected during the course of the abatement. This information shall not release the Contractor from any responsibility for OSHA compliance.

P. Emergency Action Plan and Arrangements:
1. An Emergency Action Plan shall be developed by prior to commencing abatement activities and shall be agreed to by the Contractor and the VA. The Plan shall meet the requirements of 29 CFR 1926, Subpart C, Standard 1926.35 Employee Emergency Action Plans.
2. Emergency procedures shall be in written form and prominently posted in the clean room and equipment room of the decontamination unit. Everyone, prior to entering the regulated area, must read and sign these procedures to acknowledge understanding of the regulated area layout, location of emergency exits and emergency procedures.
3. Emergency planning shall include written notification of police, fire, and emergency medical personnel of planned abatement activities; work schedule; layout of regulated area; and access to the regulated area, particularly barriers that may affect response capabilities.
4. Emergency planning shall include consideration of fire, explosion, hazardous atmospheres, electrical hazards, slips/trips and falls, confined spaces, and heat stress illness. Written procedures for response to emergency situations shall be developed and employee training in procedures shall be provided.

Q. Employees shall be trained in regulated area/site evacuation procedures in the event of workplace emergencies.
   a. For non-life-threatening situations - employees injured or otherwise incapacitated shall be decontaminated following normal procedures with assistance from fellow workers, if necessary, before exiting the regulated area to obtain proper medical treatment.

R. For life-threatening injury or illness, worker decontamination shall take least priority after measures to stabilize the injured worker, medical personnel shall remove them from the regulated area if back or neck injury is present, and secure proper medical treatment.
1. Telephone numbers of any/all emergency response personnel shall be prominently posted in the clean room, along with the location of the nearest telephone.
2. The Contractor shall provide verification of first aid/CPR training for personnel responsible for providing first aid/CPR. OSHA requires medical assistance within 3-4 minutes of a life-threatening injury/illness. Bloodborne Pathogen training shall also be verified for those personnel required to provide first aid/CPR.

S. The Emergency Action Plan shall provide for a Contingency Plan in the event that an incident occurs that may require the modification of the Asbestos Hazard Abatement Plans during abatement. Such incidents include, but are not limited to, fire; accident; power failure; negative pressure failure; and supplied air system failure. The Contractor shall detail procedures to be followed in the event of an incident assuring that asbestos abatement work is stopped and wetting is continued until correction of the problem.

T. Pre-Construction Meeting:
1. Prior to commencing the work, the Contractor shall meet with the VPIH/CIH to present and review, as appropriate, the items following this paragraph. The Contractor's Competent Person(s) who will be on-site shall participate in the pre-start meeting. The pre-start meeting is to discuss and determine procedures to be used during the project. At this meeting, the Contractor shall provide:
   a. Proof of Contractor licensing.
   b. Proof the Competent Person is trained and accredited and approved for working in this State. Verification of the experience of the Competent Person shall also be presented.
   c. A list of all workers who will participate in the project, including experience and verification of training and accreditation.
   d. A list of and verification of training for all personnel who have current first-aid/CPR training. A minimum of one person per shift must have adequate training.
   e. Current medical written opinions for all personnel working on-site meeting the requirements of 29 CFR 1926.1101 (m).
   f. Current fit-tests for all personnel wearing respirators on-site meeting the requirements of 29 CFR 1926.1101 (h) and Appendix C.
2. A copy of the Contractor's Asbestos Hazard Abatement Plan. In these procedures, the following information must be detailed, specific for this project. A copy of the Contractor's Asbestos Hazard Abatement Plan (AHAP) for Class I Glovebag Asbestos Abatement. In these procedures, the following information must be detailed, specific for this project.
   1) Regulated area preparation procedures;
   2) Notification requirements procedure of Contractor as required in 29 CFR 1926.1101 (d) Multi-Employer Worksites;
   3) If required, decontamination area set-up/layout and decontamination procedures for employees;
   4) Glovebag abatement methods/procedures and equipment to be used; and
3. Personal protective equipment to be used
4. At this meeting the Contractor shall provide all submittals as required.
5. Procedures for handling, packaging and disposal of asbestos waste.
6. Emergency Action Plan and Contingency Plan Procedures.

1.6 PROJECT COORDINATION

A. The following are the minimum administrative and supervisory personnel necessary for coordination of the work.
1. Personnel
   a. Administrative and supervisory personnel shall consist of a qualified Competent Person(s) as defined by OSHA in the Construction Standards and the Asbestos Construction Standard; Contractor Professional Industrial Hygienist and Industrial Hygiene Technicians. These employees are the Contractor's representatives responsible for compliance with these specifications and all other applicable requirements.
   b. Non-supervisory personnel shall consist of an adequate number of qualified personnel to meet the schedule requirements of the project. Personnel shall meet required qualifications. Personnel utilized on-site shall be pre-approved by the VA Representative. A request for approval shall be submitted for any person to be employed during the project giving the person's name; last four digits of social security number; qualifications; accreditation card with color picture if required by State; Certificate of Worker's Acknowledgment; and Affidavit of Medical Surveillance and Respiratory Protection and current Respirator Fit Test.
   c. Minimum qualifications for Contractor and assigned personnel are:
      1) The Contractor has conducted within the last three (3) years, three (3) projects of similar complexity and dollar value as this project; has not been cited and penalized for serious violations of Federal (and State or Local as applicable) EPA and OSHA asbestos regulations in the past three (3) years;

has adequate liability/occurrence insurance for asbestos work as required by the State; is licensed in applicable State; has adequate and qualified personnel available to complete the work; has comprehensive Asbestos Hazard Abatement Plans (AHAPs) for asbestos work; and has adequate materials, equipment and supplies to perform the work.

2) The Competent Person has four (4) years of abatement experience of which two (2) years were as the Competent Person on the project; meets the OSHA definition of a Competent Person; has been the Competent Person on two (2) projects of similar size and complexity as this project within the past three (3) years; has completed EPA AHERA/OSHA/State/Local training requirements/accreditation(s) and refreshers; and has all required OSHA documentation related to medical and respiratory protection.

3) The Contractor Professional Industrial Hygienist/CIH (CPIH/CIH) shall have five (5) years of monitoring experience and supervision of asbestos abatement projects; has participated as senior IH on five (5) abatement projects, three (3) of which are similar in size and complexity as this project; has specialized EPA AHERA/OSHA training in asbestos abatement management, respiratory protection, waste disposal and asbestos inspection; has completed the NIOSH 582 Course or equivalent, Contractor/Supervisor course; and has appropriate medical/respiratory protection records/documentation.

4) The Abatement Personnel shall have completed the EPA AHERA/OSHA abatement worker course; have training on the Asbestos Hazard Abatement Plans of the Contractor; has one year of asbestos abatement experience within the past three (3) years of similar size and complexity; has applicable medical and respiratory protection documentation; has certificate of training/current refresher and State accreditation/license.

2. All personnel shall be in compliance with OSHA construction safety training as applicable and submit certification.

1.7 RESPIRATORY PROTECTION

A. General - Respiratory Protection Program: The Contractor shall develop and implement a written Respiratory Protection Program (RPP) which is in compliance with OSHA requirements found at 29 CFR 1926.1101 and 29 CFR 1910.134. ANSI Standard Z88.2-2015 provides excellent guidance for developing a respiratory protection program. All respirators used must be NIOSH approved for asbestos abatement activities. The written RPP shall, at a minimum, contain the basic requirements found at 29 CFR 1910.134 (c) - Respiratory Protection Program.Respiratory Protection Program Coordinator: The Respiratory Protection Program Coordinator (RPPC) must be identified and shall have two (2) years of experience coordinating RPP of similar size and complexity. The RPPC must submit a signed statement attesting to the fact that the program meets the above requirements.

B. Selection and Use of Respirators: The procedure for the selection and use of respirators must be submitted to the VA as part of the Contractor's qualifications. The procedure must be written clearly enough for workers to understand. A copy of the Respiratory Protection Program must be available in the clean room of the decontamination unit or in the onsite Contractor’s office, for reference by employees or authorized visitors.

C. Minimum Respiratory Protection: Minimum respiratory protection shall be a ½-mask negative pressure air purifying respirator equipped with P100 filters, provided personal air samples in the workplace remain at or below 0.1 f/cc, determined as an 8-hour TWA. Full face powered air purifying respirator equipped with P100 filters shall be required until Contractor demonstrates that personal air samples are at or below 0.1 f/cc, determined as an 8-hour TWA. A higher level of respiratory protection shall be required, if fiber levels exceed 1 f/cc as an 8-hour TWA, inside the regulated work area. Respirator selection shall meet the requirements of 29 CFR 1926.1101 (h) and 29 CFR 1910.134 (d)(3)(i)(A) Table 1, except as indicated in this paragraph. Abatement personnel must have a respirator for their exclusive use.

D. Medical Written Opinion: No employee shall be allowed to wear a respirator unless a physician or other licensed health care professional has provided a written determination they are medically qualified to wear the class of respirator to be used on the project while wearing whole body impermeable garments and subjected to heat or cold stress.

E. Respirator Fit Test: All personnel wearing respirators shall have a current quantitative fit test which was conducted in accordance with 29 CFR 1910.134 (f) and Appendix A. Fit tests shall be done for PAPR's which have been put into a failure mode.

F. Respirator Fit Check: The Competent Person shall assure that the positive/negative pressure user seal check is done each time the respirator is donned by an employee. Head coverings must cover respirator head straps. Any situation that prevents an effective facepiece to face seal as evidenced by failure of a user seal check shall preclude that person from entering the regulated area until resolution of the problem.

G. Maintenance and Care of Respirators: The Respiratory Protection Program Coordinator shall submit evidence and documentation showing compliance with 29 CFR 1910.134 (h) maintenance and care of respirators.

1.8 **WORKER PROTECTION**

A. Training of Abatement Personnel: Prior to beginning any abatement activity, all personnel shall be trained in accordance with OSHA 29 CFR 1926.1101 (k)(9) and any additional State/Local requirements. Training must include, at a minimum, the elements listed at 29 CFR 1926.1101 (k)(9)(viii). Training shall have been conducted by a third party, EPA/State approved trainer meeting the requirements of EPA 40 CFR 763 Appendix C (AHERA MAP). Initial training certificates and current refresher and accreditation proof must be submitted for each person working at the site.

B. Medical Examinations: Medical examinations meeting the requirements of 29 CFR 1926.1101 (m) shall be provided for all personnel working in the regulated area, regardless of exposure levels. A current physician's written opinion as required by 29 CFR 1926.1101 (m)(4) shall be provided for each person and shall include in the medical opinion that the person has been evaluated for working in a heat and cold stress environment while wearing personal protective equipment (PPE) and is able to perform the work without risk of material health impairment.

C. Personal Protective Equipment: Provide whole body clothing, head coverings, foot coverings and any other personal protective equipment as determined by conducting the hazard assessment required by OSHA at 29 CFR 1910.132 (d). The Competent Person shall ensure the integrity of personal protective equipment worn for the duration of the project. Duct tape shall be used to secure all suit sleeves to wrists and to secure foot coverings at the ankle.

D. Regulated Area Entry Procedure: The Competent Person shall ensure that each time workers enter the regulated area; they remove ALL street clothes in the clean room of the decontamination unit and put on new disposable coveralls, head coverings, a clean respirator, and then proceed through the shower room to the equipment room where they put on non-disposable required personal protective equipment. NYS ICR 56 Special Conditions shall apply.

E. Decontamination Procedure: The Competent Person shall require all personnel to adhere to following decontamination procedures whenever they leave the regulated area.
   1. When exiting the regulated area, remove disposable coveralls, and ALL other clothes, disposable head coverings, and foot coverings or boots in the equipment room.
   2. Still wearing the respirator and completely naked, proceed to the shower. Showering is MANDATORY. Care must be taken to follow reasonable procedures in removing the respirator to avoid inhaling asbestos fibers while showering. The following procedure is required as a minimum:
      a. Thoroughly wet body including hair and face. If using a PAPR hold blower above head to keep filters dry.

b. With respirator still in place, thoroughly decontaminate body, hair, respirator face piece, and all other parts of the respirator except the blower and battery pack on a PAPR. Pay particular attention to cleaning the seal between the face and respirator facepiece and under the respirator straps.

c. Take a deep breath, hold it and/or exhale slowly, completely wetting hair, face, and respirator. While still holding breath, remove the respirator and hold it away from the face before starting to breathe.

3. Carefully decontaminate the facepiece of the respirator inside and out. If using a PAPR, shut down using the following sequence: a) first cap inlets to filters; b) turn blower off to keep debris collected on the inlet side of the filter from dislodging and contaminating the outside of the unit; c) thoroughly decontaminate blower and hoses; d) carefully decontaminate battery pack with a wet rag being cautious of getting water in the battery pack thus preventing destruction. **(THIS PROCEDURE IS NOT A SUBSTITUTE FOR RESPIRATOR CLEANING!)**
4. Shower and wash body completely with soap and water. Rinse thoroughly.
5. Rinse shower room walls and floor to drain prior to exiting.
6. Proceed from shower to clean room; dry off and change into street clothes or into new disposable work clothing.

F. Regulated Area Requirements: The Competent Person shall meet all requirements of 29 CFR 1926.1101 (o) and assure that all requirements for Class I Glovebag regulated areas at 29 CFR 1926.1101 (e), 29 CFR 1926.1101 (g)(1)(i)(ii)(iii), 29 CFR 1926.1101 (g)(5)(ii)(iii)(iv) are met. All personnel in the regulated area shall not be allowed to eat, drink, smoke, chew tobacco or gum, apply cosmetics, or in any way interfere with the fit of their respirator.

1.9 DECONTAMINATION FACILITIES

A. Description: Provide each regulated area with separate personnel decontamination facilities (PDF) and waste/equipment decontamination facilities (W/EDF). Ensure that the PDF are the only means of ingress and egress to the regulated area and that all equipment, bagged waste, and other material exit the regulated area only through the W/EDF.

B. General Requirements: All personnel entering or exiting a regulated area must go through the PDF and shall follow the requirements at 29 CFR 1926.1101 (j)(1) and these specifications. All waste, equipment and contaminated materials must exit the regulated area through the W/EDF and be decontaminated in accordance with these specifications. Walls and ceilings of the PDF and W/EDF must be constructed of a minimum of 3-layers of 6-mil opaque fire retardant polyethylene sheeting and be securely attached to existing building components and/or an adequate temporary framework. A minimum of 3-layers of 6-mil poly shall also be used to cover the floor under the PDF and W/EDF units. Construct doors so that they overlap and secure to adjacent surfaces. Weight inner doorway sheets with layers of duct tape so that they close quickly after release. Put arrows on sheets so they show direction of travel and overlap. If the building adjacent area is occupied, construct a solid barrier on the occupied side(s) to protect the sheeting and reduce potential for non-authorized personnel entering the regulated area.

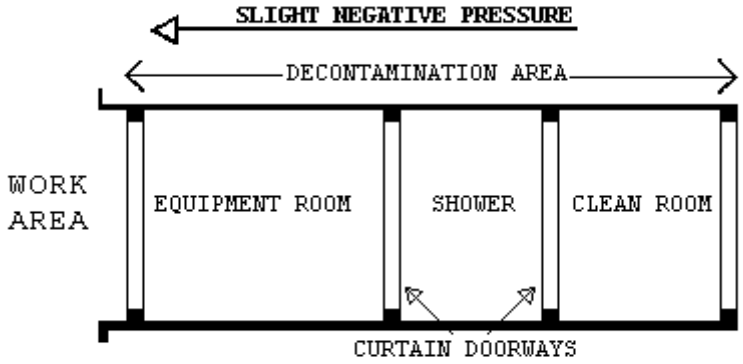
C. Temporary Facilities to the PDF and W/EDF: The Competent Person shall provide temporary water service connections to the PDF and W/EDF. Backflow prevention must be provided at the point of connection to the VA system. Water supply must be of adequate pressure and meet requirements of 29 CFR 1910.141(d)(3). Provide adequate temporary overhead electric power with ground fault circuit interruption (GFCI) protection. Provide a sub-panel equipped with GFCI protection for all temporary power in the clean room. Provide adequate lighting to provide a minimum of 50 foot candles in the PDF and W/EDF. Provide temporary heat, if needed, to maintain 70˚F throughout the PDF and W/EDF.

D. Personnel Decontamination Facility (PDF): The Competent Person shall provide a PDF consisting of shower room which is contiguous to a clean room and equipment room. The PDF must be sized to accommodate the number of personnel scheduled for the project. The shower room, located in the center of the PDF, shall be fitted with as many portable showers as

necessary to insure all employees can complete the entire decontamination procedure within 15 minutes. The PDF shall be constructed of opaque poly for privacy. The PDF shall be constructed to eliminate any parallel routes of egress without showering.

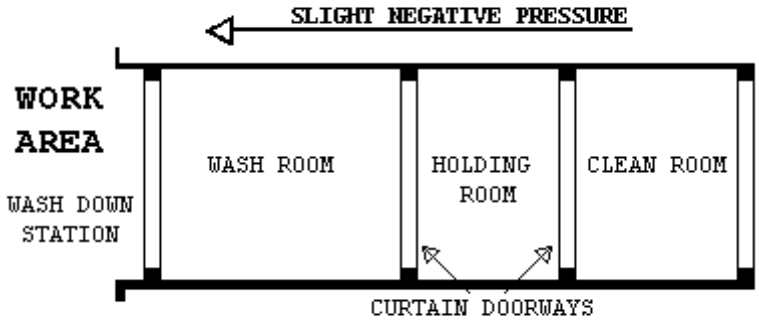
1. Clean Room: The clean room must be physically and visually separated from the rest of the building to protect the privacy of personnel changing clothes. The clean room shall be constructed of at least 3–layers of 6-mil opaque fire retardant poly to provide an air tight room. Provide a minimum of 2 - 900 mm (3 foot) wide 6-mil poly opaque fire retardant doorways. One doorway shall be the entry from outside the PDF and the second doorway shall be to the shower room of the PDF. The floor of the clean room shall be maintained in a clean, dry and sanitary condition. Shower overflow shall not be allowed into the clean room. Provide 1 storage locker per person. A portable fire extinguisher, minimum 10 pounds capacity, Type ABC, shall be provided in accordance with OSHA and NFPA Standard 10. All persons entering the regulated area shall remove all street clothing in the clean room and dress in disposable protective clothing and respiratory protection. Any person entering the clean room does so either from the outside with street clothing on or is coming from the shower room completely naked and thoroughly washed. Any person entering the regulated area to perform Glovebag removal work, in which a negative exposure assessment has been performed, shall don a double outer protective suit and respirator. Male/Females required to enter the regulated area shall be ensured of their privacy throughout the entry/exit process by posting guards at both entry points to the PDF so no male/female can enter or exit the PDF during his/her stay in the PDF.
2. Shower Room: The Competent Person shall assure that the shower room is a completely water tight compartment to be used for the movement of all personnel from the clean room to the equipment room and for the showering of all personnel going from the equipment room to the clean room. Each shower shall be constructed so water runs down the walls of the shower and into a drip pan. Install a freely draining smooth floor on top of the shower pan. The shower room shall be separated from the rest of the building and from the clean room and equipment room using air tight walls made from at least 3-layers of 6-mil opaque fire retardant poly. The shower shall be equipped with a shower head and controls, hot and cold water, drainage, soap dish and continuous supply of soap, and shall be maintained in a sanitary condition throughout its use. The controls shall be arranged so an individual can shower without assistance. Provide a flexible hose shower head, hose bibs and all other items shown on Shower Schematic. Waste water will be pumped to a drain after being filtered through a minimum of a 100 micron sock in the shower drain; a 20 micron filter; and a final 5 micron filter. Filters will be changed a minimum of once per day or more often as needed. Filter changes must be done in the shower to prevent loss of contaminated water. Hose down all shower surfaces after each shift and clean any debris from the shower pan. Residue is to be disposed of as asbestos waste. The Competent Person shall provide a decontamination area at the outer perimeter of the regulated work area where the employees will decontaminate the outer protective suit and respirator by wet wiping and HEPA vacuuming.
3. Equipment Room: The Competent Person shall provide an equipment room which shall be an air tight compartment for the storage of work equipment/tools, reusable personal protective equipment, except for a respirator and for use as a gross decontamination area for personnel exiting the regulated area. The equipment room shall be separated from the regulated area by a minimum 3 foot wide door made with 2-layers of 6-mil opaque fire retardant poly. The equipment room shall be separated from the regulated area, the shower room and the rest of the building by air tight walls and ceiling constructed of a minimum of 3-layers of 6-mil opaque fire retardant poly. Damp wipe all surfaces of the equipment room after each shift change. Provide an additional loose layer of 6-mil fire retardant poly per shift change and remove this layer after each shift. If needed, provide a temporary electrical sub-panel equipped with GFCI in the equipment room to accommodate any equipment required in the regulated area. The Competent Person shall provide a decontamination area at the outer perimeter of the regulated work area where the employees will decontaminate the outer protective suit and respirator by wet wiping and HEPA vacuuming.

4. The PDF shall be as follows: Clean room at the entrance followed by a shower room followed by an equipment room leading to the regulated area. Each doorway in the PDF shall be a minimum of 2-layers of 6-mil opaque fire retardant poly.



E. Waste/Equipment Decontamination Facility (W/EDF)

1. The Competent Person shall provide a W/EDF consisting of a wash room, holding room, and clean room for removal of waste, equipment and contaminated material from the regulated area. Personnel shall not enter or exit the W/EDF except in the event of an emergency. Clean debris and residue in the W/EDF daily. All surfaces in the W/EDF shall be wiped/hosed down after each shift and all debris shall be cleaned from the shower pan. The W/EDF shall consist of the following:
   a. Wash Down Station: Provide an enclosed shower unit in the regulated area just outside the Wash Room as an equipment bag and container cleaning station.
   b. Wash Room: Provide a wash room for cleaning of bagged or containerized asbestos containing waste materials passed from the regulated area. Construct the wash room using 50 x 100 mm (2 inches x 4 inches) wood framing and 3-layers of 6-mil fire retardant poly. Locate the wash room so that packaged materials, after being wiped clean, can be passed to the Holding Room. Doorways in the wash room shall be constructed of 2-layers of 6-mil fire retardant poly.
   c. Holding Room: Provide a holding room as a drop location for bagged materials passed from the wash room. Construct the holding room using 50 x 100 mm (2 inches x 4 inches) wood framing or approved equivalent and 3-layers of 6-mil fire retardant poly. The holding room shall be located so that bagged material cannot be passed from the wash room to the clean room unless it goes through the holding room. Doorways in the holding room shall be constructed of 2-layers of 6-mil fire retardant poly.
   d. Clean Room: Provide a clean room to isolate the holding room from the exterior of the regulated area. Construct the clean room using 2 inches x 4 inches wood framing or approved equivalent and 2-layers of 6-mil fire retardant poly. The clean room shall be located so as to provide access to the holding room from the building exterior. Doorways to the clean room shall be constructed of 2-layers of 6-mil fire retardant poly. When a negative pressure differential system is used, a rigid enclosure separation between the W/EDF clean room and the adjacent areas shall be provided.
   e. The W/EDF shall be as follows: Wash Room leading to a Holding Room followed by a Clean Room leading to outside the regulated area. See diagram.



F. Waste/Equipment Decontamination Procedures: At the washdown station in the regulated area, thoroughly wet wipe/clean contaminated equipment and/or sealed polyethylene bags and pass into Wash Room after visual inspection. When passing anything into the Wash Room, close all doorways of the W/EDF, other than the doorway between the washdown station and the Wash Room. Keep all outside personnel clear of the W/EDF. Once inside the Wash Room, wet clean the equipment and/or bags. After cleaning and inspection, pass items into the Holding Room. Close all doorways except the doorway between the Holding Room and the Clean Room. Workers from the Clean Room/Exterior shall enter the Holding Room and remove the decontaminated/cleaned equipment/bags for removal and disposal. At no time shall personnel from the clean side be allowed to enter the Wash Room.

PART 2 - PRODUCTS, MATERIALS AND EQUIPMENT

2.1 MATERIALS AND EQUIPMENT

A. General Requirements (all abatement projects): Prior to the start of work, the contractor shall provide and maintain a sufficient quantity of materials and equipment to assure continuous and efficient work throughout the duration of the project. Work shall not start unless the following items have been delivered to the site and the CPIH/CIH has submitted verification to the VA's Representative.

1. All materials shall be delivered in their original package, container or bundle bearing the name of the manufacturer and the brand name (where applicable).
2. Store all materials subject to damage off the ground, away from wet or damp surfaces and under cover sufficient enough to prevent damage or contamination. Flammable and combustible materials cannot be stored inside buildings. Replacement materials shall be stored outside of the regulated area until abatement is completed.
3. The Contractor shall not block or hinder use of buildings by patients, staff, and visitors to the VA in partially occupied buildings by placing materials/equipment in any unauthorized location.
4. The Competent Person shall inspect for damaged, deteriorating or previously used materials. Such materials shall not be used and shall be removed from the worksite and disposed of properly.
5. Polyethylene sheeting for walls in the regulated area shall be a minimum of 4-mils. For floors and all other uses, sheeting of at least 6-mils shall be used in widths selected to minimize the frequency of joints. Fire retardant poly shall be used throughout.
6. The method of attaching polyethylene sheeting shall be agreed upon in advance by the Contractor and the VA and selected to minimize damage to equipment and surfaces. Method of attachment may include any combination of moisture resistant duct tape, poly tape, furring strips, spray glue, staples, nails, screws, lumber and plywood for enclosures or approved equivalent procedures capable of sealing polyethylene to dissimilar finished or unfinished surfaces under both wet and dry conditions.

7. Polyethylene sheeting utilized for the PDF shall be opaque white or black in color, 6-mil fire retardant poly.
8. Installation and plumbing hardware, showers, hoses, drain pans, sump pumps and waste water filtration system shall be provided by the Contractor.
9. An adequate number of HEPA vacuums, scrapers, sprayers, nylon brushes, brooms, disposable mops, rags, sponges, staple guns, shovels, ladders and scaffolding of suitable height and length as well as meeting OSHA requirements, fall protection devices, water hose to reach all areas in the regulated area, airless spray equipment, and any other tools, materials or equipment required to conduct the abatement project. All electrically operated hand tools, equipment, electric cords shall be connected to GFCI protection.
10. Special protection for objects in the regulated area shall be detailed (e.g., plywood over carpeting or hardwood floors to prevent damage from scaffolds, water and falling material).
11. Disposal bags – 2-layers of 6-mil poly for asbestos waste shall be pre-printed with labels, markings and address as required by OSHA, EPA and DOT regulations.
12. The VA shall be provided an advance copy of the Safety Data Sheets (SDS) as required for all hazardous chemicals under OSHA 29 CFR 1910.1200 - Hazard Communication in the pre-project submittal. Chlorinated compounds shall not be used with any spray adhesive, mastic remover or other product. Appropriate encapsulant(s) shall be provided.
13. OSHA DANGER demarcation signs, as many and as required by OSHA 29 CFR 1926.1101(k)(7) shall be provided and placed by the Competent Person. All other posters and notices required by Federal, State and Local regulations shall be posted in the Clean Room.
14. Adequate and appropriate PPE for the project and number of personnel/shifts shall be provided. All personal protective equipment issued must be based on a written hazard assessment conducted under 29 CFR 1910.132(d)

2.2 CONTAINMENT BARRIERS AND COVERINGS IN THE REGULATED AREA

A. General: Using critical barriers, seal off the perimeter to the regulated area to completely isolate the regulated area from adjacent spaces. All horizontal surfaces in the regulated area must be covered with 2-layers of 6-mil fire retardant poly to prevent contamination and to facilitate clean-up. Should adjacent areas become contaminated, immediately stop work and clean up the contamination at no additional cost to the Government. Provide firestopping and identify all fire barrier penetrations due to abatement work as specified in Section 2.2.7; FIRESTOPPING.

B. Preparation Prior to Sealing the Regulated Area: Place all tools, scaffolding, materials and equipment needed for working in the regulated area prior to erecting any plastic sheeting. Remove all uncontaminated removable furniture, equipment and/or supplies from the regulated area before commencing work, or completely cover with 2-layers of 6-mil fire retardant poly sheeting and secure with duct tape. Lock out and tag out any HVAC systems in the regulated area.

C. Controlling Access to the Regulated Area: Access to the regulated area is allowed only through the personnel decontamination facility (PDF), if required. All other means of access shall be eliminated and OSHA Danger demarcation signs posted as required by OSHA. If the regulated area is adjacent to or within view of an occupied area, provide a visual barrier of 6-mil opaque fire retardant poly sheeting to prevent building occupant observation. If the adjacent area is accessible to the public, the barrier must be solid.

D. Critical Barriers: Completely separate any openings into the regulated area from adjacent areas using fire retardant poly at least 6-mils thick and duct tape. Individually seal with 2-layers of independently installed 6-mil poly and duct tape all HVAC openings into the regulated area. Individually seal all lighting fixtures, clocks, doors, windows, convectors, speakers, or any other objects in the regulated area. Heat must be shut off any objects covered with poly.

E. Secondary Barriers: A loose layer of 6-mil fire retardant poly shall be used as a drop cloth to protect the floor/horizontal surfaces from debris generated during the Glovebag abatement. This layer shall be replaced as needed during the work.

F. Extension of the Regulated Area: If the enclosure of the regulated area is breached in any way that could allow contamination to occur, the affected area shall be included in the regulated area and constructed as per this section. If the affected area cannot be added to the regulated area, decontamination measures must be started immediately and continue until air monitoring indicates background levels are met.

G. Firestopping:
1. Through penetrations caused by cables, cable trays, pipes, sleeves must be firestopped with a fire-rated firestop system providing an air tight seal.
2. Firestop materials that are not equal to the wall or ceiling penetrated shall be brought to the attention of the VA Representative. The Contractor shall list all areas of penetration, the type of sealant used, and whether or not the location is fire rated. Any discovery of penetrations during abatement shall be brought to the attention of the VA Representative immediately. All walls, floors and ceilings are considered fire rated unless otherwise determined by the VA Representative or Fire Marshall.
3. Any visible openings whether or not caused by a penetration shall be reported by the Contractor to the VA Representative for a sealant system determination. Firestops shall meet ASTM E814 and UL 1479 requirements for the opening size, penetrant, and fire rating needed

2.3 MONITORING, INSPECTION AND TESTING

A. General:
1. Perform throughout abatement work monitoring, inspection and testing inside and around the regulated area in accordance with the OSHA requirements and these specifications. OSHA requires that the employee exposure to asbestos must not exceed 0.1 fibers per cubic centimeter (f/cc) of air, averaged over an 8-hour work shift. The CPIH/CIH is responsible for and shall inspect and oversee the performance of the Contractor IH Technician. The IH Technician shall continuously inspect and monitor conditions inside the regulated area to ensure compliance with these specifications. In addition, the CPIH/CIH shall personally manage air sample collection, analysis, and evaluation for personnel, regulated area, and adjacent area samples inside the building, but outside the regulated area. Inside the building, but outside the regulated area air samples shall be collected at the boundary of the regulated area and/or Clean Room of the PDF, at the approximate location of HEPA exhaust discharge (if used), and at a minimum of three (3) locations in areas immediately outside the regulated work area to satisfy this specification. Additional inspection and testing requirements are also indicated in other parts of this specification.
2. The VA will employ an independent industrial hygienist (VPIH/CIH) consultant and/or use its own IH to perform various services on behalf of the VA. The VPIH/CIH will perform the necessary monitoring, inspection, testing, and other support services to ensure that VA patients, employees, and visitors will not be adversely affected by the abatement work, and that the abatement work proceeds in accordance with these specifications, that the abated areas or abated buildings have been successfully decontaminated. The work of the VPIH/CIH consultant in no way relieves the Contractor from their responsibility to perform the work in accordance with contract/specification requirements, to perform continuous inspection, monitoring and testing for the safety of their employees, and to perform other such services as specified. The cost of the VPIH/CIH and their services will be borne by the VA except for any repeat of final inspection and testing that may be required due to unsatisfactory initial results. Any repeated final inspections and/or testing, if required, will be paid for by the Contractor.
3. If fibers counted by the VPIH/CIH during abatement work, either inside or outside the regulated area, utilizing the NIOSH 7400 air monitoring method, exceed the specified respective limits, the Contractor shall stop work. The Contractor may request

confirmation of the results by analysis of the samples by TEM. Request must be in writing and submitted to the VA's Representative. Cost for the confirmation of results will be borne by the Contractor for both the collection and analysis of samples and for the time delay that may/does result for this confirmation. Confirmation sampling and analysis will be the responsibility of the CPIH/CIH with review and approval of the VPIH/CIH. An agreement between the CPIH/CIH and the VPIH/CIH shall be reached on the exact details of the confirmation effort, in writing, including such things as the number of samples, location, collection, quality control on-site, analytical laboratory, interpretation of results and any follow-up actions. This written agreement shall be co-signed by the IH's and delivered to the VA's Representative.

B. Scope of Services of the VPIH/CIH Consultant:

1. The purpose of the work of the VPIH/CIH is to: Assure quality; resolve problems; and prevent the spread of contamination beyond the regulated area. In addition, their work includes performing the final inspection and testing to determine whether the regulated area or building has been adequately decontaminated. All air monitoring is to be done utilizing PCM/TEM. The VPIH/CIH will perform the following tasks:
   a. Task 1: Establish background levels before abatement begins by collecting background samples. Retain samples for possible TEM analysis.
   b. Task 2: Perform representative air monitoring, inspection, and testing outside the regulated area during actual abatement work to detect any faults in the regulated area isolation and any adverse impact on the surroundings from regulated area activities.
   c. Task 3: Perform unannounced visits to spot check overall compliance of work with contract/specifications. These visits may include any inspection, monitoring, and testing inside and outside the regulated area and all aspects of the operation except personnel monitoring.
   d. Task 4: Provide support to the VA Representative such as evaluation of submittals from the Contractor, resolution of unforeseen developments, etc.
   e. Task 5: Perform, in the presence of the VA Representative, final inspection and testing of a decontaminated regulated area or building at the conclusion of the abatement and clean-up work to certify compliance with all regulations and the VA requirements/specifications.
   f. Task 6: Issue certificate of decontamination for each regulated area or building and project report.
2. All data, inspection results and testing results generated by the VPIH/CIH will be available to the Contractor for information and consideration. The Contractor shall cooperate with and support the VPIH/CIH for efficient and smooth performance of their work.
3. The monitoring and inspection results of the VPIH/CIH will be used by the VA to issue any Stop Removal orders to the Contractor during abatement work and to accept or reject a regulated area or building as decontaminated.

2.4 Monitoring, Inspection and Testing by Abatement Contractor CPIH/CIH: The Contractor’s CPIH/CIH is responsible for managing all monitoring, inspections, and testing required by these specifications, as well as any and all regulatory requirements adopted by these specifications. The CPIH/CIH is responsible for the continuous monitoring of all subsystems and procedures which could affect the health and safety of the Contractor’s personnel. Safety and health conditions and the provision of those conditions inside the regulated area for all persons entering the regulated area is the exclusive responsibility of the Contractor/Competent Person. The person performing the personnel and area air monitoring inside the regulated area shall be an IH Technician, who shall be trained and shall have specialized field experience in sampling and analysis. The IH Technician shall have successfully completed a NIOSH 582 Course or equivalent and provide documentation. The IH Technician shall participate in the AIHA Asbestos Analysis Registry or participate in the Proficiency Analytical Testing program of AIHA for fiber counting quality control assurance. The IH Technician shall also be an accredited EPA AHERA/State Contractor/Supervisor and Building Inspector. The IH Technician shall have

participated in five abatement projects collecting personal and area samples and have experience in substantially similar projects in size and scope. The analytical laboratory used by the Contractor to analyze the samples shall be AIHA accredited for asbestos PAT and approved by the VA prior to start of the project. A daily log shall be maintained by the CPIH/CIH or IH Technician, documenting all OSHA requirements for personal and area air monitoring for asbestos in 29 CFR 1926.1101(f), (g) and Appendix A. This log shall be made available to the VA Representative and the VPIH/CIH upon request. The log will contain, at a minimum, information on personnel or area samples, other persons represented by the sample, the date of sample collection, start and stop times for sampling, sample volume, flow rate, and fibers/cc. The CPIH/CIH shall collect and analyze samples for each representative job being done in the regulated area, i.e., removal, wetting, clean-up, and load-out. No fewer than two (2) personal air samples or 25% of representative workforce per shift shall be collected, whichever is greater, in the regulated area; a minimum of three (3) area air samples at locations inside the building but immediately outside the regulated work area; one (1) area air sample shall be collected daily at the boundary of the regulated area and/or Clean Room of the PDF; and one (1) area air sample shall be collected daily at the approximate location of HEPA exhaust discharge, if used. In addition to the continuous monitoring required, the CPIH/CIH will perform inspection and testing at the final stages of abatement for each regulated area as specified in the CPIH/CIH responsibilities. Additionally, the CPIH/CIH will monitor and record pressure readings within the containment daily with a minimum of two readings at the beginning and at the end of a shift, and submit the data in the daily report. Pressure readings with the containment may be omitted if negative pressure glovebag procedures are used. **ASBESTOS HAZARD ABATEMENT PLAN**

A. The Contractor shall have established Asbestos Hazard Abatement Plan (AHAP) in printed form and loose leaf folder consisting of simplified text, diagrams, sketches, and pictures that establish and explain clearly the ways and procedures to be followed during all phases of the work by the Contractor's personnel. The AHAP must be modified as needed to address specific requirements of the project. The AHAP shall be submitted for review and approval prior to the start of any abatement work. The minimum topics and areas to be covered by the AHAP(s) are:
   1. Minimum Personnel Qualifications
   2. Contingency Plans and Arrangements
   3. Security and Safety Procedures
   4. Respiratory Protection/Personal Protective Equipment Program and Training
   5. Medical Surveillance Program and Recordkeeping
   6. Regulated Area Requirements for Glovebag Abatement
   7. Decontamination Facilities and Entry/Exit Procedures (PDF and W/EDF) or approved equivalent.
   8. Monitoring, Inspections, and Testing
   9. Removal Procedures for Piping ACM Using the Glovebag Method
   10. Disposal of ACM waste
   11. Regulated Area Decontamination/Clean-up
   12. Regulated Area Visual and Air Clearance
   13. Project Completion/Closeout

2.5 SUBMITTALS

A. Pre-Start Meeting Submittals:
   1. Submit to the VA a minimum of 14 days prior to the pre-start meeting the following for review and approval. Meeting this requirement is a prerequisite for the pre-start meeting for this project:
      a. Submit a detailed work schedule for the entire project reflecting contract documents and the phasing/schedule requirements from the CPM chart.
      b. Submit a staff organization chart showing all personnel who will be working on the project and their capacity/function. Provide their qualifications, training, accreditations, and licenses, as appropriate. Provide a copy of the "Certificate of Worker's Acknowledgment" and the "Affidavit of Medical Surveillance and Respiratory Protection" for each person.

c. Submit Asbestos Hazard Abatement Plan developed specifically for this project, incorporating the requirements of the specifications, prepared, signed and dated by the CPIH/CIH.

d. Submit the specifics of the materials and equipment to be used for this project with manufacturer names, model numbers, performance characteristics, pictures/diagrams, and number available for the following:
   1) Supplied air system, negative air machines, HEPA vacuums, air monitoring pumps, calibration devices, pressure differential monitoring device and emergency power generating system.
   2) Waste water filtration system, shower system, containment barriers.
   3) Encapsulants, surfactants, hand held sprayers, airless sprayers, Glovebags, and fire extinguishers.
   4) Respirators, water filtration system, shower system, containment barriers equipment.
   5) Fire safety equipment to be used in the regulated area.

e. Submit the name, location, and phone number of the approved landfill; proof/verification the landfill is approved for ACM disposal; the landfill's requirements for ACM waste; the type of vehicle to be used for transportation; and name, address, and phone number of subcontractor, if used. Proof of asbestos training for transportation personnel shall be provided.

f. Submit required notifications and arrangements made with regulatory agencies having regulatory jurisdiction and the specific contingency/emergency arrangements made with local health, fire, ambulance, hospital authorities and any other notifications/arrangements.

g. Submit the name, location and verification of the laboratory and/or personnel to be used for analysis of air and/or bulk samples. Personal air monitoring must be done in accordance with OSHA 29 CFR 1926.1101(f) and Appendix A. Area or clearance air monitoring shall be conducted in accordance with EPA AHERA protocols.

h. Submit qualifications verification: Submit the following evidence of qualifications. Make sure that all references are current and verifiable by providing current phone numbers and documentation.
   1) Asbestos Abatement Company: Project experience within the past 3 years; listing projects first most similar to this project; Project Name; Type of Abatement; Duration; Cost; Reference Name/Phone Number; Final Clearance; and Completion Date.
   2) List of project(s) halted by owner, A/E, IH, regulatory agency in the last 3 years: Project Name; Reason; Date; Reference Name/Number; and Resolution.
   3) List asbestos regulatory citations (e.g., OSHA), notices of violations (e.g., Federal, State, Local NESHAP), penalties, and legal actions taken against the company including the company’s officers (including damages paid) in the last 3 years. Provide copies and all information needed for verification.

i. Submit information on personnel: Provide a resume; address each item completely; copies of certificates, accreditations, and licenses. Submit an affidavit signed by the CPIH/CIH stating that all personnel submitted below have medical records in accordance with OSHA 29 CFR 1926.1101(m) and that the company has implemented a medical surveillance program and written respiratory protection program, and maintains recordkeeping in accordance with the above regulations. Submit the phone number and doctor/clinic/hospital used for medical evaluations.
   1) CPIH/CIH and IH Technician: Name; years of abatement experience; list of projects similar to this one; certificates, licenses, accreditations for proof of AHERA/OSHA specialized asbestos training; professional affiliations; medical opinion; and current respirator fit test.
   2) Competent Person(s)/Supervisor(s): Number; names; last four digits of social security numbers; years of abatement experience as Competent

Person/Supervisor; list of similar projects in size/complexity as Competent Person/Supervisor; as a worker; certificates, licenses, accreditations; proof of AHERA/OSHA specialized asbestos training; maximum number of personnel supervised on a project; medical opinion (asbestos surveillance and respirator use); and current respirator fit test.

3) Workers: Numbers; names; last four digits of social security numbers; years of abatement experience; certificates, licenses, accreditations; training courses in asbestos abatement and respiratory protection; medical opinion (asbestos surveillance and respirator use); and current respirator fit test.

j. Submit copies of State license for asbestos abatement; copy of insurance policy, including exclusions with a letter from agent stating in plain language the coverage provided and the fact that asbestos abatement activities are covered by the policy; copy of AHAP(s) incorporating the requirements of this specification; information on who provides your training, how often; who provides medical surveillance, how often; who performs and how is personal air monitoring of abatement workers conducted; a list of references of independent laboratories/IH's familiar with your air monitoring and Asbestos Hazard Abatement Plans; copies of monitoring results of the five referenced projects listed and analytical method(s) used.

k. Rented equipment must be decontaminated prior to returning to the rental agency.

l. Submit, before the start of work, the manufacturer's technical data for all types of encapsulants, all SDS, and application instructions.

B. Submittals During Abatement:

1. The Competent Person shall maintain and submit a daily log at the regulated area documenting the dates and times of the following: purpose, attendees and summary of meetings; all personnel entering/exiting the regulated area; document and discuss the resolution of unusual events such as barrier breeching, equipment failures, emergencies, and any cause for stopping work; representative air monitoring and results/TWAs/ELs. Submit this information daily to the VA's Representative.

2. The CPIH/CIH shall document and maintain the inspection and approval of the regulated area preparation prior to start of work and daily during work.

a. Removal of any poly barriers and/or failure of negative pressure Glovebags.

b. Visual inspection/testing by the CPIH/CIH or IH Technician prior to application of lockdown encapsulant.

c. Packaging and removal of ACM waste from regulated area.

d. Disposal of ACM waste materials; copies of Waste Shipment Records/landfill receipts to the VA's Representative on a weekly basis.

C. Submittals at Completion of Abatement: The CPIH/CIH shall submit a project report consisting of the daily log book requirements and documentation of events during the abatement project including Waste Shipment Records signed by the landfill's agent. It will also include information on the containment and transportation of waste from the containment with applicable Chain of Custody forms. The report shall include a certificate of completion, signed and dated by the CPIH/CIH, in accordance with Attachment #1. All clearance and perimeter area samples must be submitted. The VA Representative will retain the abatement report after completion of the project and provide copies of the abatement report to VAMC Office of Engineer and the Safety Office.

2.6 ENCAPSULANTS

A. Types of Encapsulants:

1. The following four types of encapsulants must comply with performance requirements as stated in paragraph 2.6.2:

a. Removal encapsulant - used as a wetting agent to remove ACM.

b. Bridging encapsulant - provides a tough, durable coating on ACM.

c. Penetrating encapsulant - penetrates/encapsulates ACM at least 13 mm (1/2 inch).

d. Lockdown encapsulant - seals microscopic fibers on surfaces after ACM removal.

B. Performance Requirements:
1. Encapsulants shall meet the latest requirements of EPA; shall not contain toxic or hazardous substances; or solvents; and shall comply with the following performance requirements:
a. General Requirements for all Encapsulants:
1) ASTM E84: Flame spread of 25; smoke emission of 50.
2) University of Pittsburgh Protocol: Combustion Toxicity; zero mortality.
3) ASTM C732: Accelerated Aging Test; Life Expectancy - 20 years.
4) ASTM E96: Permeability - minimum of 0.4 perms.
b. Bridging/Penetrating Encapsulants:
1) ASTM E736: Cohesion/Adhesion Test - 24 kPa (50 pounds/square foot).
2) ASTM E119: Fire Resistance - 3 hours (Classified by UL for use on fibrous/cementitious fireproofing).
3) ASTM D2794: Gardner Impact Test; Impact Resistance - minimum 11.5 kg-mm (43 in/lb).
4) ASTM D522: Mandrel Bend Test; Flexibility - no rupture or cracking
c. Lockdown Encapsulants:
1) ASTM E119: Fire resistance - 3 hours (tested with fireproofing over encapsulant applied directly to steel member).
2) ASTM E736: Bond Strength - 48 kPa (100 pounds/square foot) (test compatibility with cementitious and fibrous fireproofing).
3) In certain situations, encapsulants may have to be applied to hot pipes/equipment. The encapsulant must be able to withstand high temperatures without cracking or creating any noxious gaseous or vapors during or after application.

2.7 CERTIFICATES OF COMPLIANCE

A. The Contractor shall submit to the VA Representative certification from the manufacturer indicating compliance with performance requirements for encapsulants when applied according to manufacturer recommendations.

B. Recyclable Protective Clothing: If recyclable clothing is provided, all requirements of EPA, DOT and OSHA shall be met.

PART 3 - EXECUTION

3.1 REGULATED AREA PREPARATIONS

A. Site Security:
1. Regulated area access is to be restricted only to authorized, trained/accredited and protected personnel. These may include the Contractor's employees, employees of Subcontractors, VA employees and representatives, State and Local inspectors, and any other designated individuals. A list of authorized personnel shall be established prior to commencing the project and shall be posted in the clean room of the decontamination unit or in a designated area located immediately outside of the regulated area established for Tent / Glovebag removal activities.
2. Entry into the regulated area by unauthorized individuals shall be reported immediately to the Competent Person by anyone observing the entry. The Competent Person shall immediately require any unauthorized person to leave the regulated area and then notify the VA Contracting Officer or VA Representative using the most expeditious means.
3. A log book shall be maintained in the clean room of the decontamination unit or in a designated area located immediately outside of the regulated area established for Tent / Glovebag removal activities. Anyone who enters the regulated area must record their name, affiliation, time in, and time out for each entry.
4. Access to the regulated area shall be through a single decontamination unit or in an area designated by the Competent Person for Tent / Glovebag removal activities. All other

access (doors, windows, hallways, etc.) shall be sealed or locked to prevent entry to or exit from the regulated area. The only exceptions for this requirement are the waste/equipment load-out area which shall be sealed except during the removal of containerized asbestos waste from the regulated area, and emergency exits. Emergency exits shall not be locked from the inside; however, they shall be sealed with poly sheeting and taped until needed. In any situation where exposure to high temperatures which may result in a flame hazard, fire retardant poly sheeting must be used.

5. The Contractor's Competent Person shall control site security during abatement operations in order to isolate work in progress and protect adjacent personnel. A 24 hour security system shall be provided at the entrance to the regulated area to assure that all entrants are logged in/out and that only authorized personnel are allowed entrance.
6. The Contractor will have the VA's assistance in notifying adjacent personnel of the presence, location and quantity of ACM in the regulated area and enforcement of restricted access by the VA's employees.
7. The regulated area shall be locked during non-working hours and secured by VA Representative or Competent Person. The VA Police shall be informed of asbestos abatement regulated areas to provide security checks during facility rounds and emergency response.

B. OSHA Danger Signs: Post OSHA DANGER signs meeting the specifications of OSHA 29 CFR 1926.1101 at any location and approaches to the regulated area where airborne concentrations of asbestos may exceed ambient background levels. Signs shall be posted at a distance sufficiently far enough away from the regulated area to permit any personnel to read the sign and take the necessary measures to avoid exposure. Additional signs will be posted following construction of the regulated area enclosure.

C. Shut Down - Lock Out Electrical: Shut down and lock out/tag out electric power to the regulated area. Provide temporary power and lighting. Ensure safe installation including GFCI of temporary power sources and equipment by compliance with all applicable electrical code requirements and OSHA requirements for temporary electrical systems. Electricity shall be provided by the VA.

D. Shut Down - Lock Out HVAC: Shut down and lock out/tag out heating, cooling, and air conditioning system (HVAC) components that are in, supply or pass through the regulated area. Investigate the regulated area and agree on pre-abatement condition with the VA's Representative. Seal all intake and exhaust vents in the regulated area with duct tape and 2-ayers of independently installed 6-mil poly. Also, seal any seams in system components that pass through the regulated area. Remove all contaminated HVAC system filters and place in labeled 6-mil poly disposal bags for disposal as asbestos waste.

E. Containment Barriers and Coverings for the Regulated Area:
1. General: Seal off any openings at the perimeter of the regulated area with critical barriers to completely isolate the regulated area and to contain all airborne asbestos contamination created by the abatement activities. Should the adjacent area past the regulated area become contaminated due to improper work activities, the Contractor shall suspend work inside the regulated area, continue wetting, and clean the adjacent areas in accordance with procedures described in these specifications. Any and all costs associated with the adjacent area cleanup shall not be borne by the VA.
2. Preparation Prior to Sealing Off: Place all materials, equipment and supplies necessary to isolate the regulated area inside the regulated area. Remove all movable material/equipment as described above and secure all unmovable material/equipment as described above. Properly secured material/ equipment shall be considered to be outside the regulated area.
3. Controlling Access to the Regulated Area: Access to the regulated area is allowed only through the personnel decontamination facility (PDF) or in an area designated by the Competent Person for Tent / Glovebag removal activities. All other means of access shall be eliminated and OSHA DANGER demarcation signs posted as required by OSHA. If the regulated area is adjacent to, or within view of an occupied area, provide a visual

barrier of 6-mil opaque fire retardant poly to prevent building occupant observation. If the adjacent area is accessible to the public, the barrier must be solid and capable of withstanding the negative pressure.

4. Critical Barriers: The regulated area must be completely separated from the adjacent area(s) and the outside by at least 2-layers of independently installed 6-mil fire retardant poly and duct tape/spray adhesive. Individually seal all supply and exhaust ventilation openings, lighting fixtures, clocks, doorways, windows, convectors, speakers, and other openings into the regulated area with 2-layers of 6-mil fire retardant poly, and taped securely in place with duct tape/spray adhesive. Critical barriers must remain in place until all work and clearances have been completed. Light fixtures shall not be operational during abatement. Auxiliary lighting shall be provided. If needed, provide plywood squares 6 inches x 6 inches x 3/8 inch (150mm x 150mm x 18mm) or approved equivalent, held in place with 6d smooth masonry/galvanized nail or approved equivalent driven through the center of the plywood square and duct tape on the poly so as to clamp the poly to the wall/surface. Locate plywood squares at each end, corner, and 4 feet (1200mm) maximum on centers
5. Extension of the Regulated Area: If the regulated area barrier is breached in any manner that could allow the passage of asbestos fibers or debris, the Competent Person shall immediately stop work, continue wetting, and proceed to extend the regulated area to enclose the affected area as per procedures described in this specification. If the affected area cannot be enclosed, decontamination measures and cleanup shall start immediately. All personnel shall be isolated from the affected area until decontamination/cleanup is completed as verified by visual inspection and air monitoring. Air monitoring at completion must indicate background levels.
6. Floor Barriers: All floors within 10 feet of Glovebag work shall be covered with 2-layers of 6-mil fire retardant poly. If no breach occurs during the Glovebag abatement operation, these layers of 6–mil fire retardant poly may be reused

F. Sanitary Facilities: The Contractor shall provide sanitary facilities for abatement personnel and maintain them in a clean and sanitary condition throughout the abatement project.

G. Pre-Cleaning:
1. Pre-Cleaning Movable Objects:
   a. The VA will provide water for abatement purposes. The Contractor shall connect to the existing VA system. The service to the shower(s), if used, shall be supplied with backflow prevention.
   b. Pre-cleaning of ACM contaminated items shall be performed after the enclosure has been erected and negative pressure has been established in the work area. PPE must be donned by all workers performing pre-cleaning activities. After items have been pre-cleaned and decontaminated, they may be removed from the work area for storage until the completion of abatement in the work area.
   c. Pre-clean all movable objects within the regulated area using a HEPA filtered vacuum and/or wet cleaning methods as appropriate. After cleaning, these objects shall be removed from the regulated area and carefully stored in an uncontaminated location.
2. Pre-Cleaning Fixed Objects:
   a. Pre-cleaning of ACM contaminated items shall be performed after the enclosure has been erected and negative pressure has been established in the work area.
   b. Pre-clean all fixed objects in the regulated area using HEPA filtered vacuums and wet cleaning techniques as appropriate. Careful attention must be paid to machinery behind grills or gratings where access may be difficult but contamination may be significant. Also, pay particular attention to wall, floor and ceiling penetration behind fixed items. After pre-cleaning, enclose fixed objects with 2-layers of 6-mil poly and seal securely in place with duct tape. Objects (e.g., permanent fixtures, shelves, electronic equipment, laboratory tables, sprinklers, alarm systems, closed circuit TV equipment and computer cables) which must remain in the regulated area and that require special ventilation or enclosure

requirements should be designated here along with specified means of protection. Contact the manufacturer for special protection requirements.

3. Pre-Cleaning Surfaces in the Regulated Area:
   a. Pre-cleaning of ACM contaminated items shall be performed after the enclosure has been erected and negative pressure has been established in the work area.

   b. Pre-clean all surfaces in the regulated area using HEPA filtered vacuums and wet cleaning methods as appropriate. Do not use any methods that would raise dust such as dry sweeping or vacuuming with equipment not equipped with HEPA filters. Do not disturb asbestos-containing materials during this pre-cleaning phase.

H. Pre-Abatement Activities:
1. Pre-Abatement Meeting: The VA Representative, upon receipt, review, and substantial approval of all pre-abatement submittals and verification by the CPIH/CIH that all materials and equipment required for the project are on the site, will arrange for a pre-abatement meeting between the Contractor, the CPIH/CIH, Competent Person, the VA Representatives, and the VPIH/CIH. The purpose of the meeting is to discuss any aspect of the submittals needing clarification or amplification and to discuss any aspect of the project execution and the sequence of the operation. The Contractor shall be prepared to provide any supplemental information or documentation to the VA's Representative regarding any submittals, materials or equipment. Upon satisfactory resolution of any outstanding issues, the VA's representative will issue a written order to proceed to the Contractor. No abatement work of any kind described in the following provisions shall be initiated prior to the VA written order to proceed.
2. Pre-Abatement Inspections and Preparations:
   a. Before any work begins on the construction of the regulated area, the Contractor will:
      1) Conduct a space-by-space inspection with an authorized VA Representative and prepare a written inventory of all existing damage in those spaces where asbestos abatement will occur. Still or video photography may be used to supplement the written damage inventory. Document will be signed and certified as accurate by both parties.
      2) The VA Representative, the Contractor, and the VPIH/CIH must be aware of AEQA 10-95 indicating the failure to identify asbestos in the areas listed as well as common issues when preparing specifications and contract documents. This is especially critical when demolition is planned, because AHERA surveys are non-destructive, and ACM may remain undetected. A NESHAP (destructive) ACM inspection should be conducted on all building structures that will be demolished. Ensure the following areas are inspected on the project: Lay-in ceilings concealing ACM; ACM behind walls/windows from previous renovations; inside utility chases/walls; transite piping/ductwork/sheets; behind radiators; lab fume hoods; transite lab countertops; roofing materials; below window sills; water/sewer lines; electrical conduit coverings; crawl spaces(previous abatement contamination); flooring/mastic covered by carpeting/new flooring; exterior insulated wall panels; on underground fuel tanks; and steam line trench coverings.
      3) Ensure that all furniture, machinery, equipment, curtains, drapes, blinds, and other movable objects required to be removed from the regulated area have been cleaned and removed or properly protected from contamination.
      4) Inspect existing firestopping in the regulated area. Correct as needed.
3. Pre-Abatement Construction and Operations:

a. Perform all preparatory work for the first regulated area in accordance with the approved work schedule and with this specification.
b. Upon completion of all preparatory work, the CPIH/CIH will inspect the work and systems and will notify the VA's Representative when the work is completed in accordance with this specification. The VA's Representative may inspect the regulated area and the systems with the VPIH/CIH and may require that upon satisfactory inspection, the Contractor's employees perform all major aspects of the approved AHAP(s), especially worker protection, respiratory systems, contingency plans, decontamination procedures, and monitoring to demonstrate satisfactory operation.
c. The CPIH/CIH shall document the pre-abatement activities described above and deliver a copy to the VA's Representative.
d. Upon satisfactory inspection of the installation of and operation of systems the VA's Representative will notify the Contractor in writing to proceed with the asbestos abatement work in accordance with this specification.

3.2 REMOVAL OF PIPING ACM

A. Wetting Materials:
1. Use amended water for the wetting of ACM prior to removal. The Competent Person shall assure that the wetting of ACM meets the definition of "adequately wet" in the EPA NESHAP regulation and OSHA’s “wet methods” for the duration of the project. A removal encapsulant may be used instead of amended water with written approval of the VA's Representative.
2. Amended Water: Provide water to which a surfactant has been added to wet the ACM and reduce the potential for fiber release during disturbance of ACM. The mixture must be equal to or greater than the wetting provided by water amended by a surfactant consisting of one ounce of 50 percent polyoxyethylene ester and 50 percent polyoxyethylene ether mixed with 5 gallons (19L) of water.
3. Removal Encapsulant: Provide a penetrating encapsulant designed specifically for the removal of ACM. The material must, when used, result in adequate wetting of the ACM and retard fiber release during disturbance equal to or greater than the amended water described above in B.

B. Secondary Barrier and Walkways: Install as a drop cloth a 6-mil poly sheet at the beginning of each work shift where removal is to be done during that shift. Secure the drop cloth (6-mil poly sheet) with duct tape or approved equivalent to prevent it from moving or debris from getting behind it. Remove the drop cloth (6-mil poly sheet) at the end of the shift or as work in the area is completed. Keep residue on the drop cloth (6-mil poly sheet) wetted. When removing, fold inward to prevent spillage and place in a disposal bag.

C. Wet Removal of ACM: Using acceptable Tent / Glovebag procedures, adequately and thoroughly wet the ACM to be removed prior to removal with amended water or when authorized by VA, removal encapsulant to reduce/prevent fiber release to the air. Adequate time must be allowed for the amended water or removal encapsulant to saturate the ACM. Abatement personnel must not disturb dry ACM. Use a fine spray of amended water or removal encapsulant. Saturate the material sufficiently to wet to the substrate without causing excessive dripping. The material must be sprayed repeatedly/continuously during the removal process in order to maintain adequately wet conditions. Removal encapsulants must be applied in accordance with the manufacturer's written instructions. Perforate or carefully separate, using wet methods, an outer covering that is painted or jacketed in order to allow penetration and wetting of the material. Where necessary, carefully remove covering while wetting to minimize fiber release.

3.3 GLOVEBAG REMOVAL PROCEDURES

A. General: All applicable OSHA requirements and Glovebag manufacturer’s recommendations shall be met during Tent / Glovebag removal operations. In cases where live steam lines are present, the lines must be shut down prior to any work being performed on the

system. No abatement work shall be conducted on live, pressurized steam lines. The Contractor may choose to use a High Temperature Glovebag in which a temperature rating ranges from 300˚F to 700˚F on steam lines that have recently been shut down and remain at high temperature for some time. In the case where a Glovebag is not feasible, the Contractor will need to build a full negative pressure containment of sufficient size or work within a negative pressure mini-enclosure and follow all regulations as it pertains to removal. The Contractor shall provide enough HEPA negative air machines to continuously maintain a negative pressure differential of -0.02 inch water column gauge (WCG) inside the regulated work area relative to adjacent non-work building areas. OSHA 29 CFR 1926.1101 (g)(5)(i)(A)(2) also requires at least four (4) air changes per hour. Contractor shall increase air changes per hour as necessary to maintain volatile organic compounds below the applicable OSHA PEL. Contractor shall protect pipe insulation from being disturbed on either side of the Glovebag removal operations with a “candy stripe” layer of 6-mil poly sheet and duct tape, if Glove bag removal activities cause the piping to dislodge ACM during performance of their work.

1. Mix the surfactant with water in the garden sprayer, following the manufacturer's directions.
2. Have each employee put on a HEPA filtered respirator approved for asbestos and check the fit using the positive/negative fit check.
3. Have each employee put on a disposable full-body suit. Remember, the hood goes over the respirator straps.
4. Check closely the integrity of the glove bag to be used. Check all seams, gloves, sleeves, and glove openings. OSHA requires the bottom of the bag to be seamless.
5. Check the pipe where the work will be performed. If it is damaged (broken lagging, hanging, etc.), wrap the entire length of the pipe in poly sheeting and "candy stripe" it with duct tape.
6. Attach Glovebag with required tools per manufacturer’s instructions.
7. Using the smoke tube and aspirator bulb, test 10 percent of Glovebags by placing the tube into the water porthole (two-inch opening to glove bag), and fill the bag with smoke and squeeze it. If leaks are found, they shall be taped closed using duct tape and the bag shall be retested with smoke.
8. Insert the wand from the water sprayer through the water porthole.
9. Insert the hose end from a HEPA vacuum into the upper portion of the glove bag.
10. Wet and remove the pipe insulation.
11. If the section of pipe is covered with an aluminum jacket, remove it first using the wire cutters to cut any bands and then use tin snips to remove the aluminum. It is important to fold the sharp edges in to prevent cutting the bag when placing it in the bottom.
12. When the work is complete, spray the upper portion of the bag and move all residue into the bottom of the bag with the other waste material. Be very thorough. Use adequate water.
13. Put all tools, after washing them off in the bag, in one of the sleeves of glove bag and turn it inside out, drawing it outside of the bag. Twist the sleeve tightly several times to seal it and tape it several tight turns with duct tape. Cut through the middle of the duct tape and remove the sleeve. Put the sleeve in the next glove bag or put it in a bucket of water to decontaminate the tools after cutting the sleeve open.
14. Turn on the HEPA vacuum and collapse the bag completely. Remove the vacuum nozzle, seal the hole with duct tape, twist the bag tightly several times in the middle, and tape it to keep the material in the bottom during removal of the glove bag from the pipe.
15. Slip a disposal bag over the glove bag (still attached to the pipe). Remove the tape securing the ends, and slit open the top of the glove bag and carefully fold it down into the disposal bag. Double bag and gooseneck waste materials.

B. Negative Pressure Glovebag Procedure:

1. In addition to the above requirements, the HEPA vacuum shall be run continuously during the Glovebag procedure until completion at which time the Glovebag will be collapsed by the HEPA vacuum prior to removal from the pipe/component.

2. The HEPA vacuum shall be attached and operated as needed to prevent collapse of the Glovebag during the removal process.

3.4 LOCKDOWN ENCAPSULATION

A. General: Lockdown encapsulation is an integral part of the ACM removal. At the conclusion of ACM removal and before removal of the primary barriers, all piping surfaces shall be encapsulated with a bridging encapsulant.

B. Sealing Exposed Edges: Seal edges of ACM exposed by removal work with two coats of encapsulant. Prior to sealing, permit the exposed edges to dry completely to permit penetration of the encapsulant.

3.5 DISPOSAL OF ACM WASTE MATERIALS

A. General: Dispose of waste ACM and debris which is packaged in accordance with these specifications, OSHA, EPA and DOT. The landfill requirements for packaging must also be met. Transport will be in compliance with 49 CFR 171 - 180 regulations. Disposal shall be done at an approved landfill. Disposal of non-friable ACM shall be done in accordance with applicable regulations.

B. Procedures:
1. The VA must be notified at least 24 hours in advance of any waste removed from the containment
2. Asbestos waste shall be packaged and moved through the W/EDF into a covered transport container in accordance with procedures in this specification. Waste shall be double-bagged and wetted with amended water prior to disposal. Wetted waste can be very heavy. Bags shall not be overfilled. Bags shall be securely sealed to prevent accidental opening and/or leakage. The top shall be tightly twisted and goose necked prior to tightly sealing with at least three wraps of duct tape. Ensure that unauthorized persons do not have access to the waste material once it is outside the regulated area. All transport containers must be covered at all times when not in use. OSHA Danger signs must be displayed during loading and unloading. Material shall not be transported in open vehicles. If drums are used for packaging, the drums shall be labeled properly and shall not be re-used.
3. Waste Load Out: Waste load out shall be done in accordance with the procedures in W/EDF Decontamination Procedures. Sealed waste bags shall be decontaminated on exterior surfaces by wet cleaning and HEPA vacuuming before being placed in the second waste bag and sealed, which then must also be wet wiped and HEPA vacuumed.
4. Asbestos waste with sharp edged components, i.e., nails, screws, lath, strapping, tin sheeting, jacketing, metal mesh, etc., which might tear poly bags shall be wrapped securely in burlap before packaging and, if needed, use a poly lined fiber drum as the second container, prior to disposal.

3.6 PROJECT DECONTAMINATION

A. General:
1. The entire work related to project decontamination shall be performed under the close supervision and monitoring of the CPIH/CIH.
2. If the asbestos abatement work is in an area which was contaminated prior to the start of abatement, the decontamination will be done by cleaning the primary poly barrier prior to its removal and cleanings of the surfaces of the regulated area after the primary barrier removal.
3. If the asbestos abatement work is in an area which was uncontaminated prior to the start of abatement, the decontamination will be done by cleaning the primary poly barrier prior to its removal, thus preventing contamination of the building when the regulated area critical barriers are removed.

B. Regulated Area Clearance: Air testing and other requirements which must be met before release of the Contractor and re-occupancy of the regulated area space are specified in Final Testing Procedures.

C. Work Description: Decontamination includes the clearance air testing in the regulated area and the decontamination and removal of the enclosures/facilities installed prior to the abatement work including primary/critical barriers, PDF and W/EDF facilities, and negative pressure systems.

D. Pre-Decontamination Conditions:
   1. Before decontamination starts, all ACM waste from the regulated area shall be removed, all waste collected and removed, and the secondary barrier of poly removed and disposed of along with any gross debris generated by the work.
   2. At the start of decontamination, the following shall be in place.
      a. Critical barriers over all openings consisting of two layers of 6-mil poly which is the sole barrier between the regulated area and the rest of the building or outside.
      b. Decontamination facilities, if required for personnel and equipment in operating condition.

E. First Cleaning: Carry out a first cleaning of all surfaces of the regulated area including items of remaining poly sheeting, tools, scaffolding, ladders/staging by wet methods and HEPA vacuuming. Do not use dry dusting/sweeping/air blowing methods. Use each surface of a wetted cleaning cloth one time only and then dispose of as contaminated waste. Continue this cleaning until there is no visible residue from abated surfaces or poly or other surfaces. Remove all filters in the air handling system and dispose of as ACM waste in accordance with these specifications. The negative pressure system shall remain in operation during this time, if used. Additional cleaning may be needed as determined by the CPIH/VPIH/CIH.

F. Pre-Clearance Inspection and Testing: The CPIH/CIH and VPIH/CIH will perform a thorough and detailed visual inspection at the end of the cleaning to determine whether there is any visible residue in the regulated area. If the visual inspection is acceptable, the CPIH/CIH will perform pre-clearance sampling using aggressive clearance as detailed in 40 CFR 763 Subpart E (AHERA) Appendix A (III)(B)(7)(d). If the sampling results show values below 0.01 f/cc, then the Contractor shall notify the VA's Representative of the results with a brief report from the CPIH/CIH documenting the inspection and sampling results and a statement verifying that the regulated area is ready for lockdown encapsulation. The VA reserves the right to utilize their own VPIH/CIH to perform a pre-clearance inspection and testing for verification.

G. Lockdown Encapsulation of Abated Surfaces: With the express written permission of the VA's Representative, perform lockdown encapsulation of all surfaces from which asbestos was abated in accordance with the procedures in this specification.

3.7 FINAL VISUAL INSPECTIONS AND AIR CLEARANCE TESTING

A. General: Notify the VA Representative 24 hours in advance for the performance of the final visual inspection and testing. The final visual inspection and testing will be performed by the VPIH/CIH after the final cleaning.

B. Final Visual Inspection: Final visual inspection will include the entire regulated area, the PDF, all poly sheeting, seals over HVAC openings, doorways, windows, and any other openings. If any debris, residue, dust or any other suspect material is detected, the final cleaning shall be repeated at no additional cost to the VA. Dust/material samples may be collected and analyzed at no additional cost to the VA at the discretion of the VPIH/CIH to confirm visual findings. When the regulated area is visually clean the final testing can be done.

C. Final Air Clearance Testing:
   1. After an acceptable final visual inspection by the VPIH/CIH and VA Representative, the VPIH/CIH will perform the final clearance testing. Air samples will be collected and analyzed in accordance with procedures for AHERA in this specification. If work is less than 260 lf/160 sf/35 cf, 5 PCM samples shall be collected for clearance and a minimum

of two field blank. If work is equal to or more than 260 lf/160 sf/35 cf, AHERA TEM sampling shall be performed for clearance. TEM analysis shall be done in accordance with procedures for EPA AHERA presented in this specification. If the release criteria are not met, the Contractor shall repeat the final cleaning and continue decontamination procedures until clearance is achieved. All additional inspection and testing costs will be borne by the Contractor.

2. If release criteria are met, proceed to perform the abatement closeout and to issue the certificate of completion in accordance with these specifications.

D. Final Air Clearance Procedures:

1. Contractor's Release Criteria: Work in a regulated area is complete when the regulated area is visually clean and airborne fiber levels have been reduced to or below 0.01 f/cc as measured by the AHERA PCM protocol, and < 70 AHERA asbestos structures per square millimeter (s/mm2) by AHERA TEM. No averaging of results will be used for this project. All five (5) TEM samples inside the regulated area shall be at or below 70 asbestos s/mm2 to satisfy the project final clearance criteria.

2. Air Monitoring and Final Clearance Sampling: To determine if the elevated airborne fiber counts encountered during abatement operations have been reduced to the specified level, the VPIH/CIH will secure samples and analyze them according to the following procedures:

   a. Fibers Counted: “Fibers” referred to in this section shall be either all fibers regardless of composition as counted in the NIOSH 7400 PCM method or asbestos fibers counted using the AHERA TEM method.

   b. Aggressive Sampling: All final air testing samples shall be collected using aggressive sampling techniques except where soil is not encapsulated or enclosed. Samples will be collected on 0.8⌠ MCE filters for PCM analysis and 0.45⌠ MCE for TEM. A minimum of 3850 Liters of air using calibrated sampling pumps shall be collected for PCM samples and a minimum of 1200 Liters of air using calibrated sampling pumps shall be collected for TEM clearance samples. Before pumps are started, initiate aggressive air mixing sampling as detailed in 40 CFR 763 Subpart E (AHERA) Appendix A (III)(B)(7)(d). Air samples will be collected in areas subject to normal air circulation away from corners, obstructed locations, and locations near windows, doors, or vents. After air sampling pumps have been shut off, circulating fans shall be shut off. The negative pressure system shall continue to operate.

E. Clearance Sampling Using PCM:

1. The VPIH/CIH will perform clearance samples as indicated by the specification.

2. The NIOSH 7400 PCM method will be used for clearance sampling with a minimum collection volume of 3850 Liters of air. A minimum of 5 PCM clearance samples shall be collected. All samples must be equal to or less than 0.01 f/cc to clear the regulated area.

F. Clearance Sampling Using TEM:

1. Clearance requires 13 samples be collected; 5 inside the regulated area; 5 outside the regulated area; and 3 field blanks.

2. The TEM method will be used for clearance sampling with a minimum collection volume of 1200 Liters of air. A minimum of 13 clearance samples shall be collected. All samples must be equal to or less than 70 AHERA structures per square millimeter (s/mm2) AHERA TEM, no averaging of results for this specific project.

G. Laboratory Testing of PCM Samples: The services of an AIHA accredited laboratory will be employed by the VA to perform analysis for the PCM air samples. The accredited laboratory shall be successfully participating in the AIHA Proficiency Analytical Testing (PAT) program. Samples will be sent daily by the VPIH/CIH so that verbal/faxed reports can be received within 24-36 hours. A complete record, certified by the laboratory, of all air monitoring tests and results will be furnished to the VA’s Representative and the Contractor.

H. Laboratory Testing of TEM Samples: Samples shall be sent by the VPIH/CIH to a NIST NVLAP accredited laboratory for analysis by TEM. The laboratory shall be successfully participating in the NIST NVLAP Airborne Asbestos Analysis (TEM) program. Verbal/faxed results from the laboratory shall be available within 24-36 hours after receipt of the samples. A complete record, certified by the laboratory, of all TEM results shall be furnished to the VA's Representative and the Contractor.

3.8 ABATEMENT CLOSEOUT AND CERTIFICATE OF COMPLIANCE

A. Completion of Abatement Work: After thorough decontamination, seal negative air machines with 2-layers of 6-mil poly and duct tape to form a tight seal at the intake/outlet ends before removal from the regulated area. Complete asbestos abatement work upon meeting the regulated area visual and air clearance criteria and fulfilling the following:

1. Remove all equipment, materials, and debris from the project area.
2. Package and dispose of all asbestos waste as required. Dispose of waste ACM and debris which is packaged in accordance with these specifications, OSHA, EPA and DOT. The landfill requirements for packaging must also be met. Transport will be in compliance with 49 CFR 171 – 180 regulations.
3. Repair or replace all interior finishes damaged during the abatement work.
4. The VA will be notified of any waste removed from the containment prior to 24 hours.
5. Fulfill other project closeout requirements as specified elsewhere in this specification.

B. Certificate of Completion by Contractor: The CPIH/CIH shall complete and sign the "Certificate of Completion" in accordance with Attachment 1 at the completion of the abatement and decontamination of the regulated area.

C. Work Shifts: All work shall generally be done during administrative hours (8:00 AM to 4:30 PM) Monday - Friday excluding Federal Holidays. Any change in the work schedule must be approved in writing by the VA Representative.

D. Re-Insulation: If required as part of the contract, replace all asbestos containing insulation with suitable non-asbestos material. Provide SDS for all replacement materials. Refer to Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION.

ATTACHMENT #1
CERTIFICATE OF COMPLETION

DATE: _____ VA Project #:_____
PROJECT NAME:_____ Abatement Contractor:_____
VAMC/ADDRESS:_____

1. I certify that I have personally inspected, monitored and supervised the abatement work of (specify regulated area or Building):
   which took place from / / to / /
2. That throughout the work all applicable requirements/regulations and the VA's specifications were met.
3. That any person who entered the regulated area was protected with the appropriate personal protective equipment and respirator and that they followed the proper entry and exit procedures and the proper operating procedures for the duration of the work.
4. That all employees of the Abatement Contractor engaged in this work were trained in respiratory protection, were experienced with abatement work, had proper medical surveillance documentation, were fit-tested for their respirator, and were not exposed at any time during the work to asbestos without the benefit of appropriate respiratory protection.
5. That I performed and supervised all inspection and testing specified and required by applicable regulations and VA specifications.
6. That the conditions inside the regulated area were always maintained in a safe and healthy condition and the maximum fiber count never exceeded 0.5 f/cc, except as described below.
7. That all abatement work was done in accordance with OSHA requirements and the manufacturer's recommendations.

CPIH/CIH Signature/Date:_____

CPIH/CIH Print Name:_____

Abatement Contractor Signature/Date:_____

Abatement Contractor Print Name:_____

ATTACHMENT #2
CERTIFICATE OF WORKER'S ACKNOWLEDGMENT

PROJECT NAME:_____DATE:_____
PROJECT ADDRESS:_____
ABATEMENT CONTRACTOR'S NAME:_____

WORKING WITH ASBESTOS CAN BE HAZARDOUS TO YOUR HEALTH. INHALING ASBESTOS HAS BEEN LINKED WITH VARIOUS TYPES OF CANCERS. IF YOU SMOKE AND INHALE ASBESTOS FIBERS, YOUR CHANCES OF DEVELOPING LUNG CANCER IS GREATER THAN THAT OF THE NON-SMOKING PUBLIC.

Your employer's contract with the owner for the above project requires that: You must be supplied with the proper personal protective equipment including an adequate respirator and be trained in its use. You must be trained in safe and healthy work practices and in the use of the equipment found at an asbestos abatement project. You must receive/have a current medical examination for working with asbestos. These things shall be provided at no cost to you. By signing this certificate of worker's acknowledgement you are indicating to the owner that your employer has met these obligations.

RESPIRATORY PROTECTION: I have been trained in the proper use of respirators and have been informed of the type of respirator to be used on the above indicated project. I have a copy of the written Respiratory Protection Program issued by my employer. I have been provided for my exclusive use, at no cost, with a respirator to be used on the above indicated project.

TRAINING COURSE: I have been trained by a third party, State/EPA accredited trainer in the requirements for an AHERA/OSHA Asbestos Abatement Worker training course, 32-hours minimum duration. I currently have a valid State accreditation certificate. The topics covered in the course include, as a minimum, the following:

Physical Characteristics and Background Information on Asbestos
Potential Health Effects Related to Exposure to Asbestos
Employee Personal Protective Equipment
Establishment of a Respiratory Protection Program
State of the Art Work Practices
Personal Hygiene
Additional Safety Hazards
Medical Monitoring
Air Monitoring
Relevant Federal, State and Local Regulatory Requirements, Procedures, and Standards
Asbestos Waste Disposal

MEDICAL EXAMINATION: I have had a medical examination within the past 12 months which was paid for by my employer. This examination included: health history, occupational history, pulmonary function test, and may have included a chest x-ray evaluation. The physician issued a positive written opinion after the examination.

Signature:_____
Printed Name:_____
Social Security Number:_____
Witness:_____

ATTACHMENT #3
AFFIDAVIT OF MEDICAL SURVEILLANCE, RESPIRATORY PROTECTION AND TRAINING/ACCREDITATION

VA PROJECT NAME AND NUMBER:_____
VA MEDICAL FACILITY:_____
ABATEMENT CONTRACTOR'S NAME AND ADDRESS:_____

1. I verify that the following individual
   Name:_____ Social Security Number:_____who is proposed to be employed in asbestos abatement work associated with the above project by the named Abatement Contractor, is included in a medical surveillance program in accordance with 29 CFR 1926.1101(m), and that complete records of the medical surveillance program as required by 29 CFR 1926.1101(m)(n) and 29 CFR 1910.20 are kept at the offices of the Abatement Contractor at the following address.
   Address:_____
2. I verify that this individual has been trained, fit-tested and instructed in the use of all appropriate respiratory protection systems and that the person is capable of working in safe and healthy manner as expected and required in the expected work environment of this project.

3. I verify that this individual has been trained as required by 29 CFR 1926.1101(k). This individual has also obtained a valid State accreditation certificate. Documentation will be kept on-site.

4. I verify that I meet the minimum qualifications criteria of the VA specifications for a CPIH.

Signature of CPIH/CIH:_____ Date:_____

Printed Name of CPIH/CIH:_____

Signature of Contractor:_____ Date:_____

Printed Name of Contractor:_____

ATTACHMENT #4
ABATEMENT CONTRACTOR/COMPETENT PERSON(S) REVIEW AND ACCEPTANCE OF THE VA'S ASBESTOS SPECIFICATIONS

VA Project Location:_____
VA Project #:_____
VA Project Description:_____

This form shall be signed by the Asbestos Abatement Contractor Owner and the Asbestos Abatement Contractor's Competent Person(s) prior to any start of work at the VA related to this Specification. If the Asbestos Abatement Contractor's/Competent Person(s) has not signed this form, they shall not be allowed to work on-site.

I, the undersigned, have read VA's Asbestos Specification regarding the asbestos abatement requirements. I understand the requirements of the VA's Asbestos Specification and agree to follow these requirements as well as all required rules and regulations of OSHA/EPA/DOT and State/Local requirements. I have been given ample opportunity to read the VA's Asbestos Specification and have been given an opportunity to ask any questions regarding the content and have received a response related to those questions. I do not have any further questions regarding the content, intent and requirements of the VA's Asbestos Specification.

At the conclusion of the asbestos abatement, I will certify that all asbestos abatement work was done in accordance with the VA's Asbestos Specification and all ACM was removed properly and no fibrous residue remains on any abated surfaces.

Abatement Contractor Owner's Signature_____Date_____

- - - END - - -

SECTION 02 82 13.19

ASBESTOS FLOOR TILE AND MASTIC ABATEMENT

PART 1 - GENERAL

1.1 SUMMARY OF THE WORK

A. Contract Documents and Related Requirements: Drawings, general provisions of the contract, including general and supplementary conditions and other Division 01 specifications, shall apply to the work of this section. The contract documents show the work to be done under the contract and related requirements and conditions impacting the project. Related requirements and conditions include applicable codes and regulations, notices and permits, existing site conditions and restrictions on use of the site, requirements for partial owner occupancy during the work, coordination with other work and the phasing of the work. In the event the Asbestos Abatement Contractor discovers a conflict in the contract documents and/or requirements or codes, the conflict must be brought to the immediate attention of the Contracting Officer for resolution. Whenever there is a conflict or overlap in the requirements, the most stringent shall apply. Any actions taken by the Contractor without obtaining guidance from the Contracting Officer shall become the sole risk and responsibility of the Asbestos Abatement Contractor. All costs incurred due to such action are also the responsibility of the Asbestos Abatement Contractor. All work shall be conducted in accordance with NYS ICR 56.

B. Extent of Work:

1. Below is a brief description of the estimated quantities of asbestos flooring materials to be abated. These quantities are for informational purposes only and are based on the best information available at the time of the specification preparation. The Contractor shall satisfy himself as to the actual quantities to be abated. Nothing in this section may be interpreted as limiting the extent of work otherwise required by this contract and related documents.
2. Removal, clean-up and disposal of asbestos containing materials (ACM) and asbestos/waste contaminated elements or debris in an appropriate regulated area for the following approximate quantities;

(9,727) square feet of ACM flooring and mastic.
(200) square feet of ACM floor tile.

HA No.	ACM Description	Material Location	Estimated Quantity*
97	Tan 12”x12” Floor Tile with Brown Specks	217A	50 SF
		217C	150 SF
		Total Estimated Amount:	**~ 200 Square Feet**
121	9”x9” Black Floor Tile	Room 233A	3 SF
		Room 233B	3 SF
		Total Estimated Amount:	**~ 6 Square Feet**
122	Mastic Under 9”x9” Black Floor Tile (HA 121 above)	Room 233A	3 SF
		Room 233B	3 SF
		Total Estimated Amount:	**~ 6 Square Feet**

1st Floor Renovation Spaces

HA No.	ACM Description	Material Location	Estimated Quantity*
-	White 12”x12” Floor Tile and Mastic	100A	154 SF
		101	167 SF
		101A	304 SF
		102	204 SF
		103	120 SF
		104	124 SF
		106	125 SF
		107	108 SF
		108	1177 SF
		109A	21 SF
		114	841 SF
		114A	15 SF
		114C	10 SF
		114D	12 SF
		115	212 SF
		116	48 SF
		121	49 SF
		122	213 SF
		125	116 SF
		126	252 SF
		126B	192 SF
		127	108 SF
		128	932 SF
		131	34 SF
		132	51 SF
		134	244 SF
		135	118 SF
	White 12”x12” Floor Tile and Mastic	145	222 SF
		146	114 SF

HA No.	ACM Description	Material Location	Estimated Quantity*
		148	64 SF
		179	15 SF
		150	95 SF
		151	209 SF
		152	221 SF
		153	224 SF
		154	214 SF
		155	103 SF
		156	114 SF
		166	147 SF
		167	124 SF
		168	285 SF
		170Z	258 SF
		173Z	278 SF
		177Z	437 SF
		Total Estimated Amount	**~ 9,631 Total SF**

Ground Floor Renovation Spaces

HA No.	ACM Description	Material Locations	Estimated Quantity*
3	Black 9”x 9” Floor Tile	Room 19C	**~ 90 Total SF**
4	Mastic of Black 9”x 9” Floor Tile	Room 19C	**~ 90 Total SF**

C. Related Work:
   1. Section 07 84 00, FIRESTOPPING
   2. Section 02 41 00, DEMOLITION
   3. Division 09, FINISHES

D. Tasks:
   1. The work tasks are summarized briefly as follows:
      a. Pre-abatement activities including pre-abatement meeting(s), inspection(s), notifications, permits, submittal approvals, regulated area preparations, emergency procedures arrangements, and Asbestos Hazard Abatement Plans for asbestos work.
      b. Abatement activities including removal , /encapsulation , enclosure , clean-up and disposal of ACM waste, recordkeeping, security, monitoring, and inspections.
      c. Cleaning and decontamination activities including final visual inspection, air monitoring and certification of decontamination.

E. Abatement Contractors Use of Premises:
   1. The Contractor and Contractor's personnel shall cooperate fully with the VA representative/consultant to facilitate efficient use of buildings and areas within buildings. The Contractor shall perform the work in accordance with the VA specifications, drawings, phasing plan and in compliance with any/all applicable Federal, State and Local regulations and requirements.
   2. The Contractor shall use the existing facilities in the building strictly within the limits indicated in contract documents as well as the approved VA Design and Construction Procedures. VA Design Construction Procedure drawings of partially occupied buildings will show the limits of regulated areas; the placement of decontamination facilities; the temporary location of bagged waste ACM; the path of transport to outside the building; and the temporary waste storage area for each building/regulated area. Any variation from the arrangements shown on drawings shall be secured in writing from the VA

Representative through the pre-abatement plan of action. The following limitations of use shall apply to existing facilities shown on drawings.

1.2 VARIATIONS IN QUANTITY

A. The quantities and locations of ACM as indicated on the drawings and the extent of work included in this section are estimated which are limited by the physical constraints imposed by occupancy of the buildings and accessibility to ACM. Accordingly, minor variations (+/- 10 percent) in quantities of ACM within the regulated area are considered as having no impact on contract price and time requirements of this contract. Where additional work is required beyond the above variation, the contractor shall provide unit prices for newly discovered ACM and those prices shall be used for additional work required under the contractor. Contractor shall field verify quantities prior to abatement with VA representative when there is a variation in the amount of ACM removal.

1.3 STOP ASBESTOS REMOVAL

A. If the Contracting Officer; their field representative; the facility Safety Officer/Manager or their designee, or the VA Professional Industrial Hygienist/Certified Industrial Hygienist (VPIH/CIH) presents a verbal **Stop Asbestos Removal Order**, the Contractor/Personnel shall immediately stop all asbestos removal and maintain HEPA filtered negative pressure air flow in the containment and adequately wet any exposed ACM. If a verbal Stop Asbestos Removal Order is issued, the VA shall follow-up with a written order to the Contractor as soon as it is practicable. The Contractor shall not resume any asbestos removal activity until authorized to do so in writing by the VA Contracting Officer. A stop asbestos removal order may be issued at any time the VA Contracting Officer determines abatement conditions/activities are not within VA specification, regulatory requirements or that an imminent hazard exists to human health or the environment. Work stoppage will continue until conditions have been corrected to the satisfaction of the VA. Standby time and costs for corrective actions will be borne by the Contractor, including the VPIH/CIH time. The occurrence of any of the following events shall be reported immediately by the Contractor's competent person to the VA Contracting Office or field representative using the most expeditious means (e.g., verbal or telephonic), followed up with written notification to the Contracting Officer as soon as practical. The Contractor shall immediately stop asbestos removal/disturbance activities and initiate fiber reduction activities if:

1. Airborne PCM analysis results equal to or greater than 0.01 f/cc above background levels inside the building but outside the regulated area;
2. breach or break in regulated area containment barrier(s);
3. less than –0.02 inch WCG pressure in the regulated area;
4. serious injury/death at the site;
5. fire/safety emergency at the site;
6. respiratory protection system failure;
7. power failure or loss or inadequate use of wetting agent;
8. any visible emissions observed outside the regulated area; or
9. failure to follow project specification requirements.

1.4 DEFINITIONS

A. General: Definitions and explanations here are neither complete nor exclusive of all terms used in the contract documents, but are general for the work to the extent they are not stated more explicitly in another element of the contract documents. Drawings must be recognized as diagrammatic in nature and not completely descriptive of the requirements indicated therein.

B. Glossary:

Abatement - Procedures to control fiber release from asbestos-containing materials. Includes removal, encapsulation, enclosure, demolition, and renovation activities related to asbestos containing materials (ACM).

Adequately wet - Sufficiently mixed or penetrated with liquid to prevent the release of particulates. If visible emissions are observed coming from the ACM, then that material has not been adequately wetted.

Aerosol - Solid or liquid particulate suspended in air.
Aggressive method - Removal or disturbance of building material by sanding, abrading, grinding, or other method that breaks, crumbles, or disintegrates intact ACM.
Aggressive air sampling - EPA AHERA defined clearance sampling method using air moving equipment such as fans and leaf blowers to aggressively disturb and maintain in the air residual fibers after abatement.
AHERA - Asbestos Hazard Emergency Response Act. Asbestos regulations for schools issued in 1987.
Aircell - Pipe or duct insulation made of corrugated cardboard which contains asbestos.
Air monitoring - The process of measuring the fiber content of a known volume of air collected over a specified period of time. The NIOSH 7400 Method, Issue 3, Fifth Edition is used to determine the fiber levels in air. For personal samples, area air samples and clearance air testing using Phase Contrast Microscopy (PCM) analysis, the NIOSH Method 7402 (Issue 2, Fourth Edition) can be used when it is necessary to confirm fibers counted by PCM as being asbestos. The AHERA TEM analysis may be used for background, area samples and clearance samples when required by this specification, or at the discretion of the VPIH/CIH as appropriate.
Air sample filter - The filter used to collect fibers which are then counted. The filter is made of mixed cellulose ester (MCE) membrane for PCM (Phase Contrast Microscopy, 25 mm, 3-piece with 2 inches Static Extension Cowl, 0.8 micron pore size) and MCE for TEM (Transmission Electron Microscopy, 25 mm, 3-piece with 2 inches Static Extension Cowl, 0.45 micron pore size).
Amended water - Water to which a surfactant (wetting agent) has been added to increase the penetrating ability of the liquid.
Asbestos - Includes chrysotile, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, actinolite asbestos, and any of these minerals that have been chemically treated or altered. Asbestos also includes PACM, as defined below.
Asbestos Hazard Abatement Plan (AHAP) - Asbestos work procedures required to be submitted by the contractor before work begins.
Asbestos-containing material (ACM) - Any material containing more than one percent of asbestos.
Asbestos contaminated elements (ACE) - Building elements such as ceilings, walls, lights, or ductwork that are contaminated with asbestos.
Asbestos-contaminated soil (ACS) – Soil found in the work area or in adjacent areas such as crawlspaces or pipe tunnels which is contaminated with asbestos-containing material debris and cannot be easily separated from the material.
Asbestos-containing waste (ACW) material - Asbestos-containing material or asbestos contaminated objects requiring disposal.
Asbestos Project Monitor – Some states require that any person conducting asbestos abatement air sampling, clearance inspections and clearance air sampling be licensed as an asbestos project monitor.
Asbestos waste decontamination facility - A system consisting of drum/bag washing facilities and a temporary storage area for cleaned containers of asbestos waste. Used as the exit for waste and equipment leaving the regulated area. In an emergency, it may be used to evacuate personnel.
Authorized person - Any person authorized by the VA, the Contractor, or government agency and required by work duties to be present in regulated areas.
Authorized visitor - Any person approved by the VA; the contractor; or any government agency representative having jurisdiction over the regulated area (e.g., OSHA, Federal and State EPA).
Barrier - Any surface that isolates the regulated area and inhibits fiber migration from the regulated area.
Containment Barrier - An airtight barrier consisting of walls, floors, and/or ceilings of sealed plastic sheeting which surrounds and seals the outer perimeter of the regulated area.
Critical Barrier - The barrier responsible for isolating the regulated area from adjacent spaces, typically constructed of 2-layers of 6-mil independently installed plastic sheeting (Polyethylene) secured in place at openings such as doors, windows, penetrations or any other opening into the regulated area.

Primary Barrier – Plastic barriers placed over critical barriers and exposed directly to abatement work or to secondary barrier.
Secondary Barrier - Any additional plastic barriers used to isolate and provide protection from debris during abatement work.
Breathing zone - The hemisphere forward of the shoulders with a radius of about 150 - 225 mm (6 - 9 inches) from the worker's nose.
Bridging encapsulant - An encapsulant that forms a layer on the surface of the ACM.
Building/facility owner - The legal entity, including a lessee, which exercises control over management and recordkeeping functions relating to a building and/or facility in which asbestos activities take place.
Bulk testing - The collection and analysis of suspect asbestos containing materials.
Certified Industrial Hygienist (CIH) - A person certified in the comprehensive practice of industrial hygiene by the American Board of Industrial Hygiene.
Class I asbestos work - Activities involving the removal of Thermal System Insulation (TSI) and surfacing ACM and Presumed Asbestos Containing Material (PACM).
Class II asbestos work - Activities involving the removal of ACM which is not thermal system insulation or surfacing material. This includes, but is not limited to, the removal of asbestos-containing wallboard, floor tile and sheeting, roofing and siding shingles, and construction mastic.
Clean room/Changing room - An uncontaminated room having facilities for the storage of employee's street clothing and uncontaminated materials and equipment.
Clearance sample - The final air sample taken after all asbestos work has been done and visually inspected. Performed by the VA's Professional Industrial Hygiene consultant/Certified Industrial Hygienist (VPIH/CIH).
Closely resemble - The major workplace conditions which have contributed to the levels of historic asbestos exposure, are no more protective than conditions of the current workplace.
Competent person - In addition to the definition in 29 CFR 1926.32(f), one who is capable of identifying existing asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure, who has the authority to take prompt corrective measures to eliminate them, as specified in 29 CFR 1926.32(f); in addition, for Class I and II work who is specially trained in a training course which meets the criteria of EPA's Model Accreditation Plan (40 CFR 763) for supervisor.
Contractor's Professional Industrial Hygienist (CPIH/CIH) - The asbestos abatement contractor's industrial hygienist. The industrial hygienist must meet the qualification requirements of a PIH and may report to a certified industrial hygienist (CIH).
Count - Refers to the fiber count or the average number of fibers greater than five microns in length with a length-to-width (aspect) ratio of at least 3 to 1, per cubic centimeter of air.
Crawlspace – An area which can be found either in or adjacent to the work area. This area has limited access and egress and may contain asbestos materials and/or asbestos contaminated soil.
Decontamination area/unit - An enclosed area adjacent to and connected to the regulated area and consisting of an equipment room, shower room, and clean room, which is used for the decontamination of workers, materials, and equipment that are contaminated with asbestos.
Demolition - The wrecking or taking out of any load-supporting structural member and any related razing, removing, or stripping of asbestos products.
Disposal bag - Typically 6-mil thick sift-proof, dustproof, leak-tight container used to package and transport asbestos waste from regulated areas to the approved landfill. Each bag/container must be labeled/marked in accordance with EPA, OSHA and DOT requirements.
Disturbance – Asbestos Operations and Maintenance Activities (OSHA Class III) that disrupt the matrix of ACM or PACM, crumble or pulverize ACM or PACM, or generate visible debris from ACM or PACM. Disturbance includes cutting away small amounts of ACM or PACM, no greater than the amount that can be contained in one standard sized glove bag or waste bag in order to access a building component. In no event shall the amount of ACM or PACM so disturbed exceed that which can be contained in one glove bag or disposal bag, which shall not exceed 60 inches in length or width.
Drum - A rigid, impermeable container made of cardboard fiber, plastic, or metal which can be sealed in order to be sift-proof, dustproof, and leak-tight.

Employee exposure - The exposure to airborne asbestos that would occur if the employee were not wearing respiratory protection equipment.
Encapsulant - A material that surrounds or embeds asbestos fibers in an adhesive matrix and prevents the release of fibers.
Encapsulation - Treating ACM with an encapsulant.
Enclosure - The construction of an air tight, impermeable, permanent barrier around ACM to control the release of asbestos fibers from the material and also eliminate access to the material.
Equipment room - A contaminated room located within the decontamination area that is supplied with impermeable bags or containers for the disposal of contaminated protective clothing and equipment.
Fiber - A particulate form of asbestos, 5 microns or longer, with a length to width (aspect) ratio of at least 3 to 1.
Fibers per cubic centimeter (f/cc) - Abbreviation for fibers per cubic centimeter, used to describe the level of asbestos fibers in air.
Filter - Media used in respirators, vacuums, or other machines to remove particulate from air.
Firestopping - Material used to close the open parts of a structure in order to prevent a fire from spreading.
Friable asbestos containing material - Any material containing more than one (1) percent asbestos as determined using the method specified in 40 CFR 763, Polarized Light Microscopy, that, when dry, can be crumbled, pulverized, or reduced to powder by hand pressure.
Glovebag - Not more than a 60 x 60 inch impervious plastic bag-like enclosure affixed around an asbestos-containing material, with glove-like appendages through which materials and tools may be handled.
High efficiency particulate air (HEPA) filter – An ASHRAE MERV 17 filter capable of trapping and retaining at least 99.97 percent of all mono-dispersed particles of 0.3 micrometers in diameter.
HEPA vacuum - Vacuum collection equipment equipped with a HEPA filter system capable of collecting and retaining asbestos fibers.
Homogeneous area - An area of surfacing, thermal system insulation or miscellaneous ACM that is uniform in color, texture and date of application.
HVAC - Heating, Ventilation and Air Conditioning
Industrial hygienist (IH) - A professional qualified by education, training, and experience to anticipate, recognize, evaluate and develop controls for occupational health hazards. Meets definition requirements of the American Industrial Hygiene Association (AIHA).
Industrial hygienist technician (IH Technician) - A person working under the direction of an IH or CIH who has special training, experience, certifications and licenses required for the industrial hygiene work assigned. Some states require that an industrial hygienist technician conducting asbestos abatement air sampling, clearance inspection and clearance air sampling be licensed as an asbestos project monitor.
Intact - The ACM has not crumbled, been pulverized, or otherwise deteriorated so that the asbestos is no longer likely to be bound with its matrix.
Lockdown - Applying encapsulant, after a final visual inspection, on all abated surfaces at the conclusion of ACM removal prior to removal of critical barriers.
National Emission Standards for Hazardous Air Pollutants (NESHAP) - EPA's rule to control emissions of asbestos to the environment (40 CFR part 61, Subpart M).
Negative initial exposure assessment - A demonstration by the employer which complies with the criteria in 29 CFR 1926.1101 (f)(2)(iii), that employee exposure during an operation is expected to be consistently below the PEL or Excursion Limit (EL).
Negative pressure - Air pressure which is lower than the surrounding area, created by exhausting air from a sealed regulated area through HEPA equipped filtration units. OSHA requires maintaining -0.02 inch water column gauge inside the negative pressure enclosure.
Negative pressure respirator - A respirator in which the air pressure inside the facepiece is negative during inhalation relative to the air pressure outside the respirator facepiece.
Non-friable ACM - Material that contains more than 1 percent asbestos but cannot be crumbled, pulverized, or reduced to powder by hand pressure.

Organic vapor cartridge - The type of cartridge used on air purifying respirators to remove organic vapor hazardous air contaminants.
Outside air - The air outside buildings and structures, including, but not limited to, the air under a bridge or in an open ferry dock.
Owner/operator - Any person who owns, leases, operates, controls, or supervises the facility being demolished or renovated or any person who owns, leases, operates, controls, or supervises the demolition or renovation operation, or both.
Penetrating encapsulant - Encapsulant that is absorbed into the ACM matrix without leaving a surface layer.
Permissible exposure limit (PEL) - The level of exposure OSHA allows for as an eight (8) hour time-weighted average (TWA). For asbestos fibers, the eight (8) hour time-weighted average PEL is 0.1 fibers per cubic centimeter (0.1 f/cc) of air and the 30-minute Excursion Limit (EL) is 1.0 fibers per cubic centimeter (1 f/cc).
Personal protective equipment (PPE) – equipment designed to protect user from injury and/or specific job hazard. Such equipment may include protective clothing, hard hats, safety glasses, fall protection, and respirators.
Personal sampling/monitoring - Representative air samples obtained in the breathing zone for one or more workers within the regulated area using a filter cassette and a calibrated air sampling pump to determine asbestos exposure.
Pipe tunnel – An area, typically located adjacent to mechanical spaces or boiler rooms in which the pipes servicing the heating system in the building are routed to allow the pipes to access heating elements. These areas may contain asbestos pipe insulation, asbestos fittings, debris or asbestos-contaminated soil.
Polarized light microscopy (PLM) - Light microscopy using dispersion staining techniques and refractive indices to identify and quantify the type of asbestos present in a bulk sample.
Polyethylene sheeting - Strong plastic barrier material 4 to 6-mils thick, semi-transparent, flame retardant per NFPA 241.
Positive/negative fit check - A method of verifying the seal of a facepiece respirator by temporarily occluding the filters and breathing in (inhaling) and then temporarily occluding the exhalation valve and breathing out (exhaling) while checking for inward or outward leakage of the respirator, respectively.
Presumed ACM (PACM) - Thermal system insulation, surfacing, and flooring material installed in buildings prior to 1981. If the building owner has actual knowledge, or should have known through the exercise of due diligence that other materials are ACM, they too must be treated as PACM. The designation of PACM may be rebutted pursuant to 29 CFR 1926.1101 (k)(5).
Professional IH - An IH who meets the definition requirements of AIHA; meets the definition requirements of OSHA as a "Competent Person" at 29 CFR 1926.1101 (b); has completed two specialized EPA approved courses on management and supervision of asbestos abatement projects; has formal training in respiratory protection and waste disposal; and has a minimum of four projects of similar complexity with this project of which at least three projects serving as the supervisory IH. The PIH may be either the VA's PIH (VPIH/CIH) or Contractor's PIH (CPIH/CIH).
Project designer - A person who has successfully completed the training requirements for an asbestos abatement project designer as required by 40 CFR 763 Subpart E, Appendix C, Part I; (B)(5).
Assigned protection factor - A value assigned by OSHA/NIOSH to indicate the expected protection provided by each respirator class, when the respirator is properly selected and worn correctly. The number indicates the reduction of exposure level from outside to inside the respirator facepiece.
Qualitative fit test (QLFT) - A fit test using a challenge material that can be sensed by the wearer if leakage in the respirator occurs.
Quantitative fit test (QNFT) - A fit test using a challenge material which is quantified outside and inside the respirator thus allowing the determination of the actual fit factor.
Regulated area - An area established by the employer to demarcate where Class I, II, III asbestos work is conducted, and any adjoining area where debris and waste from such asbestos work may accumulate; and a work area within which airborne concentrations of asbestos exceed, or there is a reasonable possibility they may exceed the PEL.

Regulated ACM (RACM) - Friable ACM; Category I non-friable ACM that has become friable; Category I non-friable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading or; Category II non-friable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces expected to act on the material in the course of the demolition or renovation operation.
Removal - All operations where ACM, PACM and/or RACM is taken out or stripped from structures or substrates, including demolition operations.
Renovation - Altering a facility or one or more facility components in any way, including the stripping or removal of asbestos from a facility component which does not involve demolition activity.
Repair - Overhauling, rebuilding, reconstructing, or reconditioning of structures or substrates, including encapsulation or other repair of ACM or PACM attached to structures or substrates.
Shower room - The portion of the PDF where personnel shower before leaving the regulated area.
Supplied air respirator (SAR) - A respiratory protection system that supplies minimum Grade D respirable air per ANSI/Compressed Gas Association Commodity Specification for Air, G-7.1-2018.
Surfacing ACM - A material containing more than 1 percent asbestos that is sprayed, troweled on or otherwise applied to surfaces for acoustical, decorative, fireproofing and other purposes.
Surfactant - A chemical added to water to decrease water's surface tension thus making it more penetrating into ACM.
Thermal system ACM - A material containing more than 1 percent asbestos applied to pipes, fittings, boilers, breeching, tanks, ducts, or other structural components to prevent heat loss or gain.
Transmission electron microscopy (TEM) - A microscopy method that can identify and count asbestos fibers.
VA Professional Industrial Hygienist (VPIH/CIH) – The Department of Veterans Affairs Professional Industrial Hygienist must meet the qualifications of a PIH, and may report to a Certified Industrial Hygienist (CIH).
VA Representative - The VA official responsible for on-going project work.
VA Total – means a building or substantial part of the building is completely removed, torn or knocked down, bulldozed, flattened, or razed, including removal of building debris.
Visible emissions - Any emissions, which are visually detectable without the aid of instruments, coming from ACM/PACM/RACM/ACS or ACM waste material.
Waste/Equipment decontamination facility (W/EDF) – The area in which equipment is decontaminated before removal from the regulated area.
Waste generator - Any owner or operator whose act or process produces asbestos-containing waste material.
Waste shipment record - The shipping document, required to be originated and signed by the waste generator, used to track and substantiate the disposition of asbestos-containing waste material.
Wet cleaning - The process of thoroughly eliminating, by wet methods, any asbestos contamination from surfaces or objects.

C. Referenced Standards Organizations: See Section 01 42 19 REFERENCED STANDARDS.

1.5 APPLICABLE CODES AND REGULATIONS

A. General Applicability of Codes, Regulations, and Standards:
1. All work under this contract shall be done in strict accordance with all applicable Federal, State, and Local regulations, standards and codes governing asbestos abatement, and any other trade work done in conjunction with the abatement. All applicable codes, regulations and standards are adopted into this specification and will have the same force and effect as this specification.
2. The most recent edition of any relevant regulation, standard, document or code shall be in effect. Where conflict among the requirements or with these specifications exists, the most stringent requirement(s) shall be utilized.

3. Copies of all standards, regulations, codes and other applicable documents, including this specification and those listed in Section 1.5 shall be available at the worksite in the clean change area of the worker decontamination system and/or the Contractor's on-site Field Office. These standards, regulations, codes and other applicable documents, including this specification and those listed in Section 1.5 may be made available electronically.

B. Contractor Responsibility: The Asbestos Abatement Contractor (Contractor) shall assume full responsibility and liability for compliance with all applicable Federal, State and Local regulations related to any and all aspects of the asbestos abatement project. The Contractor is responsible for providing and maintaining training, accreditations, medical exams, medical records, personal protective equipment (PPE), including respiratory protection and respirator fit testing, as required by applicable Federal, State and Local regulations. The Contractor shall hold the VA and VPIH/CIH consultants harmless for any Contractor's failure to comply with any applicable work, packaging, transporting, disposal, safety, health, or environmental requirement on the part of himself, his employees, or his subcontractors. The Contractor will incur all costs of the CPIH/CIH, including all sampling/analytical costs to assure compliance with OSHA/EPA/State/Local requirements related to failure to comply with the regulations applicable to the work.

C. Federal Requirements:
1. Federal requirements which govern asbestos abatement include, but are not limited to, the following regulations:
   a. Occupational Safety and Health Administration **(OSHA)**
      1) Title 29 CFR 1926.1101 - Construction Standard for Asbestos
      2) Title 29 CFR 1926 Subpart E - Personal Protective Equipment and Life Saving Equipment
      3) Title 29 CFR 1910.134 - Respiratory Protection
      4) Title 29 CFR 1926 - Construction Industry Standards
      5) Title 29 CFR 1926.33 - Access to Employee Exposure and Medical Records
      6) Title 29 CFR 1926.59 same as 1910.1200 - Hazard Communication
      7) Title 29 CFR 1926 Subpart C – General Safety and Health Provisions and Subpart D – Occupational Health and Environmental Controls
   b. Environmental Protection Agency **(EPA)**:
      1) 40 CFR 61 Subpart M - National Emission Standard for Hazardous Air Pollutants - Asbestos.
      2) 40 CFR 763 - Asbestos Hazard Emergency Response Act (AHERA) and Asbestos Hazard Abatement Reauthorization Act (ASHARA)
   c. Department of Transportation **(DOT)**
      1) Title 49 CFR 171 - 180 – Transportation

D. State Requirements:
1. State requirements that apply to the asbestos abatement work, disposal, clearance, etc., include, but are not limited to, the following:
   1. New York State Department of Health (NYSDOH)
      a. 10 NYCRR, Part 73, "Asbestos Safety Program Requirements"
   2. New York State Department of Labor (NYSDOL)
      a. 12 NYCRR, Part 56, "Asbestos"-Industrial Code Rule 56
   1. New York State Department of Environmental Conservation (NYSDEC)
      a. 6 NYCRR, Part 360 "Solid Waste Management Facilities"
      b. 6 NYCRR, Part 364 "Waste Transporter Permits"
      c. 6 NYCRR, Part 372 "Hazardous Waste Manifest System and Related Standards for Generators, Transporters and Facilities

E. Local Requirements:
2. If local requirements are more stringent than federal or state standards, the local standards are to be followed.

F. Standards:
3. Standards which govern asbestos abatement activities include, but are not limited to, the following:
   a. American National Standards Institute (ANSI)/ASSP Z9.2-2018 - Fundamentals Governing the Design and Operation of Local Exhaust Systems and ANSI/ASSE Z88.2-2015 - Practices for Respiratory Protection.
   b. Underwriters Laboratories (UL) 586-2009 - UL Standard for Safety of HEPA Filter Units, 9th Edition; ANSI Approval 2017-12-19.
4. Standards which govern encapsulation work include, but are not limited to the following:
   a. American Society for Testing and Materials International (ASTM)
5. Standards which govern the fire and safety concerns in abatement work include, but are not limited to, the following:
   a. National Fire Protection Association (NFPA) 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations.
   b. NFPA 701 - Standard Methods for Fire Tests for Flame Resistant Textiles and Film.
   c. NFPA 101 - Life Safety Code

G. EPA Guidance Documents:
6. EPA guidance documents which discuss asbestos abatement work activities are listed below. These documents are made part of this section by reference.
7. Guidance for Controlling ACM in Buildings (Purple Book) EPA 560/5-85-024
8. Asbestos Waste Management Guidance EPA 530-SW-85-007
9. A Guide to Respiratory Protection for the Asbestos Abatement Industry EPA-560-OPTS-86-001
10. Guide to Managing Asbestos in Place (Green Book) TS 799 20T July 1990

H. Notices:
11. State and Local agencies: Send written notification as required by State and Local regulations prior to beginning any work on ACM as follows:
    a. State and Local agencies: Send written notification as required by State and Local regulations including the local fire department prior to beginning any work on ACM.

12. Copies of notifications shall be submitted to the VA for the facility's records in the same time frame notification are given to EPA, State, and Local regulations prior to beginning any work on ACM as follows.

I. Permits/Licenses: The contractor shall apply for and have all required permits and licenses to perform asbestos abatement work as required by Federal, State, and Local regulations.

J. Posting and Filing of Regulations: Maintain two (2) copies of applicable Federal, State, and Local regulations. Post one copy of each at the regulated area where workers will have daily access to the regulations and keep another hard copy or electronic copy in the Contractor's office.

K. VA Responsibilities prior to commencement of work:
13. Notify occupants adjacent to regulated areas of project dates and requirements for relocation, if needed. Arrangements must be made prior to starting work for relocation of desks, files, equipment, and personal possessions to avoid unauthorized access into the regulated area. **Note: Notification of adjacent personnel is required by OSHA in 29 CFR 1926.1101 (k) to prevent unnecessary or unauthorized access to the regulated area**.

14. Submit to the Contractor results of background air sampling; including location of samples, person who collected the samples, equipment utilized, calibration data and method of analysis. During abatement, submit to the Contractor, results of bulk material analysis and air sampling data collected during the course of the abatement. This information shall not release the Contractor from any responsibility for OSHA compliance.

L. Site Security:

15. Regulated area access is to be restricted only to authorized, trained/accredited and protected personnel. These may include the Contractor's employees, employees of Subcontractors, VA employees and Representatives, State and Local inspectors, and any other designated individuals. A list of authorized personnel shall be established prior to commencing the project and shall be posted in the clean room of the decontamination unit.
16. Entry into the regulated area by unauthorized individuals shall be reported immediately to the Competent Person by anyone observing the entry. The Competent person shall immediately notify the VA Representative.
17. A log book shall be maintained in the clean room of the decontamination unit. Anyone who enters the regulated area must record their name, affiliation, time in, and time out for each entry.
18. Access to the regulated area shall be through a critical barrier doorway. All other access (doors, windows, hallways, etc.) shall be sealed or locked to prevent entry to or exit from the regulated area. The only exceptions for this requirement are the waste/equipment load-out area which shall be sealed except during the removal of containerized asbestos waste from the regulated area, and emergency exits. Emergency exits shall <u>not</u> be locked from the inside; however, they shall be sealed with poly sheeting and taped until needed.
19. The Contractor's Competent Person shall control site security during abatement operations in order to isolate work in progress and protect adjacent personnel. A 24-hour security system shall be provided at the entrance to the regulated area to assure that all entrants are logged in/out and that only authorized personnel are allowed entrance.
20. The regulated area shall be locked during non-working hours and secured by VA security guards.

M. Emergency Action Plan and Arrangements:

21. An Emergency Action Plan shall be developed prior to commencing abatement activities and shall be agreed to by the Contractor and the VA. The Plan shall meet the requirements of 29 CFR 1926, Subpart C, Standard 1926.35 Employee Emergency Action Plans.
22. Emergency procedures shall be in written form and prominently posted in the clean room and equipment room of the decontamination unit. Everyone, prior to entering the regulated area, must read and sign these procedures to acknowledge understanding of the regulated area layout, location of emergency exits and emergency procedures.
23. Emergency planning shall include written notification of police, fire, and emergency medical personnel of planned abatement activities; work schedule; layout of regulated area; and access to the regulated area, particularly barriers that may affect response capabilities.
24. Emergency planning shall include consideration of fire, explosion, hazardous atmospheres, electrical hazards, slips/trips and falls, confined spaces, and heat stress illness. Written procedures for response to emergency situations shall be developed and employee training in procedures shall be provided.
25. Employees shall be trained in regulated area/site evacuation procedures in the event of workplace emergencies.
    a. For non-life-threatening situations - employees injured or otherwise incapacitated shall be decontaminated following normal procedures with assistance from fellow workers, if necessary, before exiting the regulated area to obtain proper medical treatment.
    b. For life-threatening injury or illness, worker decontamination shall take least priority after measures to stabilize the injured worker, medical personnel shall remove

them from the regulated area if back or neck injury is present, and secure proper medical treatment.

26. Telephone numbers of any/all emergency response personnel shall be prominently posted in the clean room, along with the location of the nearest telephone.
27. The Contractor shall provide verification of first aid/CPR training for personnel responsible for providing first aid/CPR. OSHA requires medical assistance within 3-4 minutes of a life-threatening injury/illness. Bloodborne Pathogen training shall also be verified for those personnel required to provide first aid/CPR.
28. The Emergency Action Plan shall provide for a Contingency Plan in the event that an incident occurs that may require the modification of the Asbestos Hazard Abatement Plans during abatement. Such incidents include, but are not limited to, fire; accident; power failure; negative pressure failure; and supplied air system failure. The Contractor shall detail procedures to be followed in the event of an incident assuring that asbestos abatement work is stopped and wetting is continued until correction of the problem.

N. Pre-Construction Meeting:

29. Prior to commencing the work, the Contractor shall meet with the VA Certified Industrial Hygienist (VPIH/CIH) to present and review, as appropriate, the items following this paragraph. The Contractor's Competent Person(s) who will be on-site shall participate in the pre-start meeting. The pre-start meeting is to discuss and determine procedures to be used during the project. At this meeting, the Contractor shall provide:
    a. Proof of Contractor licensing.
    b. Proof the Competent Person(s) is trained and accredited and approved for working in this State. Verification of the experience of the Competent Person(s) shall also be presented.
    c. A list of all workers who will participate in the project, including experience and verification of training and accreditation.
    d. A list of and verification of training for all personnel who have current first-aid/CPR training. A minimum of one person per shift must have adequate training.
    e. Current medical written opinions for all personnel working on-site meeting the requirements of 29 CFR 1926.1101 (m).
    f. Current fit-tests for all personnel wearing respirators on-site meeting the requirements of 29 CFR 1926.1101 (h) and Appendix C.
    g. A copy of the Contractor's Asbestos Hazard Abatement Plan. In these procedures, the following information must be detailed, specific for this project.
        1) Regulated area preparation procedures;
        2) Notification requirements procedure of Contractor as required in 29 CFR 1926.1101 (d) Multi-Employer Worksites;
        3) Decontamination area set-up/layout and decontamination procedures for employees;
        4) Abatement methods/procedures and equipment to be used;
        5) Personal protective equipment to be used.
    h. At this meeting the Contractor shall provide all submittals as required.
    i. Procedures for handling, packaging and disposal of asbestos waste.
    j. Emergency Action Plan and Contingency Plan Procedures.

1.6 PROJECT COORDINATION

A. The following are the minimum administrative and supervisory personnel necessary for coordination of the work.

1. Personnel:
    a. Administrative and supervisory personnel shall consist of a qualified Competent Person(s) as defined by OSHA in the Construction Standards and the Asbestos Construction Standard; Contractor Professional Industrial Hygienist and Industrial Hygiene Technicians. These employees are the Contractor's representatives responsible for compliance with these specifications and all other applicable requirements.

b. Non-supervisory personnel shall consist of an adequate number of qualified personnel to meet the schedule requirements of the project. Personnel shall meet required qualifications. Personnel utilized on-site shall be pre-approved by the VA representative. A request for approval shall be submitted for any person to be employed during the project giving the person's name; last four digits of social security number; qualifications; accreditation card with color picture, if required by state; Certificate of Worker's Acknowledgment; and Affidavit of Medical Surveillance and Respiratory Protection and current Respirator Fit Test.

c. Minimum qualifications for Contractor and assigned personnel are:

1) The Contractor has conducted within the last three (3) years, three (3) projects of similar complexity and dollar value as this project; has not been cited and penalized for serious violations of Federal (and State or Local as applicable) EPA and OSHA asbestos regulations in the past three (3) years; has adequate liability/occurrence insurance for asbestos work as required by the state; is licensed in applicable state; has adequate and qualified personnel available to complete the work; has comprehensive Abatement Hazard Abatement Plans for asbestos work; has adequate materials, equipment and supplies to perform the work.

2) The Competent Person has four (4) years of abatement experience of which two (2) years were as the Competent Person on the project; meets the OSHA definition of a Competent Person; has been the Competent Person on two (2) projects of similar size and complexity as this project within the past three (3) years; has completed EPA AHERA/OSHA/State/Local training requirements/accreditation(s) and refreshers; and has all required OSHA documentation related to medical and respiratory protection.

3) The Contractor Professional Industrial Hygienist/CIH (CPIH/CIH) shall have five (5) years of monitoring experience and supervision of asbestos abatement projects; has participated as senior IH on five (5) abatement projects, three (3) of which are similar in size and complexity as this project; has specialized EPA AHERA/OSHA training in asbestos abatement management, respiratory protection, waste disposal and asbestos inspection; has completed the NIOSH 582 Course or equivalent, Contractor/Supervisor course; and has appropriate medical/respiratory protection records/documentation.

4) The Abatement Personnel shall have completed the EPA AHERA/OSHA abatement worker course; have training on the Asbestos Hazard Abatement Plans of the Contractor; has one year of asbestos abatement experience within the past three (3) years of similar size and complexity; has applicable medical and respiratory protection documentation; and has certificate of training/current refresher and State accreditation/license.

d. All personnel shall be in compliance with OSHA construction safety training as applicable and submit certification.

1.7 RESPIRATORY PROTECTION

A. General - Respiratory Protection Program: The Contractor shall develop and implement a written Respiratory Protection Program (RPP) which is in compliance with OSHA requirements found at 29 CFR 1926.1101 and 29 CFR 1910.134. ANSI Standard Z88.2-2015 provides excellent guidance for developing a respiratory protection program. All respirators used must be NIOSH approved for asbestos abatement activities. The written RPP shall, at a minimum, contain the basic requirements found at 29 CFR 1910.134 (c) - Respiratory Protection Program.

B. Respiratory Protection Program Coordinator: The Respiratory Protection Program Coordinator (RPPC) must be identified and shall have two (2) years of experience coordinating RPP of similar size and complexity. The RPPC must submit a signed statement attesting to the fact that the program meets the above requirements.

C. Selection and Use of Respirators: The procedure for the selection and use of respirators must be submitted to the VA as part of the Contractor's qualifications. The procedure must be written clearly enough for workers to understand. A copy of the Respiratory Protection Program must be available in the clean room of the decontamination unit or in the onsite Contractor's office, for reference by employees or authorized visitors.

D. Minimum Respiratory Protection: Shall be a ½-mask negative pressure air purifying respirator equipped with Combination P100 filters and Organic Vapor Cartridge, provided personal air samples in the workplace remain at or below 0.1 f/cc, and the applicable PEL for solvents, both determined as an 8-hour TWA. Full face powered air purifying respirator equipped with P100 filters and Organic Vapor Cartridge shall be required until Contractor demonstrates that personal air samples are at or below 0.1 f/cc, and the applicable PEL for solvents, both determined as an 8-hour TWA. A higher level of respiratory protection shall be required, if fiber levels exceed 1 f/cc as an 8-hour TWA, inside the regulated work area. Respirator selection shall meet the requirements of 29 CFR 1926.1101 (h) and 29 CFR 1910.134 (d)(3)(i)(A) Table 1, except as indicated in this paragraph. Abatement personnel must have a respirator for their exclusive use.

E. Medical Written Opinion: No employee shall be allowed to wear a respirator unless a physician or other licensed health care professional has provided a written determination they are medically qualified to wear the class of respirator to be used on the project while wearing whole body impermeable garments and subjected to heat or cold stress.

F. Respirator Fit Test: All personnel wearing respirators shall have a current qualitative/quantitative fit test which was conducted in accordance with 29 CFR 1910.134 (f) and Appendix A. Quantitative fit tests shall be done for PAPRs which have been put into a motor/blower failure mode.

G. Respirator Fit Check: The Competent Person shall assure that the positive/negative pressure user seal check is done each time the respirator is donned by an employee. Head coverings must cover respirator head straps. Any situation that prevents an effective facepiece to face seal as evidenced by failure of a user seal check shall preclude that person from entering the regulated area until resolution of the problem.

H. Maintenance and Care of Respirators: The Respiratory Protection Program Coordinator shall submit evidence and documentation showing compliance with 29 CFR 1910.134 (h) Maintenance and Care of Respirators.

I. Supplied Air Systems: If a supplied air system is used, the system shall meet all requirements of 29 CFR 1910.134 and the ANSI/Compressed Gas Association (CGA) Commodity Specification for Air current requirements for Type 1 - Grade D breathing air. Low pressure systems are not allowed to be used on asbestos abatement projects. Supplied Air respirator use shall be in accordance with EPA/NIOSH publication EPA-560-OPTS-86-001 "A Guide to Respiratory Protection for the Asbestos Abatement Industry". The competent person on site will be responsible for the supplied air system to ensure the safety of the worker.

1.8 WORKER PROTECTION

A. Training of Abatement Personnel: Prior to beginning any abatement activity, all personnel shall be trained in accordance with OSHA 29 CFR 1926.1101 (k)(9) and any additional State/Local requirements. Training must include, at a minimum, the elements listed at 29 CFR 1926.1101 (k)(9)(viii). Training shall have been conducted by a third party, EPA/State approved trainer meeting the requirements of EPA 40 CFR 763 Appendix C (AHERA MAP). Initial training certificates and current refresher and accreditation proof must be submitted for each person working at the site.

B. Medical Examinations: Medical examinations meeting the requirements of 29 CFR 1926.1101 (m) shall be provided for all personnel working in the regulated area, regardless of exposure levels. A current physician's written opinion as required by 29 CFR 1926.1101 (m)(4) shall be provided for each person and shall include in the medical opinion that the person has been

evaluated for working in a heat and cold stress environment while wearing personal protective equipment (PPE) and is able to perform the work without risk of material health impairment.

C. Personal Protective Equipment: Provide whole body clothing, head coverings, foot coverings and any other personal protective equipment as determined by conducting the hazard assessment required by OSHA at 29 CFR 1910.132 (d). The Competent Person shall ensure the integrity of personal protective equipment worn for the duration of the project. Duct tape shall be used to secure all suit sleeves to wrists and to secure foot coverings at the ankle.

D. Regulated Area Entry Procedure: The Competent Person shall ensure that each time workers enter the regulated area they remove ALL street clothes in the clean room of the decontamination unit and put on new disposable coveralls, head coverings, a clean respirator, and then proceed through the shower room to the equipment room where they put on non-disposable required personal protective equipment.

E. Decontamination Procedure: The Competent Person shall require all personnel to adhere to following decontamination procedures whenever they leave the regulated area.
   1. When exiting the regulated area, remove all disposable PPE and dispose of in a disposable bag provided in the regulated area.
   2. Carefully decontaminate and clean the respirator. Put in a clean container/bag.

F. Regulated Area Requirements: The Competent Person shall meet all requirements of 29 CFR 1926.1101 (o) and assure that all requirements for Class II regulated areas at 29 CFR 1926.1101 (e) are met applicable to Class II work and this specification. All personnel in the regulated area shall not be allowed to eat, drink, smoke, chew tobacco or gum, apply cosmetics, or in any way interfere with the fit of their respirator.

1.9 DECONTAMINATION FACILITIES

A. Description: Provide each regulated area with separate personnel decontamination facilities (PDF) and waste/equipment decontamination facilities (W/EDF). Ensure that the PDF are the only means of ingress and egress to the regulated area and that all equipment, bagged waste, and other material exit the regulated area only through the W/EDF.

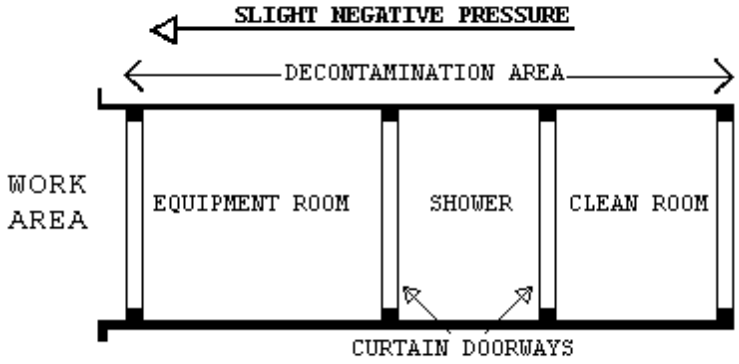
B. General Requirements: All personnel entering or exiting a regulated area must go through the PDF and shall follow the requirements at 29 CFR 1926.1101 (j)(1) and these specifications. All waste, equipment and contaminated materials must exit the regulated area through the W/EDF and be decontaminated in accordance with these specifications. Walls and ceilings of the PDF and W/EDF must be constructed of a minimum of 3-layers of 6-mil opaque fire retardant polyethylene sheeting and be securely attached to existing building components and/or an adequate temporary framework. A minimum of 3-layers of 6-mil poly shall also be used to cover the floor under the PDF and W/EDF units. Construct doors so that they overlap and secure to adjacent surfaces. Weight inner doorway sheets with layers of duct tape so that they close quickly after release. Put arrows on sheets so they show direction of travel and overlap. If the building adjacent area is occupied, construct a solid barrier on the occupied side(s) to protect the sheeting and reduce potential for non-authorized personnel entering the regulated area.

C. Temporary Facilities to the PDF and W/EDF: The Competent Person shall provide temporary water service connections to the PDF and W/EDF. Backflow prevention must be provided at the point of connection to the VA system. Water supply must be of adequate pressure and meet requirements of 29 CFR 1910.141 (d)(3). Provide adequate temporary overhead electric power with ground fault circuit interruption (GFCI) protection. Provide a sub-panel equipped with GFCI protection for all temporary power in the clean room. Provide adequate lighting to provide a minimum of 50 foot candles in the PDF and W/EDF. Provide temporary heat, if needed, to maintain 70°F throughout the PDF and W/EDF.

D. Personnel Decontamination Facility (PDF):
   1. Clean Room: The clean room must be physically and visually separated from the rest of the building to protect the privacy of personnel changing clothes. The clean room shall be constructed of at least 3-layers of 6-mil opaque fire retardant poly to provide an air tight

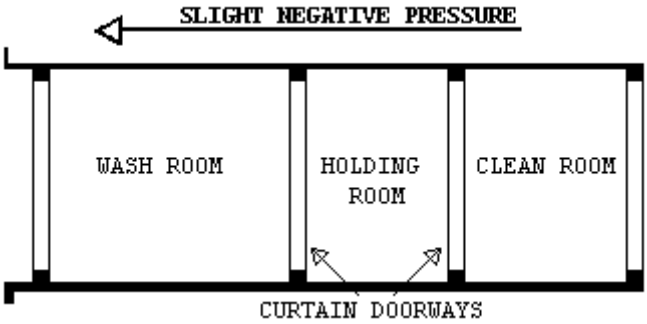
room. Provide a minimum of 2 - 900 mm (3 foot) wide 6-mil poly opaque fire retardant doorways. One doorway shall be the entry from outside the PDF and the second doorway shall be to the shower room of the PDF. The floor of the clean room shall be maintained in a clean, dry and sanitary condition. Shower overflow shall not be allowed into the clean room. Provide 1 storage locker per person. A portable fire extinguisher, minimum 10 pounds capacity, Type ABC, shall be provided in accordance with OSHA and NFPA Standard 10. All persons entering the regulated area shall remove all street clothing in the clean room and dress in disposable protective clothing and respiratory protection. Any person entering the clean room does so either from the outside with street clothing on or is coming from the shower room completely naked and thoroughly washed. Male/Females required to enter the regulated area shall be ensured of their privacy throughout the entry/exit process by posting guards at both entry points to the PDF so no male/female can enter or exit the PDF during his/her stay in the PDF.

2. Shower Room: The Competent Person shall assure that the shower room is a completely water tight compartment to be used for the movement of all personnel from the clean room to the equipment room and for the showering of all personnel going from the equipment room to the clean room. Each shower shall be constructed so water runs down the walls of the shower and into a drip pan. Install a freely draining smooth floor on top of the shower pan. The shower room shall be separated from the rest of the building and from the clean room and equipment room using air tight walls made from at least 3-layers of 6-mil opaque fire retardant poly. The shower shall be equipped with a shower head and controls, hot and cold water, drainage, soap dish and continuous supply of soap, and shall be maintained in a sanitary condition throughout its use. The controls shall be arranged so an individual can shower without assistance. Provide a flexible hose shower head, hose bibs and all other items shown on Shower Schematic. Waste water will be pumped to a drain after being filtered through a minimum of a 100 micron sock in the shower drain; a 20 micron filter; and a final 5 micron filter. Filters will be changed a minimum of daily or more often as needed. Filter changes must be done in the shower to prevent loss of contaminated water. Hose down all shower surfaces after each shift and clean any debris from the shower pan. Residue is to be disposed of as asbestos waste.
3. Equipment Room: The Competent Person shall provide an equipment room which shall be an air tight compartment for the storage of work equipment/tools, reusable personal protective equipment, except for a respirator and for use as a gross decontamination area for personnel exiting the regulated area. The equipment room shall be separated from the regulated area by a minimum 3 foot wide door made with 2-layers of 6-mil opaque fire retardant poly. The equipment room shall be separated from the regulated area, the shower room and the rest of the building by air tight walls and ceiling constructed of a minimum of 3-layers of 6-mil opaque fire retardant poly. Damp wipe all surfaces of the equipment room after each shift change. Provide an additional loose layer of 6-mil fire retardant poly per shift change and remove this layer after each shift. If needed, provide a temporary electrical sub-panel equipped with GFCI in the equipment room to accommodate any equipment required in the regulated area.
4. The PDF shall be as follows: Clean room at the entrance followed by a shower room followed by an equipment room leading to the regulated area. Each doorway in the PDF shall be a minimum of 2 layers of 6-mil opaque fire retardant poly.



E. Waste/Equipment Decontamination Facility (W/EDF):

1. The Competent Person shall provide an W/EDF consisting of a wash room, holding room, and clean room for removal of waste, equipment and contaminated material from the regulated area. Personnel shall not enter or exit the W/EDF except in the event of an emergency. Clean debris and residue in the W/EDF daily. All surfaces in the W/EDF shall be wiped/hosed down after each shift and all debris shall be cleaned from the shower pan. The W/EDF shall consist of the following:
   a. Wash Down Station: Provide an enclosed shower unit in the regulated area just outside the Wash Room as an equipment bag and container cleaning station.
   b. Wash Room: Provide a wash room for cleaning of bagged or containerized asbestos containing waste materials passed from the regulated area. Construct the wash room using 50 x 100 mm (2 inches x 4 inches) wood framing or approved equivalent and 3-layers of 6-mil fire retardant poly. Locate the wash room so that packaged materials, after being wiped clean, can be passed to the Holding Room. Doorways in the wash room shall be constructed of 2-layers of 6-mil fire retardant poly.
   c. Holding Room: Provide a holding room as a drop location for bagged materials passed from the wash room. Construct the holding room using 50 x 100 mm (2 inches x 4 inches) wood framing or approved equivalent and 3-layers of 6-mil fire retardant poly. The holding room shall be located so that bagged material cannot be passed from the wash room to the clean room unless it goes through the holding room. Doorways in the holding room shall be constructed of 2 layers of 6-mil fire retardant poly.
   d. Clean Room: Provide a clean room to isolate the holding room from the exterior of the regulated area. Construct the clean room using 2 inches x 4 inches wood framing or approved equivalent and 2-layers of 6-mil fire retardant poly. The clean room shall be located so as to provide access to the holding room from the building exterior. Doorways to the clean room shall be constructed of 2-layers of 6-mil fire retardant poly. When a negative pressure differential system is used, a rigid enclosure separation between the W/EDF clean room and the adjacent areas shall be provided.
   e. The W/EDF shall be as follows: Wash Room leading to a Holding Room followed by a Clean Room leading to outside the regulated area. See diagram.



F. Waste/Equipment Decontamination Procedures: At the washdown station, in the regulated area, thoroughly wet clean contaminated equipment and/or sealed polyethylene bags and pass into Wash Room after visual inspection. When passing anything into the Wash Room, close all doorways of the W/EDF, other than the doorway between the washdown station and the Wash Room. Keep all outside personnel clear of the W/EDF. Once inside the Wash Room, wet clean the equipment and/or bags. After cleaning and inspection, pass items into the Holding Room. Close all doorways except the doorway between the Holding Room and the Clean Room. Workers from the Clean Room/Exterior shall enter the Holding Room and remove the decontaminated/cleaned equipment/bags for removal and disposal. At no time shall personnel from the clean side be allowed to enter the Wash Room.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. General Requirements (All Abatement Project): Prior to the start of work, the contractor shall provide and maintain a sufficient quantity of materials and equipment to assure continuous and efficient work throughout the duration of the project. Work shall not start unless the following items have been delivered to the site and the CPIH/CIH has submitted verification to the VA's Representative.

1. All materials shall be delivered in their original package, container or bundle bearing the name of the manufacturer and the brand name (where applicable).
2. Store all materials subject to damage off the ground, away from wet or damp surfaces and under cover sufficient enough to prevent damage or contamination. Flammable and combustible materials cannot be stored inside buildings. Replacement materials shall be stored outside of the regulated area until abatement is completed.
3. The Contractor shall not block or hinder use of buildings by patients, staff, and visitors to the VA in partially occupied buildings by placing materials/equipment in any unauthorized location.
4. The Competent Person shall inspect for damaged, deteriorating or previously used materials. Such materials shall not be used and shall be removed from the worksite and disposed of properly.
5. Polyethylene sheeting for walls in the regulated area shall be a minimum of 4-mils. For floors and all other uses, sheeting of at least 6-mil shall be used in widths selected to minimize the frequency of joints. Fire retardant poly shall be used throughout.
6. The method of attaching polyethylene sheeting shall be agreed upon in advance by the Contractor and the VA and selected to minimize damage to equipment and surfaces. Method of attachment may include any combination of moisture resistant duct tape, poly tape, furring strips, spray glue, staples, nails, screws, lumber and plywood for enclosures or other approved equivalent procedures capable of sealing polyethylene to dissimilar finished or unfinished surfaces under both wet and dry conditions.
7. Polyethylene sheeting utilized for the PDF shall be opaque white or black in color, 6-mil fire retardant poly.

8. Installation and plumbing hardware, showers, hoses, drain pans, sump pumps and waste water filtration system shall be provided by the Contractor.
9. An adequate number of HEPA vacuums, scrapers, sprayers, nylon brushes, brooms, disposable mops, rags, sponges, staple guns, shovels, ladders and scaffolding of suitable height and length as well as meeting OSHA requirements, fall protection devices, water hose to reach all areas in the regulated area, airless spray equipment, and any other tools, materials or equipment required to conduct the abatement project. All electrically operated hand tools, equipment, electric cords shall be connected to GFCI protection.
10. Special protection for objects in the regulated area shall be detailed (e.g., plywood over carpeting or hardwood floors to prevent damage from scaffolds, water and falling material).
11. Disposal bags – 2 layers of 6-mil poly for asbestos waste shall be pre-printed with labels, markings and address as required by OSHA, EPA and DOT regulations.
12. The VA shall be provided an advance copy of the Safety Data Sheets (SDS) as required for all hazardous chemicals under OSHA 29 CFR 1910.1200 - Hazard Communication in the pre-project submittal. Chlorinated compounds shall not be used with any spray adhesive, mastic remover or other product. Appropriate encapsulant(s) shall be provided.
13. OSHA DANGER demarcation signs, as many and as required by OSHA 29 CFR 1926.1101(k)(7) shall be provided and placed by the Competent Person. All other posters and notices required by Federal and State regulations shall be posted in the Clean Room.
14. Adequate and appropriate PPE for the project and number of personnel/shifts shall be provided. All personal protective equipment issued must be based on a written hazard assessment conducted under 29 CFR 1910.132(d).

B. Negative Pressure Filtration System:
1. The Contractor shall provide enough HEPA negative air machines to continuously maintain a negative pressure differential of -0.02 inches water column gauge (WCG) inside the regulated work area relative to adjacent non-work building areas. OSHA 29 CFR 1926.1101 (g)(5)(i)(A)(2) also requires at least four (4) air changes per hour. Contractor shall increase air changes per hour as necessary to maintain volatile organic compounds below the applicable OSHA PEL. The Competent Person shall determine the number of units needed for the regulated area by dividing the cubic feet in the regulated area by 15 and then dividing that result by the cubic feet per minute (CFM) for each unit to determine the number of units needed to continuously maintain a negative pressure differential of -0.02 inches WCG. Provide a standby unit in the event of machine failure and/or emergency in an adjacent area. HEPA equipped negative air machines shall be discharged outside of the building a minimum of 3 feet from building make-up air, doors, open windows, patients, visitors and staff.
2. NIOSH has done extensive studies and has determined that negative air machines typically operate at ~50 percent efficiency. The contractor shall consider this in their determination of number of units needed to continuously maintain a pressure differential of -0.02 inches WCG. The contractor shall use 8 air changes per hour or double the number of machines, based on their calculations, or submit proof their machines operate at stated capacities, at a 2 inches pressure drop across the filters.

C. Design and Layout:
1. Before start of work submit the design and layout of the regulated area and the negative air machines. The submittal shall indicate the number of, location of and size of negative air machines. The point(s) of exhaust, air flow within the regulated area, anticipated negative pressure differential, and supporting calculations for sizing shall be provided. In addition, submit the following:
   a. Method of supplying power to the units and designation/location of the panels.
   b. Description of testing method(s) for correct air volume and pressure differential.

c. If auxiliary power supply is to be provided for the negative air machines, provide a schematic diagram of the power supply and manufacturer's data on the generator and switch.

D. Negative Air Machines (HEPA Units)

1. Negative Air Machine Cabinet: The cabinet shall be constructed of steel or other durable material capable of withstanding potential damage from rough handling and transportation. The width of the cabinet shall be less than 30 inches in order to fit in standard doorways. The cabinet must be factory sealed to prevent asbestos fibers from being released during use, transport, or maintenance. Any access to and replacement of filters shall be from the inlet end. The unit must be on casters or wheels.
2. Negative Air Machine Fan: The rating capacity of the fan must indicate the CFM under actual operating conditions. Manufacturer's typically use "free-air" (no resistance) conditions when rating fans. The fan must be a centrifugal type fan.
3. Negative Air Machine Final Filter: The final filter shall be a HEPA filter. The filter media must be completely sealed on all edges within a structurally rigid frame. The filter shall align with a continuous flexible gasket material in the negative air machine housing to form an air tight seal. Each HEPA filter shall be certified by the manufacturer to have an efficiency of not less than 99.97 percent. Testing shall have been done in accordance with Military Standard MIL-STD-282 and Army Instruction Manual 136-300-175A. Each filter must bear a UL586 label to indicate ability to perform under specified conditions. Each filter shall be marked with the name of the manufacturer, serial number, air flow rating, efficiency and resistance, and the direction of test air flow.
4. Negative Air Machine Pre-filters: The pre-filters, which protect the final HEPA filter by removing larger particles, are required to prolong the operating life of the HEPA filter. Two stages of pre-filtration are required. A first stage pre-filter shall be a low efficiency type for particles 10 micron or larger. A second stage pre-filter shall have a medium efficiency effective for particles down to 5 micron or larger. Pre-filters shall be installed either on or in the intake opening of the NAM and the second stage filter must be held in place with a special housing or clamps.
5. Negative Air Machine Instrumentation: Each unit must be equipped with a gauge to measure the pressure drop across the filters and to indicate when filters have become loaded and need to be changed. A table indicating the cfm for various pressure readings on the gauge shall be affixed near the gauge for reference or the reading shall indicate at what point the filters shall be changed, noting cfm delivery. The unit must have an elapsed time meter to show total hours of operation.
6. Negative Air Machine Safety and Warning Devices: An electrical/ mechanical lockout must be provided to prevent the fan from being operated without a HEPA filter. Units must be equipped with an automatic shutdown device to stop the fan in the event of a rupture in the HEPA filter or blockage in the discharge of the fan. Warning lights are required to indicate normal operation; too high a pressure drop across filters; or too low of a pressure drop across filters.
7. Negative Air Machine Electrical: All electrical components shall be approved by the National Electrical Manufacturer's Association (NEMA) and Underwriters Laboratories (UL). Each unit must be provided with overload protection and the motor, fan, fan housing, and cabinet must be grounded.
8. It is essential that replacement HEPA filters be tested using an “in-line” testing method, to ensure the seal around the periphery was not damaged during replacement. Damage to the outer HEPA filter seal could allow contaminated air to bypass the HEPA filter and be discharged to an inappropriate location. Contractor will provide written documentation of test results for negative air machine units with HEPA filters.
9. Pressure Differential: The fully operational negative air system within the regulated area shall continuously maintain a pressure differential $\geq$ -0.02 inches WCG inside the regulated work area. Before any disturbance of any asbestos material, this shall be demonstrated to the VA by use of a pressure differential meter/manometer as required by OSHA 29 CFR 1926.1101(g)(5)(i). The Competent Person shall be responsible for

providing, maintaining, and documenting the negative pressure and air changes as required by OSHA and this specification. Contractor shall provide “firewatch” when negative machines are operational and there is no active abatement.

2.2 CONTAINMENT BARRIERS AND COVERINGS IN THE REGULATED AREA

A. General:
1. Using critical barriers, seal off the perimeter to the regulated area to completely isolate the regulated area from adjacent spaces. All surfaces in the regulated area must be covered to prevent contamination and to facilitate clean-up. Should adjacent areas become contaminated as a result of the work, Contractor shall immediately stop work and clean up the contamination at no additional cost to the VA. Provide firestopping and identify all fire barrier penetrations due to abatement work as specified in Specification Section 07 84 00; FIRESTOPPING and Section 2.2.6.
2. Place all tools, scaffolding, materials and equipment needed for working in the regulated area prior to erecting any plastic sheeting. All uncontaminated removable furniture, equipment and/or supplies shall be removed by the VA from the regulated area before commencing work. Any objects remaining in the regulated area shall be completely covered with 2-layers of 6-mil fire retardant poly sheeting and secured with duct tape. Lock out and tag out any HVAC/electrical systems in the regulated area

B. Controlling Access to the Regulated Area: Access to the regulated area is allowed only through the personnel decontamination facility (PDF). All other means of access shall be eliminated and OSHA DANGER demarcation signs posted as required by OSHA. If the regulated area is adjacent to, or within view of an occupied area, provide a visual barrier of 6-mil opaque fire retardant poly to prevent building occupant observation. If the adjacent area is accessible to the public, the barrier must be solid and capable of withstanding the negative pressure.

C. Critical Barriers: Completely separate any operations in the regulated area from adjacent areas using 2-layers of 6-mil fire retardant poly and duct tape. Individually seal with 2-layers of 6-mil poly and duct tape all HVAC openings into the regulated area. Individually seal all lighting fixtures, clocks, doors, windows, convectors, speakers, or any other objects/openings in the regulated area. Heat must be shut off any objects covered with poly.

D. Secondary Barriers: A loose layer of 6-mil poly shall be used as a drop cloth to protect the primary layers from debris generated during the abatement. This layer shall be replaced as needed during the work and at a minimum once per work day.

E. Extension of the Regulated Area: If the enclosure of the regulated area is breached in any way that could allow contamination to occur, the affected area shall be included in the regulated area and constructed as per this section. Decontamination measures must be started immediately and continue until air monitoring indicates background levels are met.

F. Firestopping:
1. Through penetrations caused by cables, cable trays, pipes, sleeves, conduits, etc. must be firestopped with a fire-rated firestop system providing an air tight seal.
2. Firestop materials that are not equal to the wall or ceiling penetrated shall be brought to the attention of the VA Representative. The contractor shall list all areas of penetration, the type of sealant used, and whether or not the location is fire rated. Any discovery of penetrations during abatement shall be brought to the attention of the VA Representative immediately. All walls, floors and ceilings are considered fire rated unless otherwise determined by the VA Representative or Fire Marshall.
3. Any visible openings whether or not caused by a penetration shall be reported by the Contractor to the VA Representative for a sealant system determination. Firestops shall meet ASTM E814 and UL 1479 requirements for the opening size, penetrant, and fire rating needed

2.3 MONITORING, INSPECTION AND TESTING

A. General:

1. Perform throughout abatement work monitoring, inspection and testing inside and around the regulated area in accordance with the OSHA requirements and these specifications. OSHA requires that the Employee exposure to asbestos must not exceed 0.1 fibers per cubic centimeter (f/cc) of air, averaged over an 8-hour work shift. The CPIH/CIH is responsible for and shall inspect and oversee the performance of the Contractor IH Technician. The IH Technician shall continuously inspect and monitor conditions inside the regulated area to ensure compliance with these specifications. In addition, the CPIH/CIH shall personally manage air sample collection, analysis, and evaluation for personnel, regulated area, and adjacent area samples inside the building, but outside the regulated area. Inside the building, but outside the regulated area air samples shall be collected in the Clean Room of the PDF, at the approximate location of HEPA exhaust discharge, and at a minimum of three (3) locations in areas immediately outside the regulated work area to satisfy this specification. Additional inspection and testing requirements are also indicated in other parts of this specification.
2. The VA will employ an independent industrial hygienist (VPIH/CIH) consultant and/or use its own IH to perform various services on behalf of the VA. The VPIH/CIH will perform the necessary monitoring, inspection, testing, and other support services to ensure that VA patients, employees, and visitors will not be adversely affected by the abatement work, and that the abatement work proceeds in accordance with these specifications, that the abated areas or abated buildings have been successfully decontaminated. The work of the VPIH/CIH consultant in no way relieves the Contractor from their responsibility to perform the work in accordance with contract/specification requirements, to perform continuous inspection, monitoring and testing for the safety of their employees, and to perform other such services as specified. The cost of the VPIH/CIH and their services will be borne by the VA except for any repeat of final inspection and testing that may be required due to unsatisfactory initial results. Any repeated final inspections and/or testing, if required, will be paid for by the Contractor.
3. If fibers counted by the VPIH/CIH during abatement work, either inside or outside the regulated area, utilizing the NIOSH 7400 air monitoring method, exceed the specified respective limits, the Contractor shall stop work. The Contractor may request confirmation of the results by analysis of the samples by TEM. Request must be in writing and submitted to the VA's Representative. Cost for the confirmation of results will be borne by the Contractor for both the collection and analysis of samples and for the time delay that may/does result for this confirmation. Confirmation sampling and analysis will be the responsibility of the CPIH/CIH with review and approval of the VPIH/CIH. An agreement between the CPIH/CIH and the VPIH/CIH shall be reached on the exact details of the confirmation effort, in writing, including such things as the number of samples, location, collection, quality control on-site, analytical laboratory, interpretation of results and any follow-up actions. This written agreement shall be co-signed by the IH's and delivered to the VA's Representative

B. Scope of Services of the VPIS/CIH Consultant:
1. The purpose of the work of the VPIH/CIH is to: assure quality; adherence to the specification; resolve problems; prevent the spread of contamination beyond the regulated area; and assure clearance at the end of the project. In addition, their work includes performing the final inspection and testing to determine whether the regulated area or building has been adequately decontaminated. All air monitoring is to be done utilizing PCM/TEM. The VPIH/CIH will perform the following tasks:
   a. Task 1: Establish background levels before abatement begins by collecting background samples. Retain samples for possible TEM analysis.
   b. Task 2: Perform Representative air monitoring, inspection, and testing outside the regulated area during actual abatement work to detect any faults in the regulated area isolation and any adverse impact on the surroundings from regulated area activities.
   c. Task 3: Perform unannounced visits to spot check overall compliance of work with contract/specifications. These visits may include any inspection, monitoring, and

testing inside and outside the regulated area and all aspects of the operation except personnel monitoring.

d. Task 4: Provide support to the VA Representative such as evaluation of submittals from the Contractor, resolution of conflicts, interpret data, etc.

e. Task 5: Perform, in the presence of the VA Representative, final inspection and testing of a decontaminated regulated area at the conclusion of the abatement to certify compliance with all regulations and VA requirements/specifications.

f. Task 6: Issue certificate of decontamination for each regulated area and project report.

2. All documentation, inspection results and testing results generated by the VPIH/CIH will be available to the Contractor for information and consideration. The Contractor shall cooperate with and support the VPIH/CIH for efficient and smooth performance of their work.

3. The monitoring and inspection results of the VPIH/CIH will be used by the VA to issue any Stop Removal orders to the Contractor during abatement work and to accept or reject a regulated area or building as decontaminated.

C. Monitoring, Inspection and Testing by Contractor CPIH/CIH: The Contractor's CPIH/CIH is responsible for managing all monitoring, inspections, and testing required by these specifications, as well as any and all regulatory requirements adopted by these specifications. The CPIH/CIH is responsible for the continuous monitoring of all subsystems and procedures which could affect the health and safety of the Contractor's personnel. Safety and health conditions and the provision of those conditions inside the regulated area for all persons entering the regulated area is the exclusive responsibility of the Contractor/Competent Person. The person performing the personnel and area air monitoring inside the regulated area shall be an IH Technician, who shall be trained and shall have specialized field experience in sampling and analysis. The IH Technician shall have successfully completed a NIOSH 582 Course or equivalent and provide documentation. The IH Technician shall participate in the AIHA Asbestos Analysis Registry or participate in the Proficiency Analytical Testing program of AIHA for fiber counting quality control assurance. The IH Technician shall also be an accredited EPA AHERA/State Contractor/Supervisor and Building Inspector. The IH Technician shall have participated in five abatement projects collecting personal and area samples and have experience in substantially similar projects in size and scope. The analytical laboratory used by the Contractor to analyze the samples shall be AIHA accredited for asbestos PAT and approved by the VA prior to start of the project. A daily log shall be maintained by the CPIH/CIH or IH Technician, documenting all OSHA requirements for personal and area air monitoring for asbestos in 29 CFR 1926.1101 (f), (g) and Appendix A. This log shall be made available to the VA Representative and the VPIH/CIH upon request. The log will contain, at a minimum, information on personnel or area samples, other persons represented by the sample, the date of sample collection, start and stop times for sampling, sample volume, flow rate, and fibers/cc. The CPIH/CIH shall collect and analyze samples for each Representative job being done in the regulated area, i.e., removal, wetting, clean-up, and load-out. No fewer than two (2) personal air samples or 25 percent of Representative workforce per shift shall be collected, whichever is greater, in the regulated area; a minimum of three (3) area air samples at locations inside the building but immediately outside the regulated work area; one (1) area air sample shall be collected daily in the Clean Room of the PDF; and one (1) area air sample shall be collected daily at the approximate location of HEPA exhaust discharge. In addition to the continuous monitoring required, the CPIH/CIH will perform inspection and testing at the final stages of abatement for each regulated area as specified in the CPIH/CIH responsibilities. Additionally, the CPIH/CIH will monitor and record pressure readings within the containment daily with a minimum of two readings at the beginning and at the end of a shift, and submit the data in the daily report.

2.4 ASBESTOS HAZARD ABATEMENT PLAN

A. The Contractor shall have an established Asbestos Hazard Abatement Plan (AHAP) in printed form and loose leaf folder consisting of simplified text, diagrams, sketches, and pictures that

establish and explain clearly the procedures to be followed during all phases of the work by the Contractor's personnel. The AHAP must be modified as needed to address specific requirements of this project and the specifications. The AHAP(s) shall be submitted for review and approval to the VA prior to the start of any abatement work. The minimum topics and areas to be covered by the AHAP(s) are:

1. Minimum Personnel Qualifications
2. Emergency Action Plan/Contingency Plans and Arrangements
3. Security and Safety Procedures
4. Respiratory Protection/Personal Protective Equipment Program and Training
5. Medical Surveillance Program and Recordkeeping
6. Regulated Area Requirements - Containment Barriers/Isolation of Regulated Area
7. Decontamination Facilities and Entry/Exit Procedures (PDF and W/EDF)
8. Negative Pressure Systems Requirements
9. Monitoring, Inspections, and Testing
10. Removal Procedures for ACM
11. Removal of Contaminated Soil (if applicable)
12. Encapsulation Procedures for ACM
13. Disposal of ACM waste/equipment
14. Regulated Area Decontamination/Clean-up
15. Regulated Area Visual and Air Clearance
16. Project Completion/Closeout

2.5 SUBMITTALS

A. Pre-Start Meeting Submittals:

1. Submit to the VA a minimum of 14 days prior to the pre-start meeting the following for review and approval. Meeting this requirement is a prerequisite for the pre-start meeting for this project:
   a. Submit a detailed work schedule for the entire project reflecting contract documents and the phasing/schedule requirements from the CPM chart.
   b. Submit a staff organization chart showing all personnel who will be working on the project and their capacity/function. Provide their qualifications, training, accreditations, and licenses, as appropriate. Provide a copy of the "Certificate of Worker's Acknowledgment" and the "Affidavit of Medical Surveillance and Respiratory Protection" for each person.
   c. Submit Asbestos Hazard Abatement Plan developed specifically for this project, incorporating the requirements of the specifications, prepared, signed and dated by the CPIH/CIH.
   d. Submit the specifics of the materials and equipment to be used for this project with manufacturer names, model numbers, performance characteristics, pictures/diagrams, and number available for the following:
      1) Supplied air system, negative air machines, HEPA vacuums, air monitoring pumps, calibration devices, pressure differential monitoring device and emergency power generating system.
      2) Waste water filtration system, shower system, containment barriers.
      3) Encapsulants, surfactants, hand held sprayers, airless sprayers, glovebags, and fire extinguishers.
      4) Respirators, protective clothing, fall protection and other required personal protective equipment.
      5) Fire safety equipment to be used in the regulated area.
   e. Submit the name, location, and phone number of the approved landfill; proof/verification the landfill is approved for ACM disposal; the landfill's requirements for ACM waste; the type of vehicle to be used for transportation; and name, address, and phone number of subcontractor, if used. Proof of asbestos training for transportation personnel shall be provided.
   f. Submit required notifications and arrangements made with regulatory agencies having regulatory jurisdiction and the specific contingency/emergency

arrangements made with local health, fire, ambulance, hospital authorities and any other notifications/arrangements.

g. Submit the name, location and verification of the laboratory and/or personnel to be used for analysis of air and/or bulk samples. Personal air monitoring must be done in accordance with OSHA 29 CFR 1926.1101(f) and Appendix A. Area or clearance air monitoring shall be conducted in accordance with EPA AHERA protocols.

h. Submit qualifications verification: Submit the following evidence of qualifications. Make sure that all references are current and verifiable by providing current phone numbers and documentation.
   1) Asbestos Abatement Company: Project experience within the past 3 years; listing projects first most similar to this project: Project Name; Type of Abatement; Duration; Cost; Reference Name/Phone Number; Final Clearance; Completion Date
   2) List of project(s) halted by owner, A/E, IH, regulatory agency in the last 3 years: Project Name; Reason; Date; Reference Name/Number; Resolution
   3) List asbestos regulatory citations (e.g., OSHA), notices of violations (e.g., Federal and state EPA), penalties, and legal actions taken against the company including the company's officers (including damages paid) in the last 3 years. Provide copies and all information needed for verification.

i. Submit information on personnel: Provide a resume; address each item completely; copies of certificates, accreditations, and licenses. Submit an affidavit signed by the CPIH/CIH stating that all personnel submitted below have medical records in accordance with OSHA 29 CFR 1926.1101(m) and that the company has implemented a medical surveillance program and written respiratory protection program, and maintains recordkeeping in accordance with the above regulations. Submit the phone number and doctor/clinic/hospital used for medical evaluations.
   1) CPIH/CIH and IH Technician: Name; years of abatement experience; list of projects similar to this one; certificates, licenses, accreditations for proof of AHERA/OSHA specialized asbestos training; professional affiliations; medical opinion; and current respirator fit test.
   2) Competent Person(s)/Supervisor(s): Number; names; last four digits of social security numbers; years of abatement experience as Competent Person/Supervisor; list of similar projects in size/complexity as Competent Person/Supervisor; as a worker; certificates, licenses, accreditations; proof of AHERA/OSHA specialized asbestos training; maximum number of personnel supervised on a project; medical opinion (asbestos surveillance and respirator use); and current respirator fit test.
   3) Workers: Numbers; names; last four digits of social security numbers; years of abatement experience; certificates, licenses, accreditations; training courses in asbestos abatement and respiratory protection; medical opinion (asbestos surveillance and respirator use); and current respirator fit test.

j. Submit copies of State license for asbestos abatement; copy of insurance policy, including exclusions with a letter from agent stating in plain language the coverage provided and the fact that asbestos abatement activities are covered by the policy; copy of the AHAP incorporating the requirements of this specification; information on who provides your training, how often; who provides medical surveillance, how often; who performs and how is personal air monitoring of abatement workers conducted; a list of references of independent laboratories/IH's familiar with your air monitoring and Asbestos Hazard Abatement Plans; copies of monitoring results of the five referenced projects listed and analytical methods used.

k. Rented equipment must be decontaminated prior to returning to the rental agency.

l. Submit, before the start of work, the manufacturer's technical data for all types of encapsulants, all SDS, and application instructions.

B. Submittals During Abatement:

1. The Competent Person shall maintain and submit a daily log at the regulated area documenting the dates and times of the following: purpose, attendees and summary of meetings; all personnel entering/exiting the regulated area; document and discuss the resolution of unusual events such as barrier breeching, equipment failures, emergencies, and any cause for stopping work; Representative air monitoring and results/TWAs/ELs. Submit this information daily to the VA's Representative.
2. The CPIH/CIH shall document and maintain the inspection and approval of the regulated area preparation prior to start of work and daily during work.
   a. Removal of any poly barriers.
   b. Visual inspection/testing by the CPIH/CIH or IH Technician prior to application of lockdown encapsulant.
   c. Packaging and removal of ACM waste from regulated area.
   d. Disposal of ACM waste materials; copies of Waste Shipment Records/landfill receipts to the VA's Representative on a weekly basis.

C. Submittals at Completion of Abatement: The CPIH/CIH shall submit a project report consisting of the daily log book requirements and documentation of events during the abatement project including Waste Shipment Records signed by the landfill's agent. It will also include information on the containment and transportation of waste from the containment with applicable Chain of Custody forms. The report shall include a certificate of completion, signed and dated by the CPIH/CIH, in accordance with Attachment #1. All clearance and perimeter area samples must be submitted. The VA Representative will retain the abatement report after completion of the project and provide copies of the abatement report to VAMC Office of Engineer and the Safety Office.

PART 3 - EXECUTION

3.1 PRE-ABATEMENT ACTIVITIES

A. Pre-Abatement Meeting: The VA Representative, upon receipt, review, and substantial approval of all pre-abatement submittals and verification by the CPIH/CIH that all materials and equipment required for the project are on the site, will arrange for a pre-abatement meeting between the Contractor, the CPIH/CIH, Competent Person, the VA Representative(s), and the VPIH/CIH. The purpose of the meeting is to discuss any aspect of the submittals needing clarification or amplification and to discuss any aspect of the project execution and the sequence of the operation. The Contractor shall be prepared to provide any supplemental information/documentation to the VA's Representative regarding any submittals, documentation, materials or equipment. Upon satisfactory resolution of any outstanding issues, the VA's Representative will issue a written order to proceed to the Contractor. No abatement work of any kind described in the following provisions shall be initiated prior to the VA written order to proceed.

B. Pre-Abatement Inspections and Preparations:
   1. Before any work begins on the construction of the regulated area, the Contractor will:
      a. Conduct a space-by-space inspection with an authorized VA Representative and prepare a written inventory of all existing damage in those spaces where asbestos abatement will occur. Still or video photography may be used to supplement the written damage inventory. Document will be signed and certified as accurate by both parties.
      b. The VA Representative, the Contractor, and the VPIH/CIH must be aware of AEQA 10-95 indicating the failure to identify asbestos in the areas listed as well as common issues when preparing specifications and contract documents. This is especially critical when demolition is planned, because AHERA surveys are non-destructive, and ACM may remain undetected. A NESHAP (destructive) ACM inspection should be conducted on all building structures that will be demolished. Ensure the following areas are inspected on the project: Lay-in ceilings concealing ACM; ACM behind walls/windows from previous renovations; inside utility

chases/walls; transite piping/ductwork/sheets; behind radiators; lab fume hoods; transite lab countertops; roofing materials; below window sills; water/sewer lines; electrical conduit coverings; crawl spaces(previous abatement contamination); flooring/mastic covered by carpeting/new flooring; exterior insulated wall panels; on underground fuel tanks; and steam line trench coverings.

c. Ensure that all furniture, machinery, equipment, curtains, drapes, blinds, and other movable objects required to be removed from the regulated area have been cleaned and removed or properly protected from contamination.

d. If present and required, remove and dispose of carpeting from floors in the regulated area. If carpet comes up without disturbing ACM flooring material, the carpet can be disposed of as C&D waste. If ACM floor tile is attached to the carpet while the Contractor is removing the carpet, that section of the carpet will be disposed of as asbestos waste.

e. Inspect existing firestopping in the regulated area. Correct as needed.

C. Pre-Abatement Construction and Operations:

1. Perform all preparatory work for the first regulated area in accordance with the approved work schedule and with this specification.
2. Upon completion of all preparatory work, the CPIH/CIH will inspect the work and systems and will notify the VA's Representative when the work is completed in accordance with this specification. The VA's Representative may inspect the regulated area and the systems with the VPIH/CIH and may require that upon satisfactory inspection, the Contractor's employees perform all major aspects of the approved AHAP, especially worker protection, respiratory systems, contingency plans, decontamination procedures, and monitoring to demonstrate satisfactory operation. The operational systems for respiratory protection and the negative pressure system shall be demonstrated for proper performance.
3. The CPIH/CIH shall document the pre-abatement activities described above and deliver a copy to the VA's Representative.
4. Upon satisfactory inspection of the installation of and operation of systems the VA's Representative will notify the Contractor in writing to proceed with the asbestos abatement work in accordance with this specification and all applicable regulations

3.2 REGULATED AREA PREPARATIONS

A. OSHA DANGER Signs: Post OSHA DANGER signs meeting the specifications of OSHA 29 CFR 1926.1101 at any location and approaches to the regulated area. Signs shall be posted at a distance sufficiently far enough away from the regulated area to permit any personnel to read the sign and take the necessary measures to avoid exposure. Additional signs will be posted following construction of the regulated area enclosure.

B. Controlling Access to the Regulated Area: Access to the regulated area is allowed only through the personnel decontamination facility (PDF), if required. All other means of access shall be eliminated and OSHA Danger demarcation signs posted as required by OSHA. If the regulated area is adjacent to or within view of an occupied area, provide a visual barrier of 6-mil opaque fire retardant poly sheeting to prevent building occupant observation. If the adjacent area is accessible to the public, the barrier must be solid.

C. Shut Down – Lock Out Electrical: Shut down and lock out/tag out electric power to the regulated area. Provide temporary power and lighting. Ensure safe installation including GFCI of temporary power sources and equipment by compliance with all applicable electrical code and OSHA requirements for temporary electrical systems. Electricity shall be provided by the VA.

D. Shut Down – Lock Out HVAC: Shut down and lock out/tag out heating, cooling, and air conditioning system (HVAC) components that are in, supply or pass through the regulated area. Investigate the regulated area and agree on pre-abatement condition with the VA's Representative. Seal all intake and exhaust vents in the regulated area with duct tape and 2 layers of independently installed 6-mil poly. Also, seal any seams in system components that

pass through the regulated area. Remove all contaminated HVAC system filters and place in labeled 6-mil polyethylene disposal bags for staging and eventual disposal as asbestos waste.

E. Sanitary Facilities: The Contractor shall provide sanitary facilities for abatement personnel and maintain them in a clean and sanitary condition throughout the abatement project.

F. Water for Abatement: The VA will provide water for abatement purposes. The Contractor shall connect to the existing VA system. The service to the shower(s) shall be supplied with backflow prevention.

G. Preparation Prior to Sealing Off: Place all tools, materials and equipment needed for working in the regulated area prior to erecting any plastic sheeting. Remove all uncontaminated removable furniture, equipment and/or supplies from the regulated area before commencing work, or completely cover with 2-layers of 6-mil fire retardant poly sheeting and secure with duct tape.

H. Critical Barriers: Completely separate any openings into the regulated area from adjacent areas using fire retardant poly at least 6-mils thick and duct tape. Individually seal with 2-layers of independently installed 6-mil poly and duct tape all HVAC openings into the regulated area. Individually seal all lighting fixtures, clocks, doors, windows, convectors, speakers, or any other objects in the regulated area. Heat must be shut off any objects covered with poly.

I. Floor Barriers: If floor removal is not being done, all floors in the regulated area shall be covered with 2-layers of 6-mil fire retardant poly and brought up the wall 24 inches.

J. Pre-Cleaning Movable Objects:
   1. Pre-cleaning of ACM contaminated items shall be performed after the enclosure has been erected and negative pressure has been established in the work area. After items have been pre-cleaned and decontaminated, they may be removed from the work area for storage until the completion of abatement in the work area.
   2. Pre-clean all movable objects within the regulated area using a HEPA filtered vacuum and/or wet cleaning methods as appropriate. After cleaning, these objects shall be removed from the regulated area and carefully stored in an uncontaminated location. Pre-cleaning may not be required if flooring materials is in good condition and are the only ACM present.

K. Pre-Cleaning Fixed Objects:
   1. Pre-cleaning of ACM contaminated items shall be performed after the enclosure has been erected and negative pressure has been established in the work area.
   2. Pre-clean all fixed objects in the regulated area using HEPA filtered vacuums and/or wet cleaning techniques as appropriate. Careful attention must be paid to machinery behind grills or gratings where access may be difficult but contamination may be significant. Also, pay particular attention to wall, floor and ceiling penetration behind fixed items. After pre-cleaning, enclose fixed objects with 2-layers of 6-mil poly and seal securely in place with duct tape. Objects (e.g., permanent fixtures, shelves, electronic equipment, laboratory tables, sprinklers, alarm systems, closed circuit TV equipment and computer cables) which must remain in the regulated area and that require special ventilation or enclosure requirements should be designated here along with specified means of protection. Contact the manufacturer for special protection requirements.

L. Pre-Cleaning Surfaces in the Regulated Area:
   1. Pre-cleaning of ACM contaminated items shall be performed after the enclosure has been erected and negative pressure has been established in the work area.
   2. Pre-clean all surfaces in the regulated area using HEPA filtered vacuums and wet cleaning methods as appropriate. Do not use any methods that would raise dust such as dry sweeping or vacuuming with equipment not equipped with HEPA filters. Do not disturb asbestos-containing materials during this pre-cleaning phase.

M. Extension of the Regulated Area: If the regulated area barrier is breached in any manner that could allow the passage of asbestos fibers or debris, the Competent Person shall immediately stop work, continue wetting, and proceed to extend the regulated area to enclose the affected

area as per procedures described in this specification. If the affected area cannot be enclosed, decontamination measures and cleanup shall start immediately. All personnel shall be isolated from the affected area until decontamination/cleanup is completed as verified by visual inspection and air monitoring. Air monitoring at completion must indicate background levels.

3.3 REMOVABLE OF CLASS II FLOORING AND MASTIC, MATERIALS

A. General: All applicable requirements of OSHA, EPA, and DOT shall be followed during Class II work. Keep materials intact to the extent feasible; wet while working with it; wrap as soon as possible with 2-layers of 6-mil plastic for disposal.

B. Removal of Flooring Materials:
   1. All requirements of OSHA Flooring agreement provisions shall be followed:
      a. The Contractor shall provide enough HEPA negative air machines to effect > -0.02 inches WCG pressure. Provide a standby unit in the event of machine failure and/or emergency in an adjacent area. The contractor shall use double the number of machines, based on their calculations, or submit proof their machines operate at stated capacities, at a 2 inches pressure drop across the filters.
      b. Flooring shall be removed intact, as much as feasible. Do not rip or tear flooring.
      c. Mechanical chipping or sanding is not allowed.
      d. Flooring shallbe removed by manual methods (hand tools).
      e. Wet clean and HEPA vacuum the floor before and after removal of flooring.
      f. Place a 6-mil poly layer 4 feet by 10 feet adjacent to the regulated area for use as a decontamination area if a PDF is not specified. All waste must be contained in the regulated area.
      g. Package all waste in 6-mil poly lined fiberboard drums or double bag in 6-mil polyethylene bags.

C. REMOVAL OF MASTIC
   1. All chemical mastic removers must be low in volatile organic compound (VOC) content, have a flash point greater than 200 degrees Fahrenheit, contain no chlorinated solvents, and comply with California Air Resources Board (CARB) thresholds for VOCs (effective January 1, 2010).
   2. Negative air machine as required under flooring removal shall be provided and operated in accordance with this project specification.
   3. Follow all manufacturers' instructions in the use of the mastic removal material. Verify that there are no ignition sources in the work area and minimize the amount of mastic removal material used at any given time to eliminate fire hazards and objectionable odors. Contractor shall inspect flooring for possible cracks / openings that will allow mastic remover to penetrate.
   4. Package all waste in 6-mil poly lined fiberboard drums or double bag in 6-mil polyethylene bags.

3.4 DISPOSAL OF CLASS II WASTE MATERIAL

A. General: Dispose of waste ACM and debris which is packaged in accordance with these specifications, OSHA, EPA and DOT. The landfill requirements for packaging must also be met. Transport will be in compliance with 49 CFR 171–180 regulations. Disposal shall be done at an approved landfill. Disposal of non-friable ACM shall be done in accordance with applicable State and Local regulations.

3.5 PROJECT DECONTAMINATION

A. General:
   1. The VA must be notified at least 24 hours in advance of any waste removed from the containment.
   2. The entire work related to project decontamination shall be performed under the close supervision and monitoring of the CPIH/CIH.
   3. If the asbestos abatement work is in an area which was contaminated prior to the start of abatement, the decontamination will be done by cleaning the primary barrier poly prior to

its removal and cleanings of the surfaces of the regulated area after the primary barrier removal.

4. If the asbestos abatement work is in an area which was uncontaminated prior to the start of abatement, the decontamination will be done by cleaning the primary barrier poly prior to its removal, thus preventing contamination of the building when the regulated area critical barriers are removed.

B. Regulated Area Clearance: Air testing and other requirements which must be met before release of the Contractor and re-occupancy of the regulated area space are specified in Final Testing Procedures

C. Work Description: Decontamination includes the clearance air testing in the regulated area and the decontamination and removal of the enclosures/facilities installed prior to the abatement work including primary/critical barriers, PDF and W/EDF facilities, and negative pressure systems.

D. Pre-Decontamination Conditions:
1. Before decontamination starts, all ACM waste from the regulated area shall be removed, all waste collected and removed, and the secondary barrier of poly removed and disposed of along with any gross debris generated by the work.
2. At the start of decontamination, the following shall be in place:
   a. Critical barriers over all openings consisting of two layers of 6-mil poly which is the sole barrier between the regulated area and the rest of the building or outside.
   b. Decontamination facilities, if required for personnel and equipment in operating condition.

E. Cleaning: Carry out a first cleaning of all surfaces of the regulated area including items of remaining poly sheeting, tools, scaffolding, ladders/staging by wet methods and HEPA vacuuming. Do not use dry dusting/sweeping/air blowing methods. Use each surface of a wetted cleaning cloth one time only and then dispose of as contaminated waste. Continue this cleaning until there is no visible residue from abated surfaces or poly or other surfaces. Remove all filters in the air handling system and dispose of as ACM waste in accordance with these specifications. The negative pressure system shall remain in operation during this time. Additional cleaning(s) may be needed as determined by the CPIH/VPIH/CIH.

3.6 VISUAL INSPECTION AND AIR CLEARANCE TESTING

A. General: Notify the VA Representative 24 hours in advance for the performance of the final visual inspection and testing. The final visual inspection and testing will be performed by the VPIH/CIH after the final cleaning.

B. Visual Inspection: Final visual inspection will include the entire regulated area, the PDF, all poly sheeting, seals over HVAC openings, doorways, windows, and any other openings. If any debris, residue, dust or any other suspect material is detected, the final cleaning shall be repeated at no additional cost to the VA. Dust/material samples may be collected and analyzed at no additional cost to the VA at the discretion of the VPIH/CIH to confirm visual findings. When the regulated area is visually clean the final testing can be done

C. Air Clearance Testing:
1. After an acceptable final visual inspection by the VPIH/CIH and VA Representative, the VPIH/CIH will perform the final clearance testing. Air samples will be collected and analyzed in accordance with procedures for AHERA in this specification. If work is less than 260 lf/160 sf/35 cf, 5 PCM samples shall be collected for clearance and a minimum of two field blank. If work is equal to or more than 260 lf/160 sf/35 cf, AHERA TEM sampling shall be performed for clearance. TEM analysis shall be done in accordance with procedures for EPA AHERA presented in this specification. If the release criteria are not met, the Contractor shall repeat the final cleaning and continue decontamination procedures until clearance is achieved. **All Additional inspection and testing costs will be borne by the Contractor.**

2. If release criteria are met, proceed to perform the abatement closeout and to issue the certificate of completion in accordance with these specifications.

D. FinaL Air Clearance Procedures:
1. Contractor's Release Criteria: Work in a regulated area is complete when the regulated area is visually clean and airborne fiber levels have been reduced to or below 0.01 f/cc as measured by the AHERA PCM protocol and ≤ 70 AHERA asbestos structures per square millimeter (s/mm^2) by AHERA TEM. No averaging of results will be used for this project. All five (5) TEM samples inside the regulated area shall be at or below 70 asbestos s/mm^2 to satisfy the project final clearance criteria.
2. Air Monitoring and Final Clearance Sampling: To determine if the elevated airborne fiber counts encountered during abatement operations have been reduced to the specified level, the VPIH/CIH will secure samples and analyze them according to the following procedures.
   a. Fibers Counted: “Fibers” referred to in this section shall be either all fibers regardless of composition as counted in the NIOSH 7400 PCM method or asbestos fibers counted using the AHERA TEM method.
   b. Aggressive Sampling: All final air testing samples shall be collected using aggressive sampling techniques. Samples will be collected on 0.8⌠ MCE filters for PCM analysis and 0.45⌠ MCE for TEM. A minimum of 3850 Liters of air using calibrated sampling pumps shall be collected for PCM samples and a minimum of 1200 Liters of air using calibrated sampling pumps shall be collected for TEM clearance samples. Before pumps are started, initiate aggressive air mixing sampling as detailed in 40 CFR 763 Subpart E (AHERA) Appendix A (III)(B)(7)(d). Air samples will be collected in areas subject to normal air circulation away from corners, obstructed locations, and locations near windows, doors, or vents. After air sampling pumps have been shut off, circulating fans shall be shut off. The negative pressure system shall continue to operate.

3.7 ABATEMENT CLOSEOUT AND CERTIFICATE OF COMPLIANCE

A. Completion of Abatement Work:
1. After thorough decontamination, complete asbestos abatement work upon meeting the regulated area clearance criteria and fulfilling the following:
   a. Remove all equipment, materials, and debris from the project area.
   b. Package and dispose of all asbestos waste as required.
   c. Repair or replace all interior finishes damaged during the abatement work.
   d. Fulfill other project closeout requirements as specified elsewhere in this specification

B. Certificate of Completion by Contractor: The CPIH shall complete and sign the "Certificate of Completion" in accordance with Attachment 1 at the completion of the abatement and decontamination of the regulated area.

C. Work Shifts: All work shall generally be done during administrative hours (8:00 AM to 4:30 PM) Monday - Friday excluding Federal Holidays. Any change in the work schedule must be approved in writing by the VA Representative.

ATTACHMENT #1
CERTIFICATE OF COMPLETION

DATE: _____ VA Project #:_____
PROJECT NAME:_____ Abatement Contractor:_____
VAMC/ADDRESS:_____

1. I certify that I have personally inspected, monitored and supervised the abatement work of (specify regulated area or Building):
   which took place from / / to / /
2. That throughout the work all applicable requirements/regulations and the VA's specifications were met.
3. That any person who entered the regulated area was protected with the appropriate personal protective equipment and respirator and that they followed the proper entry and exit procedures and the proper operating procedures for the duration of the work.
4. That all employees of the Abatement Contractor engaged in this work were trained in respiratory protection, were experienced with abatement work, had proper medical surveillance documentation, were fit-tested for their respirator, and were not exposed at any time during the work to asbestos without the benefit of appropriate respiratory protection.
5. That I performed and supervised all inspection and testing specified and required by applicable regulations and VA specifications.
6. That the conditions inside the regulated area were always maintained in a safe and healthy condition and the maximum fiber count never exceeded 0.5 f/cc, except as described below.
7. That all abatement work was done in accordance with OSHA requirements and the manufacturer’s recommendations.

CPIH/CIH Signature/Date:_____

CPIH/CIH Print Name:_____

Abatement Contractor Signature/Date:_____

Abatement Contractor Print Name:_____

ATTACHMENT #2
CERTIFICATE OF WORKER'S ACKNOWLEDGMENT

PROJECT NAME:_____DATE:_____
PROJECT ADDRESS:_____
ABATEMENT CONTRACTOR'S NAME:_____

WORKING WITH ASBESTOS CAN BE HAZARDOUS TO YOUR HEALTH. INHALING ASBESTOS HAS BEEN LINKED WITH VARIOUS TYPES OF CANCERS. IF YOU SMOKE AND INHALE ASBESTOS FIBERS, YOUR CHANCES OF DEVELOPING LUNG CANCER IS GREATER THAN THAT OF THE NON-SMOKING PUBLIC.

Your employer's contract with the owner for the above project requires that: You must be supplied with the proper personal protective equipment including an adequate respirator and be trained in its use. You must be trained in safe and healthy work practices and in the use of the equipment found at an asbestos abatement project. You must receive/have a current medical examination for working with asbestos. These things shall be provided at no cost to you. By signing this certificate of worker's acknowledgement you are indicating to the owner that your employer has met these obligations.

RESPIRATORY PROTECTION: I have been trained in the proper use of respirators and have been informed of the type of respirator to be used on the above indicated project. I have a copy of the written Respiratory Protection Program issued by my employer. I have been provided for my exclusive use, at no cost, with a respirator to be used on the above indicated project.

TRAINING COURSE: I have been trained by a third party, State/EPA accredited trainer in the requirements for an AHERA/OSHA Asbestos Abatement Worker training course, 32-hours minimum duration. I currently have a valid State accreditation certificate. The topics covered in the course include, as a minimum, the following:

Physical Characteristics and Background Information on Asbestos
Potential Health Effects Related to Exposure to Asbestos
Employee Personal Protective Equipment
Establishment of a Respiratory Protection Program
State of the Art Work Practices
Personal Hygiene
Additional Safety Hazards
Medical Monitoring
Air Monitoring
Relevant Federal, State and Local Regulatory Requirements, Procedures, and Standards
Asbestos Waste Disposal

MEDICAL EXAMINATION: I have had a medical examination within the past 12 months which was paid for by my employer. This examination included: health history, occupational history, pulmonary function test, and may have included a chest x-ray evaluation. The physician issued a positive written opinion after the examination.

Signature:_____
Printed Name:_____
Social Security Number:_____
Witness:_____

ATTACHMENT #3
AFFIDAVIT OF MEDICAL SURVEILLANCE, RESPIRATORY PROTECTION AND TRAINING/ACCREDITATION

VA PROJECT NAME AND NUMBER:_____
VA MEDICAL FACILITY:_____
ABATEMENT CONTRACTOR'S NAME AND ADDRESS:_____

1. I verify that the following individual

Name:_____ Social Security Number: _____who is proposed to be employed in asbestos abatement work associated with the above project by the named Abatement Contractor, is included in a medical surveillance program in accordance with 29 CFR 1926.1101(m), and that complete records of the medical surveillance program as required by 29 CFR 1926.1101(m)(n) and 29 CFR 1910.20 are kept at the offices of the Abatement Contractor at the following address.

Address:_____

2. I verify that this individual has been trained, fit-tested and instructed in the use of all appropriate respiratory protection systems and that the person is capable of working in safe and healthy manner as expected and required in the expected work environment of this project.

3. I verify that this individual has been trained as required by 29 CFR 1926.1101(k). This individual has also obtained a valid State accreditation certificate. Documentation will be kept on-site.

4. I verify that I meet the minimum qualifications criteria of the VA specifications for a CPIH.

Signature of CPIH/CIH:_____ Date:_____

Printed Name of CPIH/CIH:_____

Signature of Contractor:_____ Date:_____

Printed Name of Contractor:_____

ATTACHMENT #4
ABATEMENT CONTRACTOR/COMPETENT PERSON(S) REVIEW AND ACCEPTANCE OF THE VA'S ASBESTOS SPECIFICATIONS

VA Project Location:_____
VA Project #:_____
VA Project Description:_____

1. This form shall be signed by the Asbestos Abatement Contractor Owner and the Asbestos Abatement Contractor's Competent Person(s) prior to any start of work at the VA related to this Specification. If the Asbestos Abatement Contractor's/Competent Person(s) has not signed this form, they shall not be allowed to work on-site.

2 I, the undersigned, have read VA's Asbestos Specification regarding the asbestos abatement requirements. I understand the requirements of the VA's Asbestos Specification and agree to follow these requirements as well as all required rules and regulations of OSHA/EPA/DOT and State/Local requirements. I have been given ample opportunity to read the VA's Asbestos Specification and have been given an opportunity to ask any questions regarding the content and have received a response related to those questions. I do not have any further questions regarding the content, intent and requirements of the VA's Asbestos Specification.

3. At the conclusion of the asbestos abatement, I will certify that all asbestos abatement work was done in accordance with the VA's Asbestos Specification and all ACM was removed properly and no fibrous residue remains on any abated surfaces.

Abatement Contractor Owner's Signature_____Date_____

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SECTION 02 82 13.31
ASBESTOS TRANSITE-TYPE ABATEMENT

PART 1 - GENERAL

1.1 SUMMARY OF THE WORK

A. Drawings, general provisions of the contract, including general and supplementary conditions and other Division 01 specifications, shall apply to the work of this section. The contract documents show the work to be done under the contract and related requirements and conditions impacting the project. Related requirements and conditions include applicable codes and regulations, notices and permits, existing site conditions and restrictions on use of the site, requirements for partial owner occupancy during the work, coordination with other work and the phasing of the work. In the event the Asbestos Abatement Contractor discovers a conflict in the contract documents and/or requirements or codes, the conflict must be brought to the immediate attention of the Contracting Officer for resolution. Whenever there is a conflict or overlap in the requirements, the most stringent shall apply. Any actions taken by the Contractor without obtaining guidance from the Contracting Officer shall become the sole risk and responsibility of the Asbestos Abatement Contractor. All costs incurred due to such action are also the responsibility of the Asbestos Abatement Contractor.

B. Extent of Work:

1. Below is a brief description of the estimated quantities of asbestos Transite-type materials to be abated. These quantities are for informational purposes only and are based on the best information available at the time of the specification preparation. The Contractor shall satisfy himself as the actual quantities to be abated. Nothing in this section may be interpreted as limiting the extent of work otherwise required by this contract and related documents. Contractor shall field verify quantities prior to abatement. All work shall be conducted in accordance with NYS ICR 56.

2. Removal, clean-up and disposal of ACM Transite-type in an appropriate regulated area in the following approximate quantities;

(1,176) square feet of Transite-board

Material Location	Estimated Quantity*
205B	12 SF
207	144 SF
208B	24 SF
208C	36 SF
209	24 SF
210	60 SF
210A	48 SF
210B	12 SF
211	24 SF
213	12 SF
214A	12 SF
215	36 SF
217A	12 SF
217B	12 SF
217C	60 SF
217D	12 SF
217E	12 SF
221A	12 SF
222	12 SF
223	12 SF
224	12 SF
225	12 SF
226	12 SF
227	12 SF
227B	12 SF
228	72 SF
228A	48 SF
229	48 SF
230	36 SF
231	24 SF
232	108 SF
232A	12 SF
234	12 SF
235	24 SF
235B	12 SF

Material Location	Estimated Quantity*
-	**Total Estimated Quantity ~ 1,176 Square Feet ~ 98 Transite-board panels, 12 square feet each**

C. Related Work:

1. Section 07 84 00, FIRESTOPPING.
2. Section 02 41 00, DEMOLITION.
3. Division 09, FINISHES

D. Tasks:

1. The work tasks are summarized briefly as follows:
   a. Pre-abatement activities including pre-abatement meeting(s), inspection(s), notifications, permits, submittal approvals, regulated area preparations, emergency procedures arrangements, and standard operating procedures for asbestos abatement work.
   b. Abatement activities including removal , encapsulation , enclosure , clean-up and disposal of ACM waste, recordkeeping, security, monitoring, and inspections.
   c. Cleaning and decontamination activities including final visual inspection, air monitoring and certification of decontamination.

E. Abatement Contractors Use of Premises:

1. The Contractor and Contractor's personnel shall cooperate fully with the VA Representative/consultant to facilitate efficient use of buildings and areas within buildings. The Contractor shall perform the work in accordance with the VA specifications, drawings, phasing plan and in compliance with any/all applicable Federal, State and Local regulations and requirements.
2. The Contractor shall use the existing facilities in the building strictly within the limits indicated in contract documents as well as the approved VA Design and Construction Procedure. VA Design and Construction Procedure drawings of partially occupied buildings will show the limits of regulated areas; the placement of decontamination facilities; the temporary location of bagged waste ACM; the path of transport to outside the building; and the temporary waste storage area for each building/regulated area. Any variation from the arrangements shown

on drawings shall be secured in writing from the VA Representative through the pre-abatement plan of action. The following limitations of use shall apply to existing facilities shown on drawings:

SPEC WRITER NOTE: SPEC WRITER NOTE: Provide specific limitations on the use of facility elements such as corridors, stairs, elevators, loading platforms, etc., which are not dedicated for the use of the Contractor during his work. Consult with the VA on this and secure verification in writing on the conditions of use.

1.2 VARIATIONS IN QUANTITY

A. The quantities and locations of ACM as indicated on the drawings and the extent of work included in this section are estimated which are limited by the physical constraints imposed by occupancy of the buildings and accessibility to ACM. Accordingly, minor variations (+/- 10 percent) in quantities of ACM within the regulated area are considered as having no impact on contract price and time requirements of this contract. Where additional work is required beyond the above variation, the contractor shall provide unit prices for newly discovered ACM and those prices shall be used for additional work required under the contract.

1.3 STOP ASBESTOS REMOVAL

A. If the Contracting Officer; their field Representative; the facility Safety Officer/Manager or their designee, or the VA Professional Industrial Hygienist/Certified Industrial Hygienist (VPIH/CIH) presents a verbal Stop Asbestos Removal Order, the Contractor/Personnel shall immediately stop all asbestos removal and maintain HEPA filtered negative pressure air flow in the containment and adequately wet any exposed ACM. If a verbal Stop Asbestos Removal Order is issued, the VA shall follow-up with a written order to the Contractor as soon as practicable. The Contractor shall not resume any asbestos removal activity until authorized to do so in writing by the VA Contracting Officer. A stop asbestos removal order may be issued at any time the VA Contracting Officer determines abatement conditions/activities are not within VA specification, regulatory requirements or that an imminent hazard exists to human health or the environment. Work stoppage will continue until conditions have been corrected to the satisfaction of the VA. Standby time and costs for corrective actions will be borne by the Contractor, including the VPIH/CIH time. The occurrence of any of the following events shall be reported immediately by the Contractor's competent person to the VA Contracting Officer or field Representative using the most expeditious means (e.g., verbal or telephonic), followed up with written notification to the Contracting Officer as soon as it is practical. The Contractor shall immediately stop asbestos removal/disturbance activities and initiate fiber reduction activities:

1. Airborne PCM analysis results equal to or greater than 0.01 f/cc above background levels inside the building but outside the regulated area;
2. breach or break in regulated area containment barrier(s);
3. less than –0.02 inch WCG pressure in the regulated area;
4. serious injury/death at the site;
5. fire/safety emergency at the site;
6. respiratory protection system failure;
7. power failure or loss of wetting agent; or
8. any visible emissions observed outside the regulated area; or
9. failure to follow project specification requirements.

1.4 DEFINITIONS

A. General: Definitions and explanations here are neither complete nor exclusive of all terms used in the contract documents, but are general for the work to the extent they are not stated more explicitly in another element of the contract documents. Drawings must be recognized as diagrammatic in nature and not completely descriptive of the requirements indicated therein.

B. Glossary:

Abatement - Procedures to control fiber release from asbestos-containing materials. Includes removal, encapsulation, enclosure, demolition, and renovation activities related to asbestos containing materials (ACM).

Adequately wet - Sufficiently mixed or penetrated with liquid to prevent the release of particulates. If visible emissions are observed coming from the ACM, then that material has not been adequately wetted.

Aerosol - Solid or liquid particulate suspended in air.

Aggressive method - Removal or disturbance of building material by sanding, abrading, grinding, or other method that breaks, crumbles, or disintegrates intact ACM.

Aggressive air sampling - EPA AHERA defined clearance sampling method using air moving equipment such as fans and leaf blowers to aggressively disturb and maintain in the air residual fibers after abatement.

AHERA - Asbestos Hazard Emergency Response Act. Asbestos regulations for schools issued in 1987.

Aircell - Pipe or duct insulation made of corrugated cardboard which contains asbestos.

Air monitoring - The process of measuring the fiber content of a known volume of air collected over a specified period of time. The NIOSH 7400 Method, Issue 3, Fifth Edition is used to determine the fiber levels in air. For personal samples, area air samples and clearance air testing using Phase Contrast Microscopy (PCM) analysis, the NIOSH Method 7402 (Issue 2, Fourth Edition) can be used when it is necessary to confirm fibers counted by PCM as being asbestos.

The AHERA TEM analysis may be used for background, area samples and clearance samples when required by this specification, or at the discretion of the VPIH/CIH as appropriate.

Air sample filter - The filter used to collect fibers which are then counted. The filter is made of mixed cellulose ester (MCE) membrane for PCM (Phase Contrast Microscopy, 25 mm, 3-piece with 2 inches Static Extension Cowl, 0.8 micron pore size) and MCE for TEM (Transmission Electron Microscopy, 25 mm, 3-piece with 2 inches Static Extension Cowl, 0.45 micron pore size).

Amended water - Water to which a surfactant (wetting agent) has been added to increase the penetrating ability of the liquid.

Asbestos - Includes chrysotile, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, actinolite asbestos, and any of these minerals that have been chemically treated or altered. Asbestos also includes PACM, as defined below.

Asbestos Hazard Abatement Plan (AHAP) - Asbestos work procedures required to be submitted by the contractor before work begins.

Asbestos-containing material (ACM) - Any material containing more than one percent of asbestos.

Asbestos contaminated elements (ACE) - Building elements such as ceilings, walls, lights, or ductwork that are contaminated with asbestos.

Asbestos-contaminated soil (ACS) – Soil found in the work area or in adjacent areas such as crawlspaces or pipe tunnels which is contaminated with asbestos-containing material debris and cannot be easily separated from the material.

Asbestos-containing waste (ACW) material - Asbestos-containing material or asbestos contaminated objects requiring disposal.

Asbestos Project Monitor – Some states require that any person conducting asbestos abatement air sampling, clearance inspections and clearance air sampling be licensed as an asbestos project monitor.

Asbestos waste decontamination facility - A system consisting of drum/bag washing facilities and a temporary storage area for cleaned containers of asbestos waste. Used as the exit for waste and equipment leaving the regulated area. In an emergency, it may be used to evacuate personnel.

Authorized person - Any person authorized by the VA, the Contractor, or government agency and required by work duties to be present in regulated areas.

Authorized visitor - Any person approved by the VA; the contractor; or any government agency representative having jurisdiction over the regulated area (e.g., OSHA, Federal and State EPA).

Barrier - Any surface that isolates the regulated area and inhibits fiber migration from the regulated area.

Containment Barrier - An airtight barrier consisting of walls, floors, and/or ceilings of sealed plastic sheeting which surrounds and seals the outer perimeter of the regulated area.

Critical Barrier - The barrier responsible for isolating the regulated area from adjacent spaces, typically constructed of 2-layers of 6-mil independently installed plastic sheeting (Polyethylene) secured in place at openings such as doors, windows, penetrations or any other opening into the regulated area.

Primary Barrier – Plastic barriers placed over critical barriers and exposed directly to abatement work or to secondary barrier.

Secondary Barrier - Any additional plastic barriers used to isolate and provide protection from debris during abatement work.

Breathing zone - The hemisphere forward of the shoulders with a radius of about 150 - 225 mm (6 - 9 inches) from the worker's nose.

Bridging encapsulant - An encapsulant that forms a layer on the surface of the ACM.

Building/facility owner - The legal entity, including a lessee, which exercises control over management and recordkeeping functions relating to a building and/or facility in which asbestos activities take place.

Bulk testing - The collection and analysis of suspect asbestos containing materials.

Certified Industrial Hygienist (CIH) - A person certified in the comprehensive practice of industrial hygiene by the American Board of Industrial Hygiene.

Class I asbestos work - Activities involving the removal of Thermal System Insulation (TSI) and surfacing ACM and Presumed Asbestos Containing Material (PACM).

Class II asbestos work - Activities involving the removal of ACM which is not thermal system insulation or surfacing material. This includes, but is not limited to, the removal of asbestos-containing wallboard, floor tile and sheeting, roofing and siding shingles, and construction mastic.

Clean room/Changing room - An uncontaminated room having facilities for the storage of employee's street clothing and uncontaminated materials and equipment.

Clearance sample - The final air sample taken after all asbestos work has been done and visually inspected. Performed by the VA's Professional Industrial Hygiene consultant/Certified Industrial Hygienist (VPIH/CIH).

Closely resemble - The major workplace conditions which have contributed to the levels of historic asbestos exposure, are no more protective than conditions of the current workplace.

Competent person - In addition to the definition in 29 CFR 1926.32(f), one who is capable of identifying existing asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure, who has the authority to take prompt corrective measures to eliminate them, as specified in 29 CFR 1926.32(f); in addition, for Class I and II work who is specially trained in a training course which meets the criteria of EPA's Model Accreditation Plan (40 CFR 763) for supervisor.

Contractor's Professional Industrial Hygienist (CPIH/CIH) - The asbestos abatement contractor's industrial hygienist. The industrial hygienist must meet the qualification requirements of a PIH and may report to a certified industrial hygienist (CIH).

Count - Refers to the fiber count or the average number of fibers greater than five microns in length with a length-to-width (aspect) ratio of at least 3 to 1, per cubic centimeter of air.

Crawlspace – An area which can be found either in or adjacent to the work area. This area has limited access and egress and may contain asbestos materials and/or asbestos contaminated soil.

Decontamination area/unit - An enclosed area adjacent to and connected to the regulated area and consisting of an equipment room, shower room, and clean room, which is used for the decontamination of workers, materials, and equipment that are contaminated with asbestos.

Demolition - The wrecking or taking out of any load-supporting structural member and any related razing, removing, or stripping of asbestos products.

Disposal bag - Typically 6-mil thick sift-proof, dustproof, leak-tight container used to package and transport asbestos waste from regulated areas to the approved landfill. Each bag/container must be labeled/marked in accordance with EPA, OSHA and DOT requirements.

Disturbance – Asbestos Operations and Maintenance Activities (OSHA Class III) that disrupt the matrix of ACM or PACM, crumble or pulverize ACM or PACM, or generate visible debris from ACM or PACM. Disturbance includes cutting away small amounts of ACM or PACM, no greater than the amount that can be contained in one standard sized glove bag or waste bag in order to access a building component. In no event shall the amount of ACM or PACM so disturbed exceed that which can be contained in one glove bag or disposal bag, which shall not exceed 60 inches in length or width.

Drum - A rigid, impermeable container made of cardboard fiber, plastic, or metal which can be sealed in order to be sift-proof, dustproof, and leak-tight.

Employee exposure - The exposure to airborne asbestos that would occur if the employee were not wearing respiratory protection equipment.

Encapsulant - A material that surrounds or embeds asbestos fibers in an adhesive matrix and prevents the release of fibers.

Encapsulation - Treating ACM with an encapsulant.

Enclosure - The construction of an air tight, impermeable, permanent barrier around ACM to control the release of asbestos fibers from the material and also eliminate access to the material.

Equipment room - A contaminated room located within the decontamination area that is supplied with impermeable bags or containers for the disposal of contaminated protective clothing and equipment.

Fiber - A particulate form of asbestos, 5 microns or longer, with a length to width (aspect) ratio of at least 3 to 1.

Fibers per cubic centimeter (f/cc) - Abbreviation for fibers per cubic centimeter, used to describe the level of asbestos fibers in air.

Filter - Media used in respirators, vacuums, or other machines to remove particulate from air.

Firestopping - Material used to close the open parts of a structure in order to prevent a fire from spreading.

Friable asbestos containing material - Any material containing more than one (1) percent asbestos as determined using the method specified in 40 CFR 763, Polarized Light Microscopy, that, when dry, can be crumbled, pulverized, or reduced to powder by hand pressure.

Glovebag - Not more than a 60 x 60 inch impervious plastic bag-like enclosure affixed around an asbestos-containing material, with glove-like appendages through which materials and tools may be handled.

High efficiency particulate air (HEPA) filter – An ASHRAE MERV 17 filter capable of trapping and retaining at least 99.97 percent of all mono-dispersed particles of 0.3 micrometers in diameter.

HEPA vacuum - Vacuum collection equipment equipped with a HEPA filter system capable of collecting and retaining asbestos fibers.

Homogeneous area - An area of surfacing, thermal system insulation or miscellaneous ACM that is uniform in color, texture and date of application.

HVAC - Heating, Ventilation and Air Conditioning

Industrial hygienist (IH) - A professional qualified by education, training, and experience to anticipate, recognize, evaluate and develop controls for occupational health hazards. Meets definition requirements of the American Industrial Hygiene Association (AIHA).

Industrial hygienist technician (IH Technician) - A person working under the direction of an IH or CIH who has special training, experience, certifications and licenses required for the industrial hygiene work assigned. Some states require that an industrial hygienist technician conducting asbestos abatement air sampling, clearance inspection and clearance air sampling be licensed as an asbestos project monitor.

Intact - The ACM has not crumbled, been pulverized, or otherwise deteriorated so that the asbestos is no longer likely to be bound with its matrix.

Lockdown - Applying encapsulant, after a final visual inspection, on all abated surfaces at the conclusion of ACM removal prior to removal of critical barriers.

National Emission Standards for Hazardous Air Pollutants (NESHAP) - EPA's rule to control emissions of asbestos to the environment (40 CFR part 61, Subpart M).

Negative initial exposure assessment - A demonstration by the employer which complies with the criteria in 29 CFR 1926.1101 (f)(2)(iii), that employee exposure during an operation is expected to be consistently below the PEL or Excursion Limit (EL).

Negative pressure - Air pressure which is lower than the surrounding area, created by exhausting air from a sealed regulated area through HEPA equipped filtration units. OSHA requires maintaining -0.02 inch water column gauge inside the negative pressure enclosure.

Negative pressure respirator - A respirator in which the air pressure inside the facepiece is negative during inhalation relative to the air pressure outside the respirator facepiece.

Non-friable ACM - Material that contains more than 1 percent asbestos but cannot be crumbled, pulverized, or reduced to powder by hand pressure.

Organic vapor cartridge - The type of cartridge used on air purifying respirators to remove organic vapor hazardous air contaminants.

Outside air - The air outside buildings and structures, including, but not limited to, the air under a bridge or in an open ferry dock.

Owner/operator - Any person who owns, leases, operates, controls, or supervises the facility being demolished or renovated or any person who owns, leases, operates, controls, or supervises the demolition or renovation operation, or both.

Penetrating encapsulant - Encapsulant that is absorbed into the ACM matrix without leaving a surface layer.

Permissible exposure limit (PEL) - The level of exposure OSHA allows for as an eight (8) hour time-weighted average (TWA). For asbestos fibers, the eight (8) hour time-weighted average PEL is 0.1 fibers per cubic centimeter (0.1 f/cc) of air and the 30-minute Excursion Limit (EL) is 1.0 fibers per cubic centimeter (1 f/cc).

Personal protective equipment (PPE) – equipment designed to protect user from injury and/or specific job hazard. Such equipment may include protective clothing, hard hats, safety glasses, fall protection, and respirators.

Personal sampling/monitoring - Representative air samples obtained in the breathing zone for one or more workers within the regulated area using a filter cassette and a calibrated air sampling pump to determine asbestos exposure.

Pipe tunnel – An area, typically located adjacent to mechanical spaces or boiler rooms in which the pipes servicing the heating system in the building are routed to allow the pipes to access heating elements. These areas may contain asbestos pipe insulation, asbestos fittings, debris or asbestos-contaminated soil.

Polarized light microscopy (PLM) - Light microscopy using dispersion staining techniques and refractive indices to identify and quantify the type of asbestos present in a bulk sample.

Polyethylene sheeting - Strong plastic barrier material 4 to 6-mils thick, semi-transparent, flame retardant per NFPA 241.

Positive/negative fit check - A method of verifying the seal of a facepiece respirator by temporarily occluding the filters and breathing in (inhaling) and then temporarily occluding the

exhalation valve and breathing out (exhaling) while checking for inward or outward leakage of the respirator, respectively.

Presumed ACM (PACM) - Thermal system insulation, surfacing, and flooring material installed in buildings prior to 1981. If the building owner has actual knowledge, or should have known through the exercise of due diligence that other materials are ACM, they too must be treated as PACM. The designation of PACM may be rebutted pursuant to 29 CFR 1926.1101 (k)(5).

Professional IH - An IH who meets the definition requirements of AIHA; meets the definition requirements of OSHA as a "Competent Person" at 29 CFR 1926.1101 (b); has completed two specialized EPA approved courses on management and supervision of asbestos abatement projects; has formal training in respiratory protection and waste disposal; and has a minimum of four projects of similar complexity with this project of which at least three projects serving as the supervisory IH. The PIH may be either the VA's PIH (VPIH/CIH) or Contractor's PIH (CPIH/CIH).

Project designer - A person who has successfully completed the training requirements for an asbestos abatement project designer as required by 40 CFR 763 Subpart E, Appendix C, Part I; (B)(5).

Assigned protection factor - A value assigned by OSHA/NIOSH to indicate the expected protection provided by each respirator class, when the respirator is properly selected and worn correctly. The number indicates the reduction of exposure level from outside to inside the respirator facepiece.

Qualitative fit test (QLFT) - A fit test using a challenge material that can be sensed by the wearer if leakage in the respirator occurs.

Quantitative fit test (QNFT) - A fit test using a challenge material which is quantified outside and inside the respirator thus allowing the determination of the actual fit factor.

Regulated area - An area established by the employer to demarcate where Class I, II, III asbestos work is conducted, and any adjoining area where debris and waste from such asbestos work may accumulate; and a work area within which airborne concentrations of asbestos exceed, or there is a reasonable possibility they may exceed the PEL.

Regulated ACM (RACM) - Friable ACM; Category I non-friable ACM that has become friable; Category I non-friable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading or; Category II non-friable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces expected to act on the material in the course of the demolition or renovation operation.

Removal - All operations where ACM, PACM and/or RACM is taken out or stripped from structures or substrates, including demolition operations.

Renovation - Altering a facility or one or more facility components in any way, including the stripping or removal of asbestos from a facility component which does not involve demolition activity.

Repair - Overhauling, rebuilding, reconstructing, or reconditioning of structures or substrates, including encapsulation or other repair of ACM or PACM attached to structures or substrates.

Shower room - The portion of the PDF where personnel shower before leaving the regulated area.

Supplied air respirator (SAR) - A respiratory protection system that supplies minimum Grade D respirable air per ANSI/Compressed Gas Association Commodity Specification for Air, G-7.1-2018.

Surfacing ACM - A material containing more than 1 percent asbestos that is sprayed, troweled on or otherwise applied to surfaces for acoustical, decorative, fireproofing and other purposes.

Surfactant - A chemical added to water to decrease water's surface tension thus making it more penetrating into ACM.

Thermal system ACM - A material containing more than 1 percent asbestos applied to pipes, fittings, boilers, breeching, tanks, ducts, or other structural components to prevent heat loss or gain.

Transmission electron microscopy (TEM) - A microscopy method that can identify and count asbestos fibers.

VA Professional Industrial Hygienist (VPIH/CIH) – The Department of Veterans Affairs Professional Industrial Hygienist must meet the qualifications of a PIH, and may report to a Certified Industrial Hygienist (CIH).

VA Representative - The VA official responsible for on-going project work.

VA Total – means a building or substantial part of the building is completely removed, torn or knocked down, bulldozed, flattened, or razed, including removal of building debris.

Visible emissions - Any emissions, which are visually detectable without the aid of instruments, coming from ACM/PACM/RACM/ACS or ACM waste material.

Waste/Equipment decontamination facility (W/EDF) – The area in which equipment is decontaminated before removal from the regulated area.

Waste generator - Any owner or operator whose act or process produces asbestos-containing waste material.

Waste shipment record - The shipping document, required to be originated and signed by the waste generator, used to track and substantiate the disposition of asbestos-containing waste material.

Wet cleaning - The process of thoroughly eliminating, by wet methods, any asbestos contamination from surfaces or objects.

C. Referenced Standards Organizations: See Section 01 42 19 REFERENCED STANDARDS.

1.5 APPLICABLE CODES AND REGULATIONS

A. General Applicability of Codes, Regulations, and Standards:

1. All work under this contract shall be done in strict accordance with all applicable Federal, State, and Local regulations, standards and codes governing asbestos abatement, and any other trade work done in conjunction with the abatement. All applicable codes, regulations and standards are adopted into this specification and will have the same force and effect as this specification.
2. The most recent edition of any relevant regulation, standard, document or code shall be in effect. Where conflict among the requirements or with these specifications exists, the most stringent requirement(s) shall be utilized.
3. Copies of all standards, regulations, codes and other applicable documents, including this specification and those listed in Section 1.5 shall be available at the worksite in the clean change area of the worker decontamination system and/or the Contractor's on-site Field Office. These standards, regulations, codes and other applicable documents, including this specification and those listed in Section 1.5 may be made available electronically.

B. Contractor Responsibility: The Asbestos Abatement Contractor (Contractor) shall assume full responsibility and liability for compliance with all applicable Federal, State and Local regulations related to any and all aspects of the asbestos abatement project. The Contractor is responsible for providing and maintaining training, accreditations, medical exams, medical records, personal protective equipment (PPE) including respiratory protection, and respirator fit testing, as required by applicable Federal, State and Local regulations. The Contractor shall hold the VA and VPIH/CIH consultants harmless for any Contractor's failure to comply with any applicable work, packaging, transporting, disposal, safety, health, or environmental requirement on the part of himself, his employees, or his subcontractors. The Contractor will incur all costs of the CPIH/CIH, including all sampling/analytical costs to assure compliance with OSHA/EPA/State/Local requirements related to failure to comply with the regulations applicable to the work.

C. Federal Requirements:

1. Federal requirements which govern asbestos abatement include, but are not limited to, the following regulations:
   a. Occupational Safety and Health Administration **(OSHA)**
      1) Title 29 CFR 1926.1101 - Construction Standard for Asbestos
      2) Title 29 CFR 1926 Subpart E - Personal Protective Equipment and Life Saving Equipment
      3) Title 29 CFR 1910.134 - Respiratory Protection
      4) Title 29 CFR 1926 - Construction Industry Standards
      5) Title 29 CFR 1926.33 - Access to Employee Exposure and Medical Records
      6) Title 29 CFR 1926.59 same as 1910.1200 - Hazard Communication

7) Title 29 CFR 1926 Subpart C – General Safety and Health Provisions and Subpart D – Occupational Health and Environmental Controls

b. Environmental Protection Agency **(EPA)**:

1) 40 CFR 61 Subpart M - National Emission Standard for Hazardous Air Pollutants - Asbestos.

2) 40 CFR 763 - Asbestos Hazard Emergency Response Act (AHERA) and Asbestos Hazard Abatement Reauthorization Act (ASHARA)

c. Department of Transportation **(DOT)**

1) Title 49 CFR 171 - 180 – Transportation

D. State Requirements:

1. State requirements that apply to the asbestos abatement work, disposal, clearance, etc., include, but are not limited to, the following:

PART 1 - New York State Department of Health (NYSDOH)

1. 10 NYCRR, Part 73, “Asbestos Safety Program Requirements”

PART 2 - New York State Department of Labor (NYSDOL)

1. 12 NYCRR, Part 56, “Asbestos”-Industrial Code Rule 56

PART 3 - New York State Department of Environmental Conservation (NYSDEC)

1. 6 NYCRR, Part 360 “Solid Waste Management Facilities”

2. 6 NYCRR, Part 364 “Waste Transporter Permits”

3. 6 NYCRR, Part 372 “Hazardous Waste Manifest System and Related Standards for Generators, Transporters and Facilities F1

E. Local Requirements:

1. If local requirements are more stringent than federal or state standards, the local standards are to be followed.

F. Standards:

1. Standards which govern asbestos abatement activities include, but are not limited to, the following:

a. American National Standards Institute (ANSI)/ASSP Z9.2-2018 - Fundamentals Governing the Design and Operation of Local Exhaust Systems and ANSI/ASSE Z88.2-2015 - Practices for Respiratory Protection.

b. Underwriters Laboratories (UL) 586-2009 - UL Standard for Safety of HEPA Filter Units, 9th Edition; ANSI Approval 2017-12-19.

2. Standards which govern encapsulation work include, but are not limited to the following:

a. American Society for Testing and Materials International(ASTM)

3. Standards which govern the fire and safety concerns in abatement work include, but are not limited to, the following:

a. National Fire Protection Association (NFPA) 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations.

b. NFPA 701 - Standard Methods for Fire Tests for Flame Resistant Textiles and Film.

c. NFPA 101 - Life Safety Code

G. EPA Guidance Documents:

1. EPA guidance documents which discuss asbestos abatement work activities are listed below. These documents are made part of this section by reference.

2. Guidance for Controlling ACM in Buildings (Purple Book) EPA 560/5-85-024

3. Asbestos Waste Management Guidance EPA 530-SW-85-007

4. A Guide to Respiratory Protection for the Asbestos Abatement Industry EPA-560-OPTS-86-001

5. Guide to Managing Asbestos in Place (Green Book) TS 799 20T July 1990

H. Notices:

1. State and Local agencies: Send written notification as required by State and Local regulations including the Local fire department prior to beginning any work on ACM as follows:

2. Copies of notifications shall be submitted to the VA for the facility's records in the same time frame notification are given to EPA, State, and Local authorities.

I. Permits/Licenses: The contractor shall apply for and have all required permits and licenses to perform asbestos abatement work as required by Federal, State, and Local regulations.

SPEC WRITER NOTE: Permits and/or licenses may be required by authorities to perform asbestos abatement work. Indicate here any such requirements.

J. Posting and Filing of Regulations: Maintain two (2) copies of applicable Federal, State, and Local regulations. Post one copy of each at the regulated area where workers will have daily access to the regulations and keep another copy in the Contractor's office.

K. VA Responsibilities prior to commencement of work:

1. Notify occupants adjacent to regulated areas of project dates and requirements for relocation, if needed. Arrangements must be made prior to starting work for relocation of desks, files, equipment and personal possessions to avoid unauthorized access into the regulated area. **Note: Notification of adjacent personnel is required by OSHA in 29 CFR 1926.1101 (k) to prevent unnecessary or unauthorized access to the regulated area**.
2. Submit to the Contractor results of background air sampling; including location of samples, person who collected the samples, equipment utilized, calibration data and method of analysis. During abatement, submit to the Contractor, results of bulk material analysis and air sampling data collected during the course of the abatement. This information shall not release the Contractor from any responsibility for OSHA compliance.

L. Emergency Action Plan and Arrangements:

1. An Emergency Action Plan shall be developed prior to commencing abatement activities and shall be agreed to by the Contractor and the VA. The Plan shall meet the requirements of 29 CFR 1926, Subpart C, Standard 1926.35 Employee Emergency Action Plans.
2. Emergency procedures shall be in written form and prominently posted in the clean room and equipment room of the decontamination unit. Everyone, prior to entering the regulated area, must read and sign these procedures to acknowledge understanding of the regulated area layout, location of emergency exits and emergency procedures.
3. Emergency planning shall include written notification of police, fire, and emergency medical personnel of planned abatement activities; work schedule; layout of regulated area; and access to the regulated area, particularly barriers that may affect response capabilities.
4. Emergency planning shall include consideration of fire, explosion, hazardous atmospheres, electrical hazards, slips/trips and falls, confined spaces, and heat stress illness. Written procedures for response to emergency situations shall be developed and employee training in procedures shall be provided.
5. Employees shall be trained in regulated area/site evacuation procedures in the event of workplace emergencies.
   a. For non-life-threatening situations - employees injured or otherwise incapacitated shall be decontaminated following normal procedures with assistance from fellow workers, if necessary, before exiting the regulated area to obtain proper medical treatment.
   b. For life-threatening injury or illness, worker decontamination shall take least priority after measures to stabilize the injured worker, medical personnel shall remove them from the regulated area if back or neck injury is present, and secure proper medical treatment.
6. Telephone numbers of any/all emergency response personnel shall be prominently posted in the clean room, along with the location of the nearest telephone.
7. The Contractor shall provide verification of first aid/CPR training for personnel responsible for providing first aid/CPR. OSHA requires medical assistance within 3-4 minutes of a life-

threatening injury/illness. Bloodborne Pathogen training shall also be verified for those personnel required to provide first aid/CPR.

8. The Emergency Action Plan shall provide for a Contingency Plan in the event that an incident occurs that may require the modification of the standard operating procedures during abatement. Such incidents include, but are not limited to, fire; accident; power failure; negative pressure failure; and supplied air system failure. The Contractor shall detail procedures to be followed in the event of an incident assuring that asbestos abatement work is stopped and wetting is continued until correction of the problem.

M. Pre-Construction Meeting:

1. Prior to commencing the work, the Contractor shall meet with the VA Certified Industrial Hygienist (VPIH/CIH) to present and review, as appropriate, the items following this paragraph. The Contractor's Competent Person(s) who will be on-site shall participate in the pre-start meeting. The pre-start meeting is to discuss and determine procedures to be used during the project. At this meeting, the Contractor shall provide:

   a. Proof of Contractor licensing.
   b. Proof the Competent Person(s) is trained and accredited and approved for working in this State. Verification of the experience of the Competent Person(s) shall also be presented.
   c. A list of all workers who will participate in the project, including experience and verification of training and accreditation.
   d. A list of and verification of training for all personnel who have current first-aid/CPR training. A minimum of one person per shift must have adequate training.
   e. Current medical written opinions for all personnel working on–site meeting the requirements of 29 CFR 1926.1101 (m).
   f. Current fit-tests for all personnel wearing respirators on-site meeting the requirements of 29 CFR 1926.1101 (h) and Appendix C.
   g. A copy of the Contractor's Asbestos Hazard Abatement Plan. In these procedures, the following information must be detailed, specific for this project.
      1) Regulated area preparation procedures;
      2) Notification requirements procedure of Contractor as required in 29 CFR 1926.1101 (d) Multi-Employer Worksites;
      3) Decontamination area set-up/layout and decontamination procedures for employees;
      4) Abatement methods/procedures and equipment to be used; and
      5) Personal protective equipment to be used.

h. At this meeting the Contractor shall provide all submittals as required.

i. Procedures for handling, packaging and disposal of asbestos waste.

j. Emergency Action Plan and Contingency Plan Procedures.

1.6 PROJECT COORDINATION

A. The following are the minimum administrative and supervisory personnel necessary for coordination of the work.

1. Personnel:

a. Administrative and supervisory personnel shall consist of a qualified Competent Person(s) as defined by OSHA in the Construction Standards and the Asbestos Construction Standard; Contractor Professional Industrial Hygienist and Industrial Hygiene Technicians. These employees are the Contractor's Representatives responsible for compliance with these specifications and all other applicable requirements.

b. Non-supervisory personnel shall consist of an adequate number of qualified personnel to meet the schedule requirements of the project. Personnel shall meet required qualifications. Personnel utilized on-site shall be pre-approved by the VA Representative. A request for approval shall be submitted for any person to be employed during the project giving the person's name; last four digits of social security number; qualifications; accreditation card with color picture if required by State; Certificate of Worker's Acknowledgment; and Affidavit of Medical Surveillance and Respiratory Protection and current Respirator Fit Test.

c. Minimum qualifications for Contractor and assigned personnel are:

1) The Contractor has conducted within the last three (3) years, three (3) projects of similar complexity and dollar value as this project; has not been cited and penalized for serious violations of Federal (and State or Local as applicable) EPA and OSHA asbestos regulations in the past three (3) years; has adequate liability/occurrence insurance for asbestos work as required by the State; is licensed in applicable State; has adequate and qualified personnel available to complete the work; has comprehensive standard operating procedures for asbestos work; has adequate materials, equipment and supplies to perform the work.

2) The Competent Person has four (4) years of abatement experience of which two (2) years were as the Competent Person on the project; meets the OSHA definition of a Competent Person; has been the Competent Person on two (2) projects of similar size and complexity as this project within the past three (3) years; has completed EPA AHERA/OSHA/State/Local training requirements/accreditation(s)

and refreshers; and has all required OSHA documentation related to medical and respiratory protection.

3) The Contractor Professional Industrial Hygienist/CIH (CPIH/CIH) shall have five (5) years of monitoring experience and supervision of asbestos abatement projects; has participated as senior IH on five (5) abatement projects, three (3) of which are similar in size and complexity as this project; has specialized EPA AHERA/OSHA training in asbestos abatement management, respiratory protection, waste disposal and asbestos inspection; has completed the NIOSH 582 Course or equivalent, Contractor/Supervisor course; and has appropriate medical/respiratory protection records/documentation.

4) The Abatement Personnel shall have completed the EPA AHERA/OSHA abatement worker course; have training on the standard operating procedures of the Contractor; has one year of asbestos abatement experience within the past three (3) years of similar size and complexity; has applicable medical and respiratory protection documentation; has certificate of training/current refresher and State accreditation/license.

d. All personnel shall be in compliance with OSHA construction safety training as applicable and submit certification.

1.7 RESPIRATORY PROTECTION

A. General - Respiratory Protection Program: The Contractor shall develop and implement a written Respiratory Protection Program (RPP) which is in compliance with OSHA requirements found at 29 CFR 1926.1101 and 29 CFR 1910.134. ANSI Standard Z88.2-2015 provides excellent guidance for developing a respiratory protection program. All respirators used must be NIOSH approved for asbestos abatement activities. The written RPP shall, at a minimum, contain the basic requirements found at 29 CFR 1910.134 (c) - Respiratory Protection Program.

B. Respiratory Protection Program Coordinator: The Respiratory Protection Program Coordinator (RPPC) must be identified and shall have two (2) years of experience coordinating RPP of similar size and complexity. The RPPC must submit a signed statement attesting to the fact that the program meets the above requirements.

C. Selection and Use of Respirators: The procedure for the selection and use of respirators must be submitted to the VA as part of the Contractor's qualifications. The procedure must be written clearly enough for workers to understand. A copy of the Respiratory Protection Program must be available in the clean room of the decontamination unit or in the onsite Contractor’s office, for reference by employees or authorized visitors.

D. Minimum Respiratory Protection: Minimum respiratory protection shall be a ½-mask negative pressure air purifying respirator equipped with P100 filters, provided personal air samples in the workplace remain at or below 0.1 f/cc, determined as an 8-hour TWA. Full

face powered air purifying respirator equipped with P100 filters shall be required until Contractor demonstrates that personal air samples are at or below 0.1 f/cc, determined as an 8-hour TWA. A higher level of respiratory protection shall be required, if fiber levels exceed 1 f/cc as an 8-hour TWA, inside the regulated work area. Respirator selection shall meet the requirements of 29 CFR 1926.1101 (h) and 29 CFR 1910.134 (d)(3)(i)(A) Table 1, except as indicated in this paragraph. Abatement personnel must have a respirator for their exclusive use.

E. Medical Written Opinion: No employee shall be allowed to wear a respirator unless a physician or other licensed health care professional has provided a written determination they are medically qualified to wear the class of respirator to be used on the project while wearing whole body impermeable garments and subjected to heat or cold stress.

F. Respirator Fit Test: All personnel wearing respirators shall have a current qualitative/quantitative fit test which was conducted in accordance with 29 CFR 1910.134 (f) and Appendix A. Quantitative fit tests shall be done for PAPRs which have been put into a motor/blower failure mode.

G. Respirator Fit Check: The Competent Person shall assure that the positive/negative pressure user seal check is done each time the respirator is donned by an employee. Head coverings must cover respirator head straps. Any situation that prevents an effective facepiece to face seal as evidenced by failure of a user seal check shall preclude that person from entering the regulated area until resolution of the problem.

H. Maintenance and Care of Respirators: The Respiratory Protection Program Coordinator shall submit evidence and documentation showing compliance with 29 CFR 1910.134 (h) Maintenance and care of respirators.

1.8 WORKER PROTECTION

A. Training of Abatement Personnel: Prior to beginning any abatement activity, all personnel shall be trained in accordance with OSHA 29 CFR 1926.1101 (k)(9) and any additional State/Local requirements. Training must include, at a minimum, the elements listed at 29 CFR 1926.1101 (k)(9)(viii). Training shall have been conducted by a third party, EPA/State approved trainer meeting the requirements of EPA 40 CFR 763 Appendix C (AHERA MAP). Initial training certificates and current refresher and accreditation proof must be submitted for each person working at the site.

B. Medical Examinations: Medical examinations meeting the requirements of 29 CFR 1926.1101 (m) shall be provided for all personnel working in the regulated area, regardless of exposure levels. A current physician's written opinion as required by 29 CFR 1926.1101 (m)(4) shall be provided for each person and shall include in the medical opinion that the person has been evaluated for working in a heat and cold stress environment while wearing

personal protective equipment (PPE) and is able to perform the work without risk of material health impairment.

C. Personal Protective Equipment: Provide whole body clothing, head coverings, foot coverings and any other personal protective equipment as determined by conducting the hazard assessment required by OSHA at 29 CFR 1910.132 (d). The Competent Person shall ensure the integrity of personal protective equipment worn for the duration of the project. Duct tape shall be used to secure all suit sleeves to wrists and to secure foot coverings at the ankle.

D. Regulated Area Entry Procedure: The Competent Person shall ensure that each time workers enter the regulated area, they remove ALL street clothes in the clean room of the decontamination unit and put on new disposable coveralls, head coverings, a clean respirator, and then proceed through the shower room to the equipment room where they put on non-disposable required personal protective equipment.

E. Decontamination Procedure: The Competent Person shall require all personnel to adhere to following decontamination procedures whenever they leave the regulated area.

1. When exiting the regulated area, remove all disposable PPE and dispose of in a disposal bag provided in the regulated area.
2. Carefully decontaminate and clean the respirator. Put in a clean container/bag.

F. Regulated Area Requirements: The Competent Person shall meet all requirements of 29 CFR 1926.1101 (o) and assure that all requirements for Class II regulated areas at 29 CFR 1926.1101 (e) are met applicable to Class II work and this specification. All personnel in the regulated area shall not be allowed to eat, drink, smoke, chew tobacco or gum, apply cosmetics, or in any way interfere with the fit of their respirator.

1.9 DECONTAMINATION FACILITIES

A. Description: Provide each regulated area with a fiber drum with a disposal bag in it for personnel waste materials. The Competent Person shall provide a specific area at the outer boundary of the regulated area and designate it specifically for the decontamination of personnel and respirators.

B. Waste/Equipment Decontamination Area (W/EDA): The Competent Person shall provide a specific area in the regulated area designated for removal of all waste, equipment and contaminated material from the regulated area

C. Waste/Equipment Decontamination Procedures: Contain all waste in 6-mil poly bags or approved equivalent. Clean/decontaminate bags and pass through a double 6-mil flap doorway into another bag or fiber drum. Remove to disposal dumpster/gondola/enclosed vehicle

PART 2 - PRODUCTS, MATERIALS AND EQUIPMENT

2.1 MATERIALS AND EQUIPMENT

A. General Requirements: Prior to the start of work, the contractor shall provide and maintain a sufficient quantity of materials and equipment to assure continuous and efficient work throughout the duration of the project. Work shall not start unless the following items have been delivered to the site and the CPIH/CIH has submitted verification to the VA's Representative.

1. All materials shall be delivered in their original package, container or bundle bearing the name of the manufacturer and the brand name (where applicable).
2. Store all materials subject to damage off the ground, away from wet or damp surfaces and under cover sufficient enough to prevent damage or contamination. Flammable and combustible materials cannot be stored inside buildings. Replacement materials shall be stored outside of the regulated area until abatement is completed.
3. The Contractor shall not block or hinder use of buildings by patients, staff, and visitors to the VA in partially occupied buildings by placing materials/equipment in any unauthorized location.
4. The Competent Person shall inspect for damaged, deteriorating or previously used materials. Such materials shall not be used and shall be removed from the worksite and disposed of properly.
5. Critical penetration points into the building shall be sealed with 2-layers of 6-mil independently installed plastic sheeting (Polyethylene) secured in place at openings such as ducts, pipes, windows, louvers, penetrations or any other opening into the regulated area. A drop cloth of 1-layer of 6-mil plastic sheeting will be placed under the work area to capture falling debris and to facilitate clean-up. Fire retardant poly shall be used throughout.
6. The method of attaching polyethylene sheeting shall be agreed upon in advance by the Contractor and the VA and selected to minimize damage to equipment and surfaces. Method of attachment may include any combination of moisture resistant duct tape, poly tape, furring strips, spray glue, staples, nails, screws, lumber and plywood for enclosures or other effective procedures capable of sealing polyethylene to dissimilar finished or unfinished surfaces under both wet and dry conditions.
7. Polyethylene sheeting utilized for the PDF, if used, shall be opaque white or black in color, 6-mil fire retardant poly.
8. Installation and plumbing hardware, showers, hoses, drain pans, sump pumps and waste water filtration system shall be provided by the Contractor.
9. An adequate number of HEPA vacuums, scrapers, sprayers, nylon brushes, brooms, disposable mops, rags, sponges, staple guns, shovels, ladders and scaffolding of suitable height and length as well as meeting OSHA requirements, fall protection devices, water

hose to reach all areas in the regulated area, airless spray equipment, and any other tools, materials or equipment required to conduct the abatement project. All electrically operated hand tools, equipment, electric cords shall be connected to GFCI protection.

10. Special protection for objects in the regulated area shall be detailed (e.g., plywood over carpeting or hardwood floors to prevent damage from scaffolds, water and falling material).
11. Disposal bags – Materials shall be wrapped in 2-layers of 6-mil poly for Transite-type waste and shall be pre-printed with labels, markings and address as required by OSHA, EPA and DOT regulations. If necessary, materials may be boxed or otherwise packaged to prevent damage to Transite-type waste materials during transport. If boxed or otherwise packaged, appropriate labels shall be affixed to the outer layer of the final container.
12. The VA shall be provided an advance copy of the Safety Data Sheets (SDS) as required for all hazardous chemicals under OSHA 29 CFR 1910.1200 - Hazard Communication in the pre-project submittal. Chlorinated compounds shall not be used with any spray adhesive, mastic remover or other product. Appropriate encapsulant(s) shall be provided.
13. OSHA DANGER demarcation signs, as many and as required by OSHA 29 CFR 1926.1101(k)(7) shall be provided and placed by the Competent Person. All other posters and notices required by Federal and State and Local regulations shall be posted at the outer boundary of the regulated area or approved equivalent.
14. Adequate and appropriate PPE for the project and number of personnel/shifts shall be provided. All personal protective equipment issued must be based on a written hazard assessment conducted under 29 CFR 1910.132(d).

2.2 CONTAINMENT BARRIERS AND COVERINGS IN THE REGULATED AREA

A. General:

1. Using critical barriers, seal off the regulated area to completely isolate the regulated area from adjacent spaces. All penetrations to the regulated area must be covered with 2-layers of 6-mil fire retardant poly to prevent contamination and to facilitate clean-up. Should adjacent areas become contaminated, immediately stop work and clean up the contamination at no additional cost to the Government. Provide firestopping and identify all fire barrier penetrations due to abatement work as specified in Section 2.2.7; FIRESTOPPING.
2. Place all tools, scaffolding, materials and equipment needed for working in the regulated area prior to erecting any plastic sheeting. All uncontaminated removable furniture, equipment and/or supplies shall be removed by the VA from the regulated area before commencing work. Any objects remaining in the regulated area shall be completely covered with 2-layers of 6-mil fire retardant poly sheeting and secured with duct tape. Lock out and tag out any HVAC/electrical systems in the regulated area.

B. Controlling Access to the Regulated Area: Access to the regulated area is allowed only through the personnel decontamination facility (PDF), if required. All other means of access shall be eliminated and OSHA DANGER demarcation signs posted as required by OSHA. If the regulated area is adjacent to or within view of an occupied area, provide a visual barrier of 6-mil opaque fire retardant poly sheeting to prevent building occupant observation. If the adjacent area is accessible to the public, the barrier must be solid.

C. Critical Barriers: Completely separate any operations in the regulated area from adjacent areas using 2-layers of 6-mil fire retardant poly and duct tape. Individually seal with 2-layers of 6-mil poly and duct tape all HVAC openings into the regulated area. Individually seal all lighting fixtures, clocks, doors, windows, convectors, speakers, or any other objects/openings in the regulated area. Heat must be shut off any objects covered with poly.

D. Secondary Barriers: A loose layer of 6-mil poly shall be used as a drop cloth to protect the primary layers from debris generated during the abatement. This layer shall be replaced as needed during the work.

E. Extension of the Regulated Area: If the enclosure of the regulated area is breached in any way that could allow contamination to occur, the affected area shall be included in the regulated area and constructed as per this section. Decontamination measures must be started immediately and continue until air monitoring indicates background levels are met.

F. Firestopping:

1. Through penetrations caused by cables, cable trays, pipes, ducts, sleeves, conduits, etc. must be firestopped with a fire-rated firestop system providing an air tight seal.
2. Firestop materials that are not equal to the wall or ceiling penetrated shall be brought to the attention of the VA Representative. The contractor shall list all areas of penetration, the type of sealant used, and whether or not the location is fire rated. Any discovery of penetrations during abatement shall be brought to the attention of the VA Representative immediately. All walls, floors and ceilings are considered fire rated unless otherwise determined by the VA Representative or Fire Marshall.
3. Any visible openings whether or not caused by a penetration shall be reported by the Contractor to the VA Representative for a sealant system determination. Firestops shall meet ASTM E814 and UL 1479 requirements for the opening size, penetrant, and fire rating needed.

2.3 MONITORING, INSPECTION AND TESTING

A. General:

1. Perform throughout abatement work monitoring, inspection and testing inside and around the regulated area in accordance with the OSHA requirements and these specifications. OSHA requires that the employee exposure to asbestos must not exceed 0.1 fibers per cubic centimeter (f/cc) of air, averaged over an 8-hour work shift. The CPIH/CIH is responsible for

and shall inspect and oversee the performance of the Contractor IH Technician. The IH Technician shall continuously inspect and monitor conditions inside the regulated area to ensure compliance with these specifications. In addition, the CPIH/CIH shall personally manage air sample collection, analysis, evaluation for personnel, and regulated area.Additional inspection and testing requirements are also indicated in other parts of this specification.

2. The VA will employ an independent industrial hygienist (VPIH/CIH) consultant and/or use its own IH to perform various services on behalf of the VA. The VPIH/CIH will perform the necessary monitoring, inspection, testing, and other support services to ensure that VA patients, employees, and visitors will not be adversely affected by the abatement work, and that the abatement work proceeds in accordance with these specifications, that the abated areas or abated buildings have been successfully decontaminated. The work of the VPIH/CIH consultant in no way relieves the Contractor from their responsibility to perform the work in accordance with contract/specification requirements, to perform continuous inspection, monitoring and testing for the safety of their employees, and to perform other such services as specified. The cost of the VPIH/CIH and their services will be borne by the VA except for any repeat of final inspection and testing that may be required due to unsatisfactory initial results. Any repeated final inspections and/or testing, if required, will be paid for by the Contractor.
3. If fibers counted by the VPIH/CIH during abatement work, either inside or outside the regulated area, utilizing the NIOSH 7400 air monitoring method, exceed the specified respective limits, the Contractor shall stop work. The Contractor may request confirmation of the results by analysis of the samples by TEM. Request must be in writing and submitted to the VA's Representative. Cost for the confirmation of results will be borne by the Contractor for both the collection and analysis of samples and for the time delay that may/does result for this confirmation. Confirmation sampling and analysis will be the responsibility of the CPIH/CIH with review and approval of the VPIH/CIH. An agreement between the CPIH/CIH and the VPIH/CIH shall be reached on the exact details of the confirmation effort, in writing, including such things as the number of samples, location, collection, quality control on-site, analytical laboratory, interpretation of results and any follow-up actions. This written agreement shall be co-signed by the IH's and delivered to the VA's Representative.

B. Scope of Services of the VPIH/CIH Consultant:

1. The purpose of the work of the VPIH/CIH is to: assure quality; adherence to the specification; resolve problems; prevent the spread of contamination beyond the regulated area; and assure clearance at the end of the project. In addition, their work includes performing the final inspection and testing to determine whether the regulated area or building has been

adequately decontaminated. All air monitoring is to be done utilizing PCM/TEM. The VPIH/CIH will perform the following tasks:

a. Task 1: Establish background levels before abatement begins by collecting background samples. Retain samples for possible TEM analysis.
b. Task 2: Perform representative air monitoring, inspection, and testing outside the regulated area during actual abatement work to detect any faults in the regulated area isolation and any adverse impact on the surroundings from regulated area activities.
c. Task 3: Perform unannounced visits to spot check overall compliance of work with contract/specifications. These visits may include any inspection, monitoring, and testing inside and outside the regulated area and all aspects of the operation except personnel monitoring.
d. Task 4: Provide support to the VA Representative such as evaluation of submittals from the Contractor, resolution of conflicts, interpret data, etc.
e. Task 5: Perform, in the presence of the VA Representative, final inspection and testing of a decontaminated regulated area at the conclusion of the abatement to certify compliance with all regulations and VA requirements/specifications.
f. Task 6: Issue certificate of decontamination for each regulated area and project report.

2. All documentation, inspection results and testing results generated by the VPIH/CIH will be available to the Contractor for information and consideration. The Contractor shall cooperate with and support the VPIH/CIH for efficient and smooth performance of their work.
3. The monitoring and inspection results of the VPIH/CIH will be used by the VA to issue any Stop Removal orders to the Contractor during abatement work and to accept or reject a regulated area or building as decontaminated.

C. Monitoring, Inspection and Testing by Contractor CPIH/CIH: The Contractor's CPIH/CIH is responsible for managing all monitoring, inspections, and testing required by these specifications, as well as any and all regulatory requirements adopted by these specifications. The CPIH/CIH is responsible for the continuous monitoring of all subsystems and procedures which could affect the health and safety of the Contractor's personnel. Safety and health conditions and the provision of those conditions inside the regulated area for all persons entering the regulated area is the exclusive responsibility of the Contractor/Competent Person. The person performing the personnel and area air monitoring inside the regulated area shall be an IH Technician, who shall be trained and shall have specialized field experience in sampling and analysis. The IH Technician shall have successfully completed a NIOSH 582 Course or equivalent and provide documentation. The IH Technician shall participate in the AIHA Asbestos Analysis Registry or participate in the

Proficiency Analytical Testing program of AIHA for fiber counting quality control assurance. The IH Technician shall also be an accredited EPA AHERA/State Contractor/Supervisor and Building Inspector. The IH Technician shall have participated in five abatement projects collecting personal and area samples and have experience in substantially similar projects in size and scope. The analytical laboratory used by the Contractor to analyze the samples shall be AIHA accredited for asbestos PAT and approved by the VA prior to start of the project. A daily log shall be maintained by the CPIH/CIH or IH Technician, documenting all OSHA requirements for personal and area air monitoring for asbestos in 29 CFR 1926.1101 (f), (g) and Appendix A. This log shall be made available to the VA Representative and the VPIH/CIH upon request. The log will contain, at a minimum, information on personnel or area samples, other persons represented by the sample, the date of sample collection, start and stop times for sampling, sample volume, flow rate, and fibers/cc. The CPIH/CIH shall collect and analyze samples for each Representative job being done in the regulated area, i.e., removal, wetting, clean-up, and load-out. The CPIH/CIH shall personally manage air sample collection, analysis, and evaluation for personnel. In addition to the continuous monitoring required, the CPIH/CIH will perform inspection and testing at the final stages of abatement for each regulated area as specified in the CPIH/CIH responsibilities.

2.4 ASBESTOS HAZARD ABATEMENT PLAN

A. The Contractor shall have an established Asbestos Hazard Abatement Plan (AHAP) in printed form and loose leaf folder consisting of simplified text, diagrams, sketches, and pictures that establish and explain clearly the ways and procedures to be followed during all phases of the work by the contractor's personnel. The AHAP(s) must be modified as needed to address specific requirements of the project. The AHAP shall be submitted for review and approval prior to the start of any abatement work. The minimum topics and areas to be covered by the AHAP(s) are:

1. Minimum Personnel Qualifications
2. Emergency Action Plan and Arrangements
3. Security and Safety Procedures
4. Respiratory Protection/Personal Protective Equipment Program and Training
5. Medical Surveillance Program and Recordkeeping
6. Regulated Area Requirements for Class II work
7. Decontamination Facilities and Entry/Exit Procedures (PDF and W/EDF)
8. Monitoring, Inspections, and Testing
9. Removal Procedures for Class II Materials
10. Disposal of ACM Waste
11. Regulated Area Decontamination/Clean-up
12. Regulated Area Visual and Air Clearance

13. Project Completion/Closeout

2.5 SUBMITTALS

A. Pre-Start Meeting Submittals:

1. Submit to the VA a minimum of 14 days prior to the pre-start meeting the following for review and approval. Meeting this requirement is a prerequisite for the pre-start meeting for this project:
   a. Submit a detailed work schedule for the entire project reflecting contract documents and the phasing/schedule requirements from the CPM chart.
   b. Submit a staff organization chart showing all personnel who will be working on the project and their capacity/function. Provide their qualifications, training, accreditations, and licenses, as appropriate. Provide a copy of the "Certificate of Worker's Acknowledgment" and the "Affidavit of Medical Surveillance and Respiratory Protection" for each person.
   c. Submit Asbestos Hazard Abatement Plan developed specifically for this project, incorporating the requirements of the specifications, prepared, signed and dated by the CPIH/CIH.
   d. Submit the specifics of the materials and equipment to be used for this project with manufacturer names, model numbers, performance characteristics, pictures/diagrams, and number available for the following:
      1) Negative air machines, HEPA vacuums, air monitoring pumps, calibration devices, pressure differential monitoring device and emergency power generating system.
      2) Waste water filtration system, shower system, and containment barriers.
      3) Encapsulants, surfactants, hand held sprayers, airless sprayers, and fire extinguishers.
      4) Respirators, protective clothing, fall protection and other required personal protective equipment.
      5) Fire safety equipment to be used in the regulated area.
   e. Submit the name, location, and phone number of the approved landfill; proof/verification the landfill is approved for ACM disposal; the landfill's requirements for ACM waste; the type of vehicle to be used for transportation; and name, address, and phone number of subcontractor, if used. Proof of asbestos training for transportation personnel shall be provided.
   f. Submit required notifications and arrangements made with regulatory agencies having regulatory jurisdiction and the specific contingency/emergency arrangements made with local health, fire, ambulance, hospital authorities and any other notifications/arrangements.

g. Submit the name, location and verification of the laboratory and/or personnel to be used for analysis of air and/or bulk samples. Personal air monitoring must be done in accordance with OSHA 29 CFR 1926.1101(f) and Appendix A. Area or clearance air monitoring shall be conducted in accordance with EPA AHERA protocols.

h. Submit qualifications verification: Submit the following evidence of qualifications. Make sure that all references are current and verifiable by providing current phone numbers and documentation.

   1) Asbestos Abatement Company: Project experience within the past 3 years; listing projects first most similar to this project: Project Name; Type of Abatement; Duration; Cost; Reference Name/Phone Number; Final Clearance; and Completion Date
   2) List of project(s) halted by owner, A/E, IH, regulatory agency in the last 3 years: Project Name; Reason; Date; Reference Name/Number; Resolution
   3) List asbestos regulatory citations (e.g., OSHA), notices of violations (e.g., Federal and State and Local EPA), penalties, and legal actions taken against the company including and of the company's officers (including damages paid) in the last 3 years. Provide copies and all information needed for verification.

i. Submit information on personnel: Provide a resume; address each item completely; copies of certificates, accreditations, and licenses. Submit an affidavit signed by the CPIH/CIH stating that all personnel submitted below have medical records in accordance with OSHA 29 CFR 1926.1101(m) and that the company has implemented a medical surveillance program and written respiratory protection program, and maintains recordkeeping in accordance with the above regulations. Submit the phone number and doctor/clinic/hospital used for medical evaluations.

   1) CPIH/CIH and IH Technician: Name; years of abatement experience; list of projects similar to this one; certificates, licenses, accreditations for proof of AHERA/OSHA specialized asbestos training; professional affiliations; medical opinion; and current respirator fit test.
   2) Competent Person(s)/Supervisor(s): Number; names; last four digits of social security numbers; years of abatement experience as Competent Person/Supervisor; list of similar projects in size/complexity as Competent Person/Supervisor; as a worker; certificates, licenses, accreditations; proof of AHERA/OSHA specialized asbestos training; maximum number of personnel supervised on a project; medical opinion (asbestos surveillance and respirator use); and current respirator fit test.
   3) Workers: Numbers; names; last four digits of social security numbers; years of abatement experience; certificates, licenses, accreditations; training courses in

asbestos abatement and respiratory protection; medical opinion (asbestos surveillance and respirator use); and current respirator fit test.

j. Submit copies of State license for asbestos abatement; copy of insurance policy, including exclusions with a letter from agent stating in plain language the coverage provided and the fact that asbestos abatement activities are covered by the policy; copy of SOP's incorporating the requirements of this specification; information on who provides your training, how often; who provides medical surveillance, how often; who performs and how is personal air monitoring of abatement workers conducted; a list of references of independent laboratories/IH's familiar with your air monitoring and standard operating procedures; copies of monitoring results of the five referenced projects listed and analytical methods used.

k. Rented equipment must be decontaminated prior to returning to the rental agency.

l. Submit, before the start of work, the manufacturer's technical data for all types of encapsulants, all SDS and application instructions.

B. Submittals During Abatement:

1. The Competent Person shall maintain and submit a daily log at the regulated area documenting the dates and times of the following: purpose, attendees and summary of meetings; all personnel entering/exiting the regulated area; document and discuss the resolution of unusual events such as barrier breeching, equipment failures, emergencies, and any cause for stopping work; Representative air monitoring and results/TWAs/ELs. Submit this information daily to the VA’s Representative.

2. The CPIH/CIH shall document and maintain the inspection and approval of the regulated area preparation prior to start of work and daily during work.

   a. Removal of any poly barriers.

   b. Visual inspection/testing by the CPIH/CIH or IH Technician prior to application of lockdown encapsulant, if used.

   c. Packaging and removal of ACM waste from regulated area.

   d. Disposal of ACM waste materials; copies of Waste Shipment Records/landfill receipts to the VA's Representative on a weekly basis.

C. Submittals at Completion of Abatement: The CPIH/CIH shall submit a project report consisting of the daily log book requirements and documentation of events during the abatement project including Waste Shipment Records signed by the landfill's agent. It will also include information on the containment and transportation of waste from the containment with applicable Chain of Custody forms. The report shall include a certificate of completion, signed and dated by the CPIH/CIH, in accordance with Attachment #1. All clearance and perimeter area samples must be submitted. The VA Representative will retain

the abatement report after completion of the project and provide copies of the abatement report to VAMC Office of Engineer and the Safety Office.

PART 3 - EXECUTION

3.1 REGULATED AREA PREPARATIONS

A. Site Security:

1. Regulated area access is to be restricted only to authorized, trained/accredited and protected personnel. These may include the Contractor's employees, employees of Subcontractors, VA employees and Representatives, State and Local inspectors, and any other designated individuals. A list of authorized personnel shall be established prior to commencing the project and be posted in the clean room of the decontamination unit.
2. Entry into the regulated area by unauthorized individuals shall be reported immediately to the Competent Person by anyone observing the entry. The Competent person shall immediately notify the VA Representative.
3. A log book shall be maintained in the clean room of the decontamination unit. Anyone who enters the regulated area must record their name, affiliation, time in, and time out for each entry.
4. Access to the regulated area shall be through the PDF or approved equivalent. All other access (doors, windows, hallways, etc.) shall be sealed or locked to prevent entry to or exit from the regulated area. The only exceptions for this requirement are the waste/equipment load-out area which shall be sealed except during the removal of containerized asbestos waste from the regulated area, and emergency exits. Emergency exits shall <u>not</u> be locked from the inside or outside; however, they shall be sealed with poly sheeting and taped until needed.
5. The Contractor's Competent Person shall control site security during abatement operations in order to isolate work in progress and protect adjacent personnel. A 24-hour security system shall be provided at the entrance to the regulated area to assure that all entrants are logged in/out and that only authorized personnel are allowed entrance.
6. The Contractor will have the VA's assistance in notifying adjacent personnel of the presence, location and quantity of ACM in the regulated area and enforcement of restricted access by the VA's employees.
7. The regulated area shall be locked during non-working hours and secured by VA Representative or Competent Person. The VA Police shall be informed of asbestos abatement regulated areas to provide security checks during facility rounds and emergency response.

B. OSHA Danger Signs: Post OSHA DANGER signs meeting the specifications of OSHA 29 CFR 1926.1101 at any location and approaches to the regulated area where airborne concentrations of asbestos may exceed the PEL. Signs shall be posted at a distance

sufficiently far enough away from the regulated area to permit any personnel to read the sign and take the necessary measures to avoid exposure. Additional signs will be posted following construction of the regulated area enclosure.

C. Shut down - Lock Out Electric: Shut down and lock out/tag out electric power to the regulated area. Provide temporary power and lighting. Ensure safe installation including GFCI of temporary power sources and equipment by compliance with all applicable electrical code requirements and OSHA requirements for temporary electrical systems. Electricity shall be provided by the VA.

D. Shut Down and Lock Out HVAC:

1. Shut down and lock out/tag out heating, cooling, and air conditioning system **(HVAC)** components that are in, supply or pass through the regulated area.
2. Investigate the regulated area and agree on pre-abatement condition with the VA's Representative. Seal all intake and exhaust vents in the regulated area with duct tape and 2-layers of independently installed 6-mil poly. Also, seal any seams in system components that pass through the regulated area. Remove all contaminated HVAC system filters and place in labeled 6-mil poly disposal bags for disposal as asbestos waste.

E. Negative Pressure Filtration System:

1. The Contractor shall provide enough HEPA negative air machines to continuously maintain a negative pressure differential of -0.02 inch water column gauge (WCG) inside the regulated work area relative to adjacent non-work building areas. OSHA 29 CFR 1926.1101 (g)(5)(i)(A)(2) also requires at least four (4) air changes per hour. The Competent Person shall determine the number of units needed for the regulated area by dividing the cubic feet in the regulated area by 15 and then dividing that result by the cubic feet per minute (CFM) for each unit to determine the number of units needed to continuously maintain a negative pressure differential of -0.02 inch WCG. Provide standby units in the event of machine failure and/or emergency in an adjacent area. HEPA equipped negative air machines shall be discharged outside of the building a minimum of 30 feet from building make-up air, doors, open windows, patients, visitors and staff. Contractor shall provide “firewatch” when negative machines are operational when there is no active abatement.
2. NIOSH has done extensive studies and has determined that negative air machines typically operate at ~50 percent efficiency. The contractor shall consider this in their determination of number of units needed to provide -0.02 inch WCG. The contractor shall use 8 air changes per hour or double the number of machines, based on their calculations, or submit proof their machines operate at stated capacities, at a 2 inches pressure drop across the filters.

F. Containment Barriers and Coverings in the Regulated Area:

1. General: Using critical barriers, seal off the perimeter to the regulated area to completely isolate the regulated area from adjacent spaces. All surfaces in the regulated area must be

covered to prevent contamination and to facilitate clean-up. Should adjacent areas become contaminated as a result of the work, Contractor shall immediately stop work and clean up the contamination at no additional cost to the VA. Provide firestopping and identify all fire barrier penetrations due to abatement work as specified in Section 2.2.7; FIRESTOPPING.

2. Preparation Prior To Sealing: The Regulated Area: Place all tools, scaffolding, materials and equipment needed for working in the regulated area prior to erecting any plastic sheeting. All uncontaminated removable furniture, equipment and/or supplies shall be removed by the VA from the regulated area before commencing work. Any objects remaining in the regulated area shall be completely covered with 2-layers of 6-mil fire retardant poly sheeting and secured with duct tape. Lock out and tag out any HVAC/electrical systems in the regulated area.
3. Controlling Access to The Regulated Area: Access to the regulated area is allowed only through the personnel decontamination facility (PDF), if required. All other means of access shall be eliminated and OSHA DANGER demarcation signs posted as required by OSHA. If the regulated area is adjacent to, or within view of an occupied area, provide a visual barrier of 6-mil opaque fire retardant poly to prevent building occupant observation. If the adjacent area is accessible to the public, the barrier must be solid and capable of withstanding the negative pressure.

4. Critical Barriers: Completely separate any operations in the regulated area from adjacent areas using 2-layers of independently installed 6-mil fire retardant poly and duct tape. Individually seal with 2-layers of 6-mil poly and duct tape all HVAC openings into the regulated area. Individually seal all lighting fixtures, clocks, doors, windows, convectors, speakers, or any other objects/openings in the regulated area. Heat must be shut off any objects covered with poly.
5. Extension of the Regulated Area: If the enclosure of the regulated area is breached in any way that could allow contamination to occur, the affected area shall be included in the regulated area and constructed as per this section. If the affected area cannot be enclosed, decontamination measures and cleanup shall start immediately. All personnel shall be isolated from the affected area until decontamination/cleanup is completed as verified by visual inspection and air monitoring. Air monitoring at completion must indicate background levels.
6. Floor Barriers: If floor removal is not being done, all floors in the regulated area shall be covered with 2-layers of 6-mil fire retardant poly and brought up the wall 12 inches.

G. Personal Protective Equipment: Provide whole body clothing, head coverings, foot coverings and any other personal protective equipment as determined by conducting the hazard

assessment required by OSHA at 29 CFR 1910.132 (d). The Competent Person shall ensure the integrity of personal protective equipment worn for the duration of the project. Duct tape shall be used to secure all suit sleeves to wrists and to secure foot coverings at the ankle.

H. Sanitary Facilities: The Contractor shall provide sanitary facilities for abatement personnel and maintain them in a clean and sanitary condition throughout the abatement project.

I. Pre-Cleaning:

1. Pre-Cleaning Moveable Objects:
   a. Pre-cleaning of ACM contaminated items shall be performed after the enclosure has been erected and negative pressure has been established in the work area. After items have been pre-cleaned and decontaminated, they may be removed from the work area for storage until the completion of abatement in the work area. Pre-cleaning may not be required if Transite-type materials are in good condition and are the only ACM present.
   b. Pre-clean all movable objects within the regulated area using a HEPA filtered vacuum and/or wet cleaning methods as appropriate. After cleaning, these objects shall be removed from the regulated area and carefully stored in an uncontaminated location. Pre-cleaning may not be required if Transite-type materials are in good condition and are the only ACM present.
2. Pre-Cleaning Fixed Objects:
   a. Pre-cleaning of ACM contaminated items shall be performed after the enclosure has been erected and negative pressure has been established in the work area. Pre-cleaning may not be required if Transite-type materials are in good condition and are the only ACM present.
   b. Pre-clean all fixed objects in the regulated area using HEPA filtered vacuums and/or wet cleaning techniques as appropriate. Careful attention must be paid to machinery behind grills or gratings where access may be difficult but contamination may be significant. Also, pay particular attention to wall, floor and ceiling penetration behind fixed items. After pre-cleaning, enclose fixed objects with 2-layers of 6-mil poly and seal securely in place with duct tape. Objects (e.g., permanent fixtures, shelves, electronic equipment, laboratory tables, sprinklers, alarm systems, closed circuit TV equipment and computer cables) which must remain in the regulated area and that require special ventilation or enclosure requirements should be designated here along with specified means of protection. Contact the manufacturer for special protection requirements.

3. Pre-Cleaning Surfaces in the Regulated Area:
   a. Pre-cleaning of ACM contaminated items shall be performed after the enclosure has been erected and negative pressure has been established in the work area. Pre-

cleaning may not be required if flooring materials is in good condition and are the only ACM present.

b. Pre-clean all surfaces in the regulated area using HEPA filtered vacuums and/or wet cleaning methods as appropriate. Do not use any methods that would raise dust such as dry sweeping or vacuuming with equipment not equipped with HEPA filters. Do not disturb asbestos-containing materials during this pre-cleaning phase. Pre-cleaning may not be required if flooring materials is in good condition and are the only ACM present.

J. Pre-Abatement Activities:

1. Pre-Abatement Meeting: The VA Representative, upon receipt, review, and substantial approval of all pre-abatement submittals and verification by the CPIH that all materials and equipment required for the project are on the site, will arrange for a pre-abatement meeting between the Contractor, the CPIH, Competent Person, the VA Representative(s), and the VPIH/CIH. The purpose of the meeting is to discuss any aspect of the submittals needing clarification or amplification and to discuss any aspect of the project execution and the sequence of the operation. The Contractor shall be prepared to provide any supplemental information/ documentation to the VA's Representative regarding any submittals, documentation, materials or equipment. Upon satisfactory resolution of any outstanding issues, the VA's Representative will issue a written order to proceed to the Contractor. No abatement work of any kind described in the following provisions shall be initiated prior to the VA written order to proceed.

2. Pre-Abatement Inspections and Preparation:

a. Before any work begins on the construction of the regulated area, the Contractor will:

1) Conduct a space-by-space inspection with an authorized VA Representative and prepare a written inventory of all existing damage in those spaces where asbestos abatement will occur. Still or video photography may be used to supplement the written damage inventory. Document will be signed and certified as accurate by both parties.

2) The VA Representative, the Contractor, and the VPIH/CIH must be aware of AEQA 10-95 indicating the failure to identify asbestos in the areas listed as well as common issues when preparing specifications and contract documents. This is especially critical when demolition is planned, because AHERA surveys are non-destructive, and ACM may remain undetected. A NESHAP-compliant (destructive) ACM inspection shall be conducted on all building structures that will be demolished. Ensure the following areas are inspected on the project: Lay-in ceilings concealing ACM; ACM behind walls/windows from previous renovations; inside utility chases/walls; Transite-type piping/ductwork/sheets; behind radiators; lab fume hoods; Transite-type lab countertops; roofing materials; below window

sills; water/sewer lines; electrical conduit coverings; crawl spaces(previous abatement contamination); flooring/mastic covered by carpeting/new flooring; exterior insulated wall panels; on underground fuel tanks; steam line trench coverings.

3) Ensure that all furniture, machinery, equipment, curtains, drapes, blinds, and other movable objects required to be removed from the regulated area have been cleaned and removed or properly protected from contamination.

4) Shut down and seal with a minimum of 2-layers of independently installed 6-mil fire retardant poly all HVAC systems and critical openings in the regulated area. The regulated area critical barriers shall completely isolate the regulated area from any other air in the building. The VA's Representative will monitor the isolation provision.
5) Shut down and lock out in accordance with 29 CFR 1910.147 all electrical circuits which pose a potential hazard. Electrical arrangements will be tailored to the particular regulated area and the systems involved. All electrical circuits affected will be turned off at the circuit box outside the regulated area, not just the wall switch. The goal is to eliminate the potential for electrical shock which is a major threat to life in the regulated area due to water use and possible energized circuits. Electrical lines used to power equipment in the regulated area shall conform to all electrical safety standards and shall be isolated by the use of a ground fault circuit interrupter (GFCI). All GFCI shall be tested prior to use. The VA's Representative will monitor the electrical shutdown.
6) If required, remove and dispose of carpeting from floors in the regulated area.
7) Inspect existing firestopping in the regulated area. Correct as needed.

3. Pre-Abatement Construction and Operations:
   a. Perform all preparatory work for the first regulated area in accordance with the approved work schedule and with this specification.
   b. Upon completion of all preparatory work, the CPIH/CIH will inspect the work and systems and will notify the VA's Representative when the work is completed in accordance with this specification. The VA's Representative may inspect the regulated area and the systems with the VPIH/CIH and may require that upon satisfactory inspection, the Contractor's employees perform all major aspects of the approved AHAP(s), especially worker protection, respiratory systems, contingency plans, decontamination procedures, and monitoring to demonstrate satisfactory operation. The operational systems for

respiratory protection and the negative pressure system shall be demonstrated for proper performance.

c. The CPIH/CIH shall document the pre-abatement activities described above and deliver a copy to the VA's Representative.

d. Upon satisfactory inspection of the installation of and operation of systems, the VA's Representative will notify the Contractor in writing to proceed with the asbestos abatement work in accordance with this specification and all applicable regulations.

3.2 REMOVAL OF CLASS II TRANSITE-TYPE MATERIALS

A. General: All applicable requirements of OSHA, EPA, and DOT shall be followed during Class II work. Keep materials intact; do not break up materials; wet while working with it; wrap as soon as possible with 2-layers of 6-mil plastic for disposal, and maintain good housekeeping in work areas during abatement.

B.

C. Removal of Transite-Type:

1. All Transite-type must be wetted prior to removal. Unfasten Transite-type panels without disturbance. Keep Transite-type material intact to the extent feasible.
2. All waste must be wrapped in two layers of 6-mil poly and lowered carefully to the ground.
3. Materials may not be dropped from any height. Unless the material is carried or passed to the ground by hand, it shall be lowered to the ground via covered, dust-tight chute, crane or hoist.

3.3 DISPOSAL OF CLASS II WASTE MATERIAL

A. General: Dispose of waste ACM and debris which is packaged in accordance with these specifications, OSHA, EPA and DOT. The landfill requirements for packaging must also be met. Transport will be in compliance with 49 CFR 171–180 regulations. Disposal shall be done at an approved landfill in accordance with State and Local requirements, which are generally more restrictive than Federal EPA. Disposal of non-friable ACM shall be done in accordance with applicable State and Local regulations.

3.4 PROJECT DECONTAMINATION

A. General:

1. The entire work related to project decontamination shall be performed under the close supervision and monitoring of the CPIH/CIH.
2. If the asbestos abatement work is in an area which was contaminated prior to the start of abatement, the decontamination will be done by cleaning the primary barrier poly prior to its removal and cleanings of the surfaces of the regulated area after the primary barrier removal.
3. If the asbestos abatement work is in an area which was uncontaminated prior to the start of abatement, the decontamination will be done by cleaning the primary barrier poly prior to its

removal, thus preventing contamination of the building when the regulated area critical barriers are removed.

B. Regulated Area Clearance: Air testing and other requirements which must be met before release of the Contractor and re-occupancy of the regulated area space are specified in Final Testing Procedures.

C. Work Description: Decontamination includes the clearance air testing in the regulated area and the decontamination and removal of the enclosures/facilities installed prior to the abatement work including primary/critical barriers, PDF and W/EDF facilities, and negative pressure systems.

D. Pre-Decontamination Conditions:

1. Before decontamination starts, all ACM waste from the regulated area shall be removed, all waste collected and removed, and the secondary barrier of poly removal and disposed of along with any gross debris generated by the work.
2. At the start of decontamination, the following shall be in place:
   a. Critical barriers over all openings consisting of two layers of independently installed 6-mil poly which is the sole barrier between the regulated area and the rest of the building or outside.
   b. Decontamination facilities, if required for personnel and equipment in operating condition.

E. Cleaning: Carry out a first cleaning of all surfaces of the regulated area including items of remaining poly sheeting, tools, scaffolding, ladders/staging by wet methods and/or HEPA vacuuming. Do not use dry dusting/sweeping/air blowing methods. Use each surface of a wetted cleaning cloth one time only and then dispose of as contaminated waste. Continue this cleaning until there is no visible residue from abated surfaces or poly or other surfaces. Remove all filters in the air handling system and dispose of as ACM waste in accordance with these specifications. The negative pressure system shall remain in operation during this time. Additional cleaning(s) may be needed as determined by the CPIH/VPIH/CIH.

3.5 VISUAL INSPECTION AND AIR CLEARANCE TESTING

A. General: Notify the VA Representative 24 hours in advance for the performance of the final visual inspection and testing. The final visual inspection and testing will be performed by the VPIH/CIH after the cleaning.

B. Visual Inspection: Final visual inspection will include the entire regulated area, all poly sheeting, seals over HVAC openings, doorways, windows, and any other openings. If any debris, residue, dust or any other suspect material is detected, the cleaning shall be repeated at no additional cost to the VA. Dust/ material samples may be collected and analyzed at no additional cost to the VA at the discretion of the VPIH/CIH to confirm visual findings. When the regulated area is visually clean the final testing can be done.

C. Air Clearance Testing:

1. After an acceptable final visual inspection by the VPIH/CIH and VA Representative, the VPIH/CIH will perform the final clearance testing. Air samples will be collected and analyzed in accordance with procedures for AHERA and this specification. If work is less than 260 lf/160 sf/35 cf, 5 PCM samples shall be collected for clearance and a minimum of one field blank. If work is equal to or more than 260 lf/160 sf/35 cf, AHERA TEM sampling shall be performed for clearance. TEM analysis shall be done in accordance with procedures for EPA AHERA and this specification. If the release criteria are not met, the Contractor shall repeat the final cleaning and continue decontamination procedures until clearance is achieved. **All Additional inspection and testing costs will be borne by the Contractor**.
2. If release criteria are met, proceed to perform the abatement closeout and to issue the certificate of completion in accordance with these specifications.

D. Final Air Clearance Procedures:

1. Contractor's Release Criteria: Work in a regulated area is complete when the regulated area is visually clean and airborne fiber levels have been reduced to or below 0.01 f/cc as measured by the AHERA PCM protocol and $\leq$ 70 AHERA asbestos structures per square millimeter (s/mm^2) by AHERA TEM. No averaging of results will be used for this project. All five (5) TEM samples inside the regulated area shall be at or below 70 asbestos s/mm^2 to satisfy the project final clearance criteria.
   a. Air Monitoring and Final Clearance Sampling: To determine if the elevated airborne fiber counts encountered during abatement operations have been reduced to the specified level, the VPIH/CIH will secure samples and analyze them according to the following procedures:
      1) Fibers Counted: “Fibers” referred to in this section shall be either all fibers regardless of composition as counted in the NIOSH 7400 PCM method or asbestos fibers counted using the AHERA TEM method.
      2) Aggressive Sampling: All final air testing samples shall be collected using aggressive sampling techniques. Samples will be collected on 0.8µ MCE filters for PCM analysis and 0.45µ MCE for TEM. A minimum of 3850 Liters of air using calibrated sampling pumps shall be collected for PCM samples and a minimum of 1200 Liters of air using calibrated sampling pumps shall be collected for TEM clearance samples. Before pumps are started, initiate aggressive air mixing sampling as detailed in 40 CFR 763 Subpart E (AHERA) Appendix A (III)(B)(7)(d). Air samples will be collected in areas subject to normal air circulation away from corners, obstructed locations, and locations near windows, doors, or vents. After air sampling pumps have been shut off, circulating fans shall be shut off. The negative pressure system shall continue to operate.

3.6 ABATEMENT CLOSEOUT AND CERTIFICATE OF COMPLIANCE

A. Completion of Abatement Work:

1. After thorough decontamination, complete asbestos abatement work upon meeting the regulated area clearance criteria and fulfilling the following:
   a. Remove all equipment, materials, and debris from the project area.
   b. Package and dispose of all asbestos waste as required.
   c. Repair or replace all interior finishes damaged during the abatement work.
   d. Fulfill other project closeout requirements as specified elsewhere in this specification.

B. Certificate of Completion by Contractor: The CPIH shall complete and sign the "Certificate of Completion" in accordance with Attachment 1 at the completion of the abatement and decontamination of the regulated area.

C. Work Shifts:

1. All work shall generally be done during administrative hours (8:00 AM to 4:30 PM) Monday - Friday excluding Federal Holidays. Any change in the work schedule must be approved in writing by the VA Representative.
2. Workers will be provided with adequate washing and break area facilities located away from the containment site.

ATTACHMENT #1
CERTIFICATE OF COMPLETION

DATE: _____ VA Project #:_____

PROJECT NAME:_____ Abatement Contractor:_____

VAMC/ADDRESS:_____

1. I certify that I have personally inspected, monitored and supervised the abatement work of (specify regulated area or Building):
   which took place from / / to / /
2. That throughout the work all applicable requirements/regulations and the VA's specifications were met.
3. That any person who entered the regulated area was protected with the appropriate personal protective equipment and respirator and that they followed the proper entry and exit procedures and the proper operating procedures for the duration of the work.
4. That all employees of the Abatement Contractor engaged in this work were trained in respiratory protection, were experienced with abatement work, had proper medical surveillance documentation, were fit-tested for their respirator, and were not exposed at any time during the work to asbestos without the benefit of appropriate respiratory protection.
5. That I performed and supervised all inspection and testing specified and required by applicable regulations and VA specifications.
6. That the conditions inside the regulated area were always maintained in a safe and healthy condition and the maximum fiber count never exceeded 0.5 f/cc, except as described below.
7. That all abatement work was done in accordance with OSHA requirements and the manufacturer's recommendations.

CPIH/CIH Signature/Date:_____

CPIH/CIH Print Name:_____

Abatement Contractor Signature/Date:_____

Abatement Contractor Print Name:_____

ATTACHMENT #2
CERTIFICATE OF WORKER'S ACKNOWLEDGMENT

PROJECT NAME:_____DATE:_____

PROJECT ADDRESS:_____

ABATEMENT CONTRACTOR'S NAME:_____

WORKING WITH ASBESTOS CAN BE HAZARDOUS TO YOUR HEALTH. INHALING ASBESTOS HAS BEEN LINKED WITH VARIOUS TYPES OF CANCERS. IF YOU SMOKE AND INHALE ASBESTOS FIBERS, YOUR CHANCES OF DEVELOPING LUNG CANCER IS GREATER THAN THAT OF THE NON-SMOKING PUBLIC.

Your employer's contract with the owner for the above project requires that: You must be supplied with the proper personal protective equipment including an adequate respirator and be trained in its use. You must be trained in safe and healthy work practices and in the use of the equipment found at an asbestos abatement project. You must receive/have a current medical examination for working with asbestos. These things shall be provided at no cost to you. By signing this certificate of worker's acknowledgement you are indicating to the owner that your employer has met these obligations.

RESPIRATORY PROTECTION: I have been trained in the proper use of respirators and have been informed of the type of respirator to be used on the above indicated project. I have a copy of the written Respiratory Protection Program issued by my employer. I have been provided for my exclusive use, at no cost, with a respirator to be used on the above indicated project.

TRAINING COURSE: I have been trained by a third party, State/EPA accredited trainer in the requirements for an AHERA/OSHA Asbestos Abatement Worker training course, 32-hours minimum duration. I currently have a valid State accreditation certificate. The topics covered in the course include, as a minimum, the following:

Physical Characteristics and Background Information on Asbestos
Potential Health Effects Related to Exposure to Asbestos
Employee Personal Protective Equipment
Establishment of a Respiratory Protection Program
State of the Art Work Practices
Personal Hygiene
Additional Safety Hazards
Medical Monitoring
Air Monitoring
Relevant Federal, State and Local Regulatory Requirements, Procedures, and Standards
Asbestos Waste Disposal

MEDICAL EXAMINATION: I have had a medical examination within the past 12 months which was paid for by my employer. This examination included: health history, occupational history, pulmonary function test, and may have included a chest x-ray evaluation. The physician issued a positive written opinion after the examination.

Signature:_____

Printed Name:_____

Social Security Number:_____

Witness:_____

ATTACHMENT #3
AFFIDAVIT OF MEDICAL SURVEILLANCE, RESPIRATORY PROTECTION AND TRAINING/ACCREDITATION

VA PROJECT NAME AND NUMBER:_____

VA MEDICAL FACILITY:_____

ABATEMENT CONTRACTOR'S NAME AND ADDRESS:_____

1. I verify that the following individual
   Name:_____ Social Security Number:_____
   who is proposed to be employed in asbestos abatement work associated with the above project by the named Abatement Contractor, is included in a medical surveillance program in accordance with 29 CFR 1926.1101(m), and that complete records of the medical surveillance program as required by 29 CFR 1926.1101(m)(n) and 29 CFR 1910.20 are kept at the offices of the Abatement Contractor at the following address.
   Address:_____

2. I verify that this individual has been trained, fit-tested and instructed in the use of all appropriate respiratory protection systems and that the person is capable of working in safe and healthy manner as expected and required in the expected work environment of this project.

3. I verify that this individual has been trained as required by 29 CFR 1926.1101(k). This individual has also obtained a valid State accreditation certificate. Documentation will be kept on-site.

4. I verify that I meet the minimum qualifications criteria of the VA specifications for a CPIH.

Signature of CPIH/CIH:_____ Date:_____

Printed Name of CPIH/CIH:_____

Signature of Contractor:_____ Date:_____

Printed Name of Contractor:_____

ATTACHMENT #4
ABATEMENT CONTRACTOR/COMPETENT PERSON(S) REVIEW AND ACCEPTANCE OF THE VA'S ASBESTOS SPECIFICATIONS

VA Project Location:_____

VA Project #:_____

VA Project Description:_____

This form shall be signed by the Asbestos Abatement Contractor Owner and the Asbestos Abatement Contractor's Competent Person(s) prior to any start of work at the VA related to this Specification. If the Asbestos Abatement Contractor's/Competent Person(s) has not signed this form, they shall not be allowed to work on-site.

I, the undersigned, have read VA's Asbestos Specification regarding the asbestos abatement requirements. I understand the requirements of the VA's Asbestos Specification and agree to follow these requirements as well as all required rules and regulations of OSHA/EPA/DOT and State/Local requirements.

I have been given ample opportunity to read the VA's Asbestos Specification and have been given an opportunity to ask any questions regarding the content and have received a response related to those questions. I do not have any further questions regarding the content, intent and requirements of the VA's Asbestos Specification.

At the conclusion of the asbestos abatement, I will certify that all asbestos abatement work was done in accordance with the VA's Asbestos Specification and all ACM was removed properly and no fibrous residue remains on any abated surfaces.

Abatement Contractor Owner's Signature_____Date_____

- - - E N D - - -

SECTION 02 83 33.13

LEAD-BASED PAINT REMOVAL AND DISPOSAL

.

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Existing Conditions:
2. Removal and disposal of lead-based paint (LBP) at interior locations indicated in existing conditions listed below

Summary of Lead Based Paint

Sample ID	Color	Substrate	Location
Bldg14 – 01	Blue	Plaster	Throughout Interior
Bldg14 – 04	White	Drywall	
Bldg14 – 06	Beige	Drywall	
Bldg14 – 07	Light Green	CMU Block	
Bldg14 – 09	Green and Blue	Drywall	
Bldg14 – 10	Light Green	CMU Block	
Bldg14 - 11	Red/Grey	Concrete	

1.2 RELATED WORK

A. Section 02 82 11 TRADITIONAL ASBESTOS ABATEMENT

B. Section 02 41 00, DEMOLITION: Demolition Disturbing Lead-Based Paint.

C. Section 09 91 00, PAINTING: Surface Preparation Disturbing Lead-Based Paint.

1.3 DEFINITIONS

A. Action Level: Employee exposure, without regard to use of respirator, to an airborne lead concentration of 30 micrograms(μ) per cubic meter (m^3) of air determined as an 8-hour Time-Weighted Average (TWA). As used in this section, ”30 micrograms per cubic meter of air" refers to OSHA 29 CFR 1926.62 Lead in Construction Action Level (AL).

B. Area Monitoring: Sampling of lead concentrations within lead control area and inside physical boundaries which are representative of airborne lead concentrations which may reach breathing zone of personnel potentially exposed to lead.

C. Breathing Zone: Area within hemisphere, forward of shoulders, with 150 mm to 225 mm (6 to 9 inches) radius and center at nose or mouth of employee.

D. Certified Industrial Hygienist (CIH): As used in this section, refers to an Industrial Hygienist Certified in the Comprehensive Practice of Industrial Hygiene by the American Board of Industrial Hygiene and Board for Global EHS Credentialing, employed by Contractor.

E. Change Rooms and Shower Facilities: Rooms within designated physical boundary around lead control area equipped with separate storage facilities for clean protective work clothing and equipment and for street clothes which prevents cross contamination.

F. Competent Person: Person capable of identifying lead hazards in work area and authorized by contractor to take corrective action. Meets the OSHA definition of Competent Person.

G. Decontamination Room: Room for removal of contaminated personal protective equipment (PPE).

H. Eight-Hour Time Weighted Average (TWA): Airborne concentration of lead averaged over 8-hour workday to which an employee is exposed.

I. High Efficiency Particulate Air (HEPA) Filter Equipment: HEPA filtered vacuuming equipment with UL 586 filter system capable of collecting and retaining lead-contaminated paint dust. HEPA filter means 99.97 percent efficient against 0.3 micron (0.012 mil) size particles.

J. Lead: Metallic lead, inorganic lead compounds, and organic lead soaps. Excluded from this definition are other organic lead compounds.

K. Lead Control Area: Enclosed area or structure with full containment to prevent spreading lead dust, paint chips, and debris from lead-based paint removal operations. Lead control area is isolated by physical boundaries to prevent unauthorized entry of personnel.

L. Lead Permissible Exposure Limit (PEL): Fifty micrograms per cubic meter of air (50 $\mu g/m^3$) determined as an 8-hour TWA as determined by 29 CFR Part 1926.62. When employee is exposed for more than 8-hours per work day, determine PEL by the following formula. PEL micrograms/cubic meter (parts per million) of air = 400/No. of hrs. worked per day.

M. Personnel Monitoring: Sampling of lead concentrations within employee breathing zone to determine 8-hour time weighted average concentration according to 29 CFR Part 1926.62. Take samples that are representative of the various employee's work tasks.

N. Physical Boundary: Area physically roped or partitioned off around enclosed lead control area to limit unauthorized entry of personnel. As used in this section, "inside boundary" shall mean same as "outside lead control area."

1.4 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. American National Standards Institute (ANSI):

Z9.2-2018	Fundamentals Governing the Design & Operation of Local Exhaust Ventilation Systems.

C. Code of Federal Regulations (CFR):

29 CFR Part 1910	Occupational Safety and Health Standards.
29 CFR Part 1926	Safety and Health Regulations for Construction.
40 CFR Part 260	Hazardous Waste Management System: General.
40 CFR Part 261	Identification and Listing of Hazardous Waste.
40 CFR Part 262	Standards Applicable to Generators of Hazardous Waste.
40 CFR Part 263	Standards Applicable to Transporters of Hazardous Waste.
40 CFR Part 264	Standards for Owners and Operations of Hazardous Waste Treatment, Storage, and Disposal Facilities.

40 CFR Part 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities.
40 CFR Part 268	Land Disposal Restrictions.
49 CFR Part 172	Hazardous Material Table, Special Provisions, Hazardous Material Communications, Emergency Response Information, and Training Requirements, and Security Plans.
49 CFR Part 178	Specifications for Packaging.

D. Underwriters Laboratories (UL):

586-09	High-Efficiency, Particulate, Air Filter Units.

1.5 PRE-REMOVAL MEETINGS

Conduct pre-removal meeting at project site at a minimum 30 days before beginning Work of this section.

1. Required Participants:
   a. Contracting Officer's Representative.
   b. Certified Industrial Hygienist.
   c. Architect/Engineer.
   d. Inspection and Testing Agency.
   e. Contractor.
   f. Paint removal contractor.
   g. Other installers responsible for finishing resulting surfaces.

2. Meeting Agenda: Distribute agenda to participants at a minimum 3 days before meeting.
   a. Respiratory protection program.
   b. Hazard communication program.
   c. Hazardous waste management plan.
   d. Safety and health regulation compliance.
   e. Employee training.
   f. Removal schedule.
   g. Removal sequence.
   h. Preparatory work.
   i. Protection before, during, and after removal.
   j. Removal.
   k. Inspecting and testing.
   l. Other items affecting successful completion.
3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.6 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:
   1. Description of each product.
      a. Paint removal products.
      b. Vacuum filters.
      c. Respirators.
   2. Safety Data Sheet for each paint removal product.
   3. Installation instructions.
      a. Paint removal products.

C. Test Reports: Submit testing laboratory reports.

1. Submit air monitoring results within three working days, signed by testing laboratory employee performing air monitoring, employee analyzing sample, and CIH.

D. Certificates: Certify completed lead training.
   1. Submit certificate for each employee signed and dated by CIH and employee stating employee was trained.

E. Qualifications: Substantiate qualifications comply with specifications.
   1. Paint removal contractor.
   2. Testing laboratory.
      a. Name, address, and telephone number.
      b. Current evidence of participation in American Industrial Hygiene Association (AIHA) Laboratory Accreditation Program (LAP), LLC, Environmental Lead Laboratory Accreditation Program (ELLAP).
      c. Copy of current AIHA accreditation certificate.
   3. Industrial hygienist.
      a. Name, address, and telephone number.
      b. Resume showing previous experience.
      c. Copy of current ABIH CIH certification.
   4. Paint disposal facility.
      a. Name, address, and telephone number.
      b. Current license or authorization to receive and dispose lead contaminated waste.

F. Record Documents:

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   1. Completed and signed hazardous waste manifest from waste transporter.
   2. Toxicity Characteristic Leaching Procedure (TCLP) test results to determine if waste is hazardous.
   3. Paint disposal facility receipts and disposition reports.
   4. Certification of medical examinations.
   5. Medical Opinion that employee is qualified to wear a respirator, that employees has been trained and fit tested for the respirator.
   6. Employee training certification.

1.7 A. Safety and Health Regulation Compliance:

1. Comply with laws, ordinances, rules, and regulations of federal, state, and local authorities having jurisdiction regarding removing, handling, storing, transporting, and disposing lead waste materials.

a. Comply with applicable requirements of 29 CFR Part 1910.1025.

b. Notify Contracting Officer's Representative and request resolution of conflicts between regulations and specified requirements before starting work.

2. Comply with the following local laws, ordinances, criteria, rules and regulations regarding removing, handling, storing, transporting, and disposing lead-contaminated materials:

New York State Department of Environmental Conservation (DEC) 6 NYCRR:

a. Part 360 Solid Waste Management Facilities.

b. Part 364 Waste Transporter Permits.

c. Part 370 Hazardous Waste Management System-General.

d. Part 371 Identification and Listing of Hazardous Wastes.

e. Part 372 Hazardous Waste Manifest System and Related Standards for Generators, Transporters and Facilities.

f. Part 373 Hazardous Waste Management Facilities.

g. Part 376 Land Disposal Restrictions

1.8

A. Paint Removal Contractor: Experienced contractor, registered or licensed by applicable state agency regulating lead-based paint removal.

B. Testing Laboratory: State certified independent testing laboratory experienced in airborne lead monitoring, testing, and reporting.
   1. Successful participant in American Industrial Hygiene Association (AIHA) Laboratory Accreditation Program (LAP), LLC, Environmental Lead Laboratory Accreditation Program (ELLAP).

C. Certified Industrial Hygienist: Certified as CIH by American Board of Industrial Hygiene in comprehensive practice and responsible for:
   1. Certify Training.
   2. Review and approve lead-based paint removal plan for conformance to applicable referenced standards.
   3. Inspect lead-based paint removal work for conformance with approved plan.
   4. Direct monitoring.
   5. Ensure work is performed according to specifications.
   6. Ensure personnel and environment hazardous exposures are adequately controlled.

D. Paint Disposal Facility: State certified disposal facility qualified to receive and dispose lead-based paint.

E. Lead-based Paint Removal Plan:
   1. Submit detailed, site-specific plan describing lead-based paint removal procedures.

2. Include sketch showing location, size, and details of lead control areas, decontamination rooms, change rooms, shower facilities, and mechanical ventilation system.
3. Include eating, drinking, and restroom procedures, interface of trades, work sequencing, collected wastewater and paint debris disposal plan, air sampling plan, respirators, protective equipment, and detailed description of containment methods ensuring airborne lead concentrations do not exceed action level outside lead control area.
   a. Eating, drinking, and smoking are not acceptable within lead control area.
4. Include air sampling, training and strategy, sampling methodology, frequency, duration, and qualifications of air monitoring personnel.

F. Respiratory Protection Program: Establish and implement program required by 29 CFR Part 1910.134 and 29 CFR Part 1926.62.
   1. Provide each employee negative pressure or other appropriate respirator.
      a. Respirator fit each employee's respirator at initial fitting and at least annually thereafter, as required by 29 CFR Part 1910.134 Respiratory Protection.

G. Hazard Communication Program: Establish and implement program required by 29 CFR Part 1910.1200 which is the same as 29 CFR 1926.59.

H. Hazardous Waste Management Plan: Establish and implement plan according to applicable requirements of Federal, State, and Local hazardous waste regulations including the following:
   1. Identification of hazardous wastes associated with work.
   2. Estimated quantities of generated and disposed waste.
   3. Names and qualifications of each contractor transporting, storing, treating, and disposing wastes. Include facility location and 24-hour point of contact. Provide two copies of EPA, State and Local hazardous waste permits and EPA Identification numbers.
   4. Names and qualifications (experience and training) of personnel working on-site with hazardous wastes.
   5. List of required waste handling equipment including cleaning, volume reduction, and transport equipment.
   6. Spill prevention, containment, and cleanup contingency implementation measures.
   7. Work plan and schedule for waste containment, removal, and disposal with daily waste cleaned up and containerization.
   8. Hazardous waste disposal cost.

1.8 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 PAINT REMOVAL PRODUCTS

A. Chemical Stripper: Biodegradable, non-toxic, capable of removing existing paint layers in one application, and acceptable to CIH.

2.2 ACCESSORIES

A. Waste Collection Drums: 49 CFR Part 178; Type 1A2, steel, removable head, 200 L (55 gal.) capacity, capable of containing waste without loss.

B. Vacuum Cleaner: HEPA filtered type.

C. Scrapers:
   1. Metal type for use on metal, concrete, and masonry surfaces.
   2. Plastic type for use on wood, plaster, gypsum board, and other surfaces.

D. Rinse Water: Potable.

E. Cleaning Cloths: Cotton.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Before exposure to lead-contaminated dust, provide workers with comprehensive medical examination required by 29 CFR Part 1926.62 (j) Medical Surveillance.

B. Maintain complete and accurate employee medical records according to 29 CFR Part 1910.1020.

C. Train each employee performing paint removal, disposal, and air sampling operations according to 29 CFR Part 1926.62.
   1. Certify training is completed before employee is permitted to work on project and enter lead control area.

3.2 PREPARATION

A. Protect existing work indicated to remain.
   1. Perform paint removal work without damaging and contaminating adjacent work.
   2. Restore damage and contamination to original condition.

B. Notify Contracting Officer 20 days before starting paint removal work.

C. Lead Control Area Requirements:
   1. Establish lead control area by completely enclosing lead-based paint removal work area with containment screens.
   2. Contain removal operations using negative pressure full containment system with minimum one change room and HEPA filtered exhaust.

D. Boundary Requirements: Provide physical boundaries around lead control area by roping off area designated on drawings or providing curtains, portable partitions or other enclosures to ensure that airborne lead concentrations do not meet or exceed action level outside of lead control area.

E. Heating, Ventilating and Air Conditioning (HVAC) Systems: Shut down, lock out, and isolate HVAC systems supplying exhausting, and passing through lead control areas. Seal HVAC inlets and outlet within lead control area with 6-mil plastic sheet and tape. Tape seal seams in HVAC components passing through lead control area.

F. Change Room and Shower Facilities: Provide clean change rooms and shower facilities within physical boundary around lead control area according to 29 CFR Part 1926.62.

G. Mechanical Ventilation System:
   1. Provide ventilation system to control personnel exposure to lead using HEPA equipped negative air machines.
   2. Design, construct, install, and maintain HEPA filtered fixed local exhaust ventilation system according to ANSI Z9.2 and approved by CIH.
   3. Exhaust ventilation air to exterior wherever possible.
   4. When exhaust ventilation air must be recirculated into work area, provide HEPA filter with reliable back-up filter and controls to monitor lead concentration in return air and to bypass recirculation system automatically when system fails.

H. Personnel Protection: Provide and use required protective clothing and equipment within lead control area.

I. Warning Signs: Provide warning signs complying with 29 CFR Part 1926.62 at lead control area approaches. Locate signs so personnel read signs and take necessary precautions before entering lead control area.

3.3 WORK PROCEDURES

A. Remove lead-based paint according to approved lead-based paint removal plan.
   1. Perform work only in presence of CIH or Industrial Hygienist (IH) Technician under direction of CIH ensuring continuous inspection of work in progress and direction of air monitoring activities.
   2. Handle, store, transport, and dispose lead or and lead contaminated waste according to 40 CFR Part 260, 40 CFR Part 261, 40 CFR Part 262, 40 CFR Part 263, 40 CFR Part 264, and 40 CFR Part 265. Comply with land disposal restriction notification requirements as required by 40 CFR Part 268.

B. Use procedures and equipment required to limit occupational and environmental lead exposure when lead-based paint is removed according to 29 CFR Part 1926.62.

C. Dispose removed paint and waste according to Environmental Protection Agency (EPA), federal, state, and local requirements.

D. Personnel Exiting Procedures:
   1. When personnel exit lead control area, comply with the following procedures:
      a. Vacuum exposed clothing surfaces.
      b. Remove protective clothing and equipment in decontamination room. Place clothing in approved impermeable disposal bag.
      c. Shower.
      d. Dress in clean clothes before leaving lead control area.

E. Monitoring - General:
   1. Monitor airborne lead concentrations according to 29 CFR Part 1910.1025by testing laboratory as directed by CIH.
   2. Take personal air monitoring samples on employees anticipated to have greatest exposure risk as determined by CIH. Additionally, take air monitoring samples on minimum 25 percent of work crew or minimum of two employees, whichever is greater, during each work shift.
   3. Submit results of air monitoring samples, signed by CIH, within 16 hours after taking air samples. Notify Contracting Officer's Representative immediately of lead exposure at or exceeding action level outside of lead control area.

F. Monitoring During Paint Removal:
   1. Perform personal and area monitoring during entire paint removal operation.
   2. Conduct area monitoring at physical boundary daily for each work shift to ensure unprotected personnel are not exposed above action level anytime.
   3. For outdoor operations, take at least one sample on each shift leeward of lead control area. When adjacent areas are contaminated, clean area of contamination and have CIH visually inspect and certify lead contamination is cleaned.
   4. Stop work when outside boundary lead levels meet or exceed action level. Notify Contracting Officer's Representative, immediately.
   5. Correct conditions causing increased lead concentration as directed by CIH.
   6. Review sampling data collected during work stoppage to determine if conditions require additional work method modifications as determined by CIH.
   7. Resume paint removal when approved by CIH.

3.4 LEAD-BASED PAINT REMOVAL

A. Remove paint within areas indicated on drawings completely exposing substrate. Minimize damage to substrate.

B. Comply with paint removal processes described in the lead paint removal plan.

C. Lead-Based Paint Removal: Select processes for each application to minimize work area lead contamination and waste.

3.5 SUBSTRATE SURFACE PREPARATION

.Protect substrates from deterioration and contamination until refinished.

1. Protect metal substrates from flash rusting.

B. Prepare and paint substrates according to Section 09 91 00, PAINTING.

3.6 FIELD QUALITY CONTROL

A. Field Tests: Performed by testing laboratory specified in Section 01 45 29, TESTING LABORATORY SERVICES.

B. Perform sampling and testing for:
   1. Air monitoring.
   2. Lead-Based Paint.

3.7 CLEANING AND DISPOSAL

A. Cleaning:
   1. Maintain lead control area surfaces free of accumulating paint chips and dust. Confine dust, debris, and waste to work area.
   2. HEPA vacuum clean and wet wipe with detergent solution work area daily, at end of each shift, and when paint removal operation is complete.

B. CIH Certification: Certify in writing that inside and outside lead control area air monitoring samples are less than action level, employee respiratory protection was adequate, the work was performed according to 29 CFR Part 1926.62, and no visible accumulations of lead-based paint and dust remain on worksite.
   1. Do not remove lead control area or roped-off boundary and warning signs before Contracting Officer's Representative's receipt of CIH's certification.
   2. Re-clean areas showing dust or residual paint chips.

C. Testing: Where indicated and when directed by Contracting Officer's Representative, test lead-based paint residue and used abrasive according to 40 CFR Part 261 for hazardous waste.

D. Waste Collection:
   1. Collect lead-contaminated materials including waste, scrap, debris, bags, containers, equipment, and clothing, which may produce airborne lead contamination.
   2. Place lead contaminated materials in waste disposal drums. Label each drum identifying waste type according to 49 CFR Part 172 and date waste materials were first put into drum. Obtain and complete the Uniform Hazardous Waste Manifest forms. Comply with land disposal restriction notification requirements required by 40 CFR Part 268:
   3. Coordinate temporary storage location on project site with Contracting Officer's Representative.

E. Waste Disposal:
   1. Minimum 14 days before delivery, notify Contracting Officer's Representative who will arrange for job site inspection of drums and manifests by paint disposal facility personnel.
   2. Contracting Officer's Representative will arrange hazardous wastes removal, transport and delivery to paint disposal facility to ensure drums do not remain on project site longer than 90 calendar days from drum label date.

F. Waste Disposal:
   1. Do not store hazardous waste drums in temporary storage location longer than 90 calendar days from drum label date.

2. Remove, transport, and deliver drums to paint disposal facility.
   a. Obtain signed receipt including date, time, quantity, and description of materials received according to 40 CFR Part 262.
   b. Obtain final report of materials disposition after disposal completion.
   c. Obtain sampling / disposal requirements by Disposal Facility prior to transport, i.e. TCLP.

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SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies cast-in-place structural concrete and materials and mixes for other concrete.

1.2 RELATED WORK

A. Section 01 45 29, TESTING LABORATORY SERVICES: Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.

B. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS

C. Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS: Concrete roads, walks, and similar exterior site work.

1.3 TESTING AGENCY FOR CONCRETE MIX DESIGN

A. Testing agency for the trial concrete mix design retained and reimbursed by the Contractor and approved by COR. For all other testing, refer to Section 01 45 29 Testing Laboratory Services.

B. Testing agency maintaining active participation in Program of Cement and Concrete Reference Laboratory (CCRL) of National Institute of Standards and Technology. Accompany request for approval of testing agency with a copy of Report of Latest Inspection of Laboratory Facilities by CCRL.

C. Testing agency shall furnish equipment and qualified technicians to establish proportions of ingredients for concrete mixes.

1.4 TOLERANCES

A. Formwork: ACI 117, except the elevation tolerance of formed surfaces before removal of shores is +0 mm (+0 inch) and -20 mm (-3/4 inch).

B. Reinforcement Fabricating and Placing: ACI 117, except that fabrication tolerance for bar sizes Nos. 10, 13, and 16 (Nos. 3, 4, and 5) (Tolerance Symbol 1 in Fig. 2.1(a), ACI, 117) used as column ties or stirrups is +0 mm (+0 inch) and -13 mm (-1/2 inch) where gross bar length is less than 3600 mm (12 feet), or +0 mm (+0 inch) and -20 mm (-3/4 inch) where gross bar length is 3600 mm (12 feet) or more.

C. Cross-Sectional Dimension: ACI 117, except tolerance for thickness of slabs 12 inches or less is +20 mm (+3/4 inch) and - 6 mm (-1/4 inch). Tolerance of thickness of beams more than 300 mm (12 inch) but less than 900 mm (3 feet) is +20 mm (+3/4 inch) and -10 mm (-3/8 inch).

D. Slab Finishes: ACI 117, Section 4.5.6, F-number method in accordance with ASTM E1155, except as follows:
   1. Test entire slab surface, including those areas within 600 mm (2 feet) of construction joints and vertical elements that project through slab surface.
   2. Maximum elevation change which may occur within 600 mm (2 feet) of any column or wall element is 6 mm (0.25 inches).
   3. Allow sample measurement lines that are perpendicular to construction joints to extend past joint into previous placement no further than 1500 mm (5 feet).

1.5 REGULATORY REQUIREMENTS

A. ACI SP-66 – ACI Detailing Manual.

B. ACI 318 - Building Code Requirements for Reinforced Concrete.

C. ACI 301 – Standard Specifications for Structural Concrete.

1.6 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES. All items indicated below are required submittals requiring Contracting Officer's Representative (COR) review and approval.

B. Shop Drawings: Reinforcing steel: Complete shop drawings

C. Mill Test Reports:
1. Reinforcing Steel.
2. Cement.

D. Manufacturer's Certificates:
1. Abrasive aggregate.
2. Lightweight aggregate for structural concrete.
3. Air-entraining admixture.
4. Chemical admixtures, including chloride ion content.
5. Waterproof paper for curing concrete.
6. Liquid membrane-forming compounds for curing concrete.
7. Non-shrinking grout.
8. Liquid hardener.
9. Waterstops.
10. Expansion joint filler.
11. Adhesive binder.

E. Testing Agency for Concrete Mix Design: Approval request including qualifications of principals and technicians and evidence of active participation in program of Cement and Concrete Reference Laboratory (CCRL) of National Institute of Standards and Technology and copy of report of latest CCRL, Inspection of Laboratory.

F. Test Report for Concrete Mix Designs: Trial mixes including water-cement ratio curves, concrete mix ingredients, and admixtures.

G. Shoring and Reshoring Sequence: Submit for approval a shoring and reshoring sequence for flat slab/flat plate portions, prepared by a registered Professional Engineer. As a minimum, include timing of form stripping, reshoring, number of floors to be re-shored and timing of re-shore removal to serve as an initial outline of procedures subject to modification as construction progresses. Submit revisions to sequence, whether initiated by COR (see FORMWORK) or Contractor.

H. Test reports on splitting tensile strength (Fct) of lightweight concrete.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Conform to ACI 304. Store aggregate separately for each kind or grade, to prevent segregation of sizes and avoid inclusion of dirt and other materials.

B. Deliver cement in original sealed containers bearing name of brand and manufacturer, and marked with net weight of contents. Store in suitable watertight building in which floor is raised at least 300 mm (1 foot) above ground. Store bulk cement in separate suitable bins.

C. Deliver other packaged materials for use in concrete in original sealed containers, plainly marked with manufacturer's name and brand, and protect from damage until used.

1.8 PRE-CONCRETE CONFERENCE

A. General: At least 15 days prior to submittal of design mixes, conduct a meeting to review proposed methods of concrete construction to achieve the required results.

B. Agenda: Includes but is not limited to:
1. Submittals.
2. Coordination of work.

3. Availability of material.
4. Concrete mix design including admixtures.
5. Methods of placing, finishing, and curing.
6. Finish criteria required to obtain required flatness and levelness.
7. Timing of floor finish measurements.
8. Material inspection and testing.

C. Attendees: Include but not limited to representatives of Contractor; subcontractors involved in supplying, conveying, placing, finishing, and curing concrete; lightweight aggregate manufacturer; admixture manufacturers; COR; Consulting Engineer; Department of Veterans Affairs retained testing laboratories for concrete testing and finish (F-number) verification.

D. Minutes of the meeting: Contractor shall take minutes and type and distribute the minutes to attendees within five days of the meeting.

1.9 MOCK-UP

A. In addition to the other specified samples and tests, construct a mock-up using the materials, reinforcing, forming system and construction methods proposed for use in exposed architectural concrete.

B. Construct the mock-up with at least a 2.5 m by 2.5 m (8 feet by 8 feet) exposed surface and suitable foundations. Include the following where applicable: Control joints, reglets, recesses or other typical architectural details.

C. Before casting the mock-up, submit full detailed Shop Drawings of the mock-up formwork for review by the Architect. Perform all necessary preliminary tests to ensure that concrete used for the mock-up will exactly match the approved sample in color and texture.

D. Perform the surface treatment proposed for use on one or more areas not less than 300 mm by 300 mm (1 foot by 1 foot) on the back side of the mock-up to establish the texture of finish required by the Architect. Repeat as required until a sample satisfactory to the Architect has been obtained.

E. Treat the finished front surface of the mock-up to produce a uniform appearance similar in every respect to the approved sample area.

F. The completed mock-up shall be inspected by the Architect. Failure of the mock-up to match the approved sample will require the construction of further mock-ups until approval is obtained. Remove rejected mock-ups immediately.

G. Maintain the approved mock-ups in good condition at the job site until all architectural concrete surfaces have been completed and approved by the Architect. Remove the mock-up from the site after completion of the above.

1.10 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

B. American Concrete Institute (ACI):

117-10 ..... Specifications for Tolerances for Concrete Construction and Materials and Commentary

211.1-91(R2009) ..... Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete

211.2-98(R2004) ..... Standard Practice for Selecting Proportions for Structural Lightweight Concrete

214R-11(R2019) ..... Guide to Evaluation of Strength Test Results of Concrete

301-16 ..... Specifications for Structural Concrete

304R-00(R2009) ..... Guide for Measuring, Mixing, Transporting, and Placing Concrete

305.1-14 ..... Specification for Hot Weather Concreting

306.1-90(R2002) ..... Standard Specification for Cold Weather Concreting

308.1-11 ..... Specification for Curing Concrete

309R-05..... Guide for Consolidation of Concrete

318/318-19 ..... Building Code Requirements for Structural Concrete and Commentary

347R-14..... Guide to Formwork for Concrete

SP-66-04 ..... ACI Detailing Manual

C. American National Standards Institute and American Hardboard Association (ANSI/AHA):
A135.4-2012..... Basic Hardboard

D. ASTM International (ASTM):
A615/A615M-20 ..... Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement

A653/A653M-20 ..... Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc Iron Alloy Coated (Galvannealed) by the Hot Dip Process

A706/A706M-16 ..... Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement

A767/A767M-19 ..... Standard Specification for Zinc Coated (Galvanized) Steel Bars for Concrete Reinforcement

A775/A775M-19 ..... Standard Specification for Epoxy Coated Steel Reinforcing Bars

A820/820M-16..... Standard Specification for Steel Fibers for Fiber Reinforced Concrete

A996/A996M-16 ..... Standard Specification for Rail Steel and Axle Steel Deformed Bars for Concrete Reinforcement

A1064/A1064M-18a ..... Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

C31/C31M-19a..... Standard Practice for Making and Curing Concrete Test Specimens in the field

C33/C33M-18..... Standard Specification for Concrete Aggregates

C39/C39M-20..... Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

C94/C94M-19a..... Standard Specification for Ready Mixed Concrete

C143/C143M-20..... Standard Test Method for Slump of Hydraulic Cement Concrete

C150C150M-20..... Standard Specification for Portland Cement

C171-16..... Standard Specification for Sheet Materials for Curing Concrete

C172C172M-17..... Standard Practice for Sampling Freshly Mixed Concrete

C173/C173M-16... ..... Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method

C192/C192M-19..... Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory

C231/C231M-17a ..... Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method

C260/C260M-10a(2016) ..... Standard Specification for Air Entraining Admixtures for Concrete

C309-19..... Standard Specification for Liquid Membrane Forming Compounds for Curing Concrete

C330/C330M-17a ..... Standard Specification for Lightweight Aggregates for Structural Concrete

C494/C494M-19 ..... Standard Specification for Chemical Admixtures for Concrete

C618-19..... Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

C666/C666M-15 ..... Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing

C881/C881M-20 ..... Standard Specification for Epoxy Resin Base Bonding Systems for Concrete

C1107/1107M-20 ..... Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)

C1315-19..... Standard Specification for Liquid Membrane Forming Compounds Having Special Properties for Curing and Sealing Concrete

D6/D6M-95(2018) ..... Standard Test Method for Loss on Heating of Oil and Asphaltic Compounds

D297-15(2019) ..... Standard Test Methods for Rubber Products Chemical Analysis

D412—16 ..... Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension

D1751-18..... Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)

D4263-83(2018) ..... Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.

E1155-20..... Standard Test Method for Determining F_F Floor Flatness and F_L Floor Levelness Numbers

F1249-20 ..... Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor

F1869-16a ..... Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

E. American Welding Society (AWS):
D1.4/D1.4M-18 ..... Structural Welding Code – Steel Reinforcing Bars

F. Concrete Reinforcing Steel Institute (CRSI):
Handbook 2008

G. National Cooperative Highway Research Program (NCHRP):
Report On ..... Concrete Sealers for the Protection of Bridge Structures

H. U. S. Department of Commerce Product Standard (PS):

PS 1-07 .....Structural Plywood

PS 20-20 .....American Softwood Lumber Standard

I. U. S. Army Corps of Engineers Handbook for Concrete and Cement:
CRD C513.....Rubber Waterstops

CRD C572.....Polyvinyl Chloride Waterstops

PART 2 - PRODUCTS

2.1 FORMS

A. Wood: PS 20 free from loose knots and suitable to facilitate finishing concrete surface specified; tongue and grooved.

B. Plywood: PS-1 Exterior Grade B-B (concrete-form) 16 mm (5/8 inch), or 20 mm (3/4 inch) thick for unlined contact form. B-B High Density Concrete Form Overlay optional.

C. Metal for Concrete Rib-Type Construction: Steel (removal type) of suitable weight and form to provide required rigidity.

D. Permanent Steel Form for Concrete Slabs: Corrugated, ASTM A653, Grade E, and Galvanized, ASTM A653, G90. Provide venting where insulating concrete fill is used.

E. Corrugated Fiberboard Void Boxes: Double faced, completely impregnated with paraffin and laminated with moisture resistant adhesive, size as shown. Design forms to support not less than 48 KPa (1000 psf) and not lose more than 15 percent of their original strength after being completely submerged in water for 24 hours and then air dried.

F. Form Lining:
1. Hardboard: ANSI/AHA A135.4, Class 2 with one (S1S) smooth side)
2. Plywood: Grade B-B Exterior (concrete-form) not less than 6 mm (1/4 inch) thick.
3. Plastic, fiberglass, or elastomeric capable of reproducing the desired pattern or texture.

G. Concrete products shall comply with following standards for biobased materials:

Material Type	Percent by Weight
Concrete Penetrating Liquid	79 percent biobased material
Concrete form Release Agent	87 percent biobased material
Concrete Sealer	11 percent biobased material

H. The minimum-content standards are based on the weight (not the volume) of the material.

I. Form Ties: Develop a minimum working strength of 13.35 kN (3000 pounds) when fully assembled. Ties shall be adjustable in length to permit tightening of forms and not have any lugs, cones, washers to act as spreader within form, nor leave a hole larger than 20 mm (3/4 inch) diameter, or a depression in exposed concrete surface, or leave metal closer than 40 mm (1 1/2 inches) to concrete surface. Wire ties not permitted. Cutting ties back from concrete face not permitted.

2.2 MATERIALS

A. Portland Cement: ASTM C150 Type I or II.

B. Fly Ash: ASTM C618, Class C or F including supplementary optional requirements relating to reactive aggregates and alkalies, and loss on ignition (LOI) not to exceed 5 percent. Do not exceed more than 25 percent total cementitious content by weight.

C. Coarse Aggregate: ASTM C33.
   1. Size 67 or Size 467 may be used for footings and walls over 300 mm (12 inches) thick.
   2. Coarse aggregate for interior slabs on grade shall conform to the following:
      a. Dense or well graded aggregate.
         1) Percent retained on each sieve below the top size and above the No. 100 sieve:
            a) 8 to 18 percent for 1-1/2 inches (38 mm)top size.
            b) 8 to 22 percent for 3/4 or 1 inch (19 or 25 mm) top size.
         2) The above requirements may be deviated from based on locally available material.
            a) One or two non-adjacent sieves sizes may fall outside of the limits set above.
            b) Percent retained on two adjacent sieves sizes shall not be less than 5 percent of the above required.
            c) Percent retained on three adjacent sieve sizes shall not be less than 8 percent of the above required.
            d) When the percent retained on each of two adjacent sieve sizes is less than 8 percent the total percent retained on either of these sieves and the adjacent outside sieve should be at least 13 percent (for example, if both the No. 4 and No. 8 (4.75 and 2.36 mm)sieves have 6 percent retained on each item then: 1. the total retained on the 3/8 inch and No. 4 (9.5 and 4.75 mm) sieves should be at least 13 percent, and 2. the total retained on the No. 8 and No. 16 (2.36 and 1.18 mm) sieves should be at least 13 percent.
   3. Coarse aggregate for applied topping, encasement of steel columns, and metal pan stair fill shall be Size 7.
   4. Maximum size of coarse aggregates not more than one-fifth of narrowest dimension between sides of forms, one-third of depth of slabs, nor three-fourth of minimum clear spacing between reinforcing bars.

D. Lightweight Aggregates for Structural Concrete: ASTM C330, Table 1. Maximum size of aggregate not larger than one-fifth of narrowest dimension between forms, nor three-fourth of minimum clear distance between reinforcing bars. Contractor to furnish certified report to verify that aggregate is sound and durable, and has a durability factor of not less than 80 based on 300 cycles of freezing and thawing when tested in accordance with ASTM C666.

E. Fine Aggregate: ASTM C33. Fine aggregate for applied concrete floor topping shall pass a 4.75 mm (No. 4) sieve, 10 percent maximum shall pass a 150 µm (No. 100) sieve.

F. Mixing Water: Fresh, clean, and potable.

G. Admixtures:
   1. Water Reducing Admixture: ASTM C494, Type A and not contain more chloride ions than are present in municipal drinking water.
   2. Water Reducing, Retarding Admixture: ASTM C494, Type D and not contain more chloride ions than are present in municipal drinking water.
   3. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C494, Type F or G, and not contain more chloride ions than are present in municipal drinking water. Use of superplasticizer requires COR approval.
   4. Non-Corrosive, Non-Chloride Accelerator: ASTM C494, Type C or E, and not contain more chloride ions than are present in municipal drinking water. Admixture manufacturer must have long-term non-corrosive test data from an independent testing laboratory of at least one year duration using an acceptable accelerated corrosion test method such as that using electrical potential measures.
   5. Air Entraining Admixture: ASTM C260.
   6. Microsilica: Use only with prior review and acceptance of the COR. Use only in conjunction with high range water reducer.
   7. Calcium Nitrite corrosion inhibitor: ASTM C494 Type C.

8. Prohibited Admixtures: Calcium chloride, thiocyanate or admixtures containing more than 0.05 percent chloride ions are not permitted.
9. Certification: Written conformance to the requirements above and the chloride ion content of the admixture prior to mix design review.

H. Vapor Barrier: ASTM F1249, 0.38 mm (15 mil) WVT 0.007 foot/hour.

I. Reinforcing Steel: ASTM A615, or ASTM A996, deformed, grade as shown.

J. Welded Wire Fabric: ASTM A185.

K. Reinforcing Bars to be Welded: ASTM A706.

L. Galvanized Reinforcing Bars: ASTM A767.

M. Epoxy Coated Reinforcing Bars: ASTM A775.

N. Cold Drawn Steel Wire: ASTM A1064.

O. Reinforcement for Concrete Fireproofing: 100 mm x 100 mm x 3.4 mm diameter (4 x 4-W1.4 x W1.4) welded wire fabric, secured in place to hold mesh 20 mm (3/4 inch) away from steel. Mesh at steel columns shall be wired to No. 10 (No. 3) vertical corner steel bars.

P. Reinforcement for Metal Pan Stair Fill: 50 mm (2 inch) wire mesh, either hexagonal mesh at .8Kg/m^2 (1.5 pounds per square yard), or square mesh at .6Kg/m^2 (1.17 pounds per square yard).

Q. Supports, Spacers, and Chairs: Types which will hold reinforcement in position shown in accordance with requirements of ACI 318 except as specified.

R. Expansion Joint Filler: ASTM D1751.

S. Sheet Materials for Curing Concrete: ASTM C171.

T. Liquid Membrane-forming Compounds for Curing Concrete: ASTM C309, Type I, with fugitive dye, and shall meet the requirements of ASTM C1315.Compound shall be compatible with scheduled surface treatment, such as paint and resilient tile, and shall not discolor concrete surface.

U. Abrasive Aggregate: Aluminum oxide grains or emery grits.

V. Liquid Hardener and Dustproofer: Fluosilicate solution of magnesium fluosilicate or zinc fluosilicate. Magnesium and zinc may be used separately or in combination as recommended by manufacturer. Use only on exposed slab. Do not use where floor is covered with resilient flooring, paint or other finish coating.

W. Moisture Vapor Emissions & Alkalinity Control Sealer: 100 percent active colorless aqueous siliconate solution concrete surface.
1. ASTM C1315 Type 1 Class A, and ASTM C309 Type 1 Class A, penetrating product to have no less than 34 percent solid content, leaving no sheen, volatile organic compound (VOC) content rating as required to suite regulatory requirements. The product shall have at least a five (5) year documented history in controlling moisture vapor emission from damaging floor covering, compatible with all finish materials.
2. MVE 15-Year Warranty:
   a. When a floor covering is installed on a below grade, on grade, or above grade concrete slab treated with Moisture Vapor Emissions & Alkalinity Control Sealer according to manufacturer's instruction, sealer manufacturer shall warrant the floor covering system against failure due to moisture vapor migration or moisture-born contaminates for a period of fifteen (15) years from the date of original installation. The warranty shall <u>cover all labor and materials</u> needed to replace all floor covering that fails due to moisture vapor emission & moisture born contaminates.

X. Penetrating Sealer: For use on parking garage ramps and decks. High penetration silane sealer providing minimum 95 percent screening per National Cooperative Highway Research Program

(NCHRP) No. 244 standards for chloride ion penetration resistance. Requires moist (non-membrane) curing of slab.

Y. Non-Shrink Grout:
1. ASTM C1107, pre-mixed, produce a compressive strength of at least 18 MPa at three days and 35 MPa (5000 psi) at 28 days. Furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95 percent bearing under a 1200 mm x 1200 mm (4 foot by 4 foot) base plate.
2. Where high fluidity or increased placing time is required, furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95 percent under an 450 mm x 900 mm (18 inch by 36 inch) base plate.

Z. Adhesive Binder: ASTM C881.

AA. Waterstops:
1. Polyvinyl Chloride Waterstop: CRD C572.
2. Rubber Waterstops: CRD C513.
3. Bentonite Waterstop: Flexible strip of bentonite 25 mm x 20 mm (1 inch by 3/4 inch), weighing 8.7 kg/m (5.85 pounds per foot) composed of Butyl Rubber Hydrocarbon (ASTM D297), Bentonite (SS-S-210-A) and Volatile Matter (ASTM D6).
4. Non-Metallic Hydrophilic: Swellable strip type compound of polymer modified chloroprene rubber that swells upon contact with water shall conform to ASTM D412 as follows: Tensile strength 420 psi minimum; ultimate elongation 600 percent minimum. Hardness shall be 50 minimum on the type A durameter and the volumetric expansion ratio in in 70 deg water shall be 3 to 1 minimum.

BB. Porous Backfill: Crushed stone or gravel graded from 25 mm to 20 mm (1 inch to 3/4 inch).

CC. Fibers:
1. Synthetic Fibers: Monofilament or fibrillated polypropylene fibers for secondary reinforcing of concrete members. Use appropriate length and 0.9 kg/m^3 (1.5 lb. per cubic yard). Product shall have a UL rating.
2. Steel Fibers: ASTM A820, Type I cold drawn, high tensile steel wire for use as primary reinforcing in slab-on-grade. Minimum dosage rate 18 kg/m^3 (30 lb. per cubic yard).

DD. Epoxy Joint Filler: Two component, 100 percent solids compound, with a minimum shore D hardness of 50.

EE. Bonding Admixture: Non-rewettable, polymer modified, bonding compound.

FF. Architectural Concrete: For areas designated as architectural concrete on the Contract Documents, use colored cements and specially selected aggregates as necessary to produce a concrete of a color and finish which exactly matches the designated sample panel.

2.3 CONCRETE MIXES

A. Mix Designs: Proportioned in accordance with Section 5.3, "Proportioning on the Basis of Field Experience and/or Trial Mixtures" of ACI 318.
1. If trial mixes are used, make a set of at least 6 cylinders in accordance with ASTM C192 for test purposes from each trial mix; test three for compressive strength at 7 days and three at 28 days.
2. Submit a report of results of each test series, include a detailed listing of the proportions of trial mix or mixes, including cement, admixtures, weight of fine and coarse aggregate per m^3 (cubic yard) measured dry rodded and damp loose, specific gravity, fineness modulus, percentage of moisture, air content, water-cement ratio, and consistency of each cylinder in terms of slump. Include dry unit weight of lightweight structural concrete.
3. Prepare a curve showing relationship between water-cement ratio at 7-day and 28-day compressive strengths. Plot each curve using at least three specimens.
4. If the field experience method is used, submit complete standard deviation analysis.

B. Fly Ash Testing: Submit certificate verifying conformance with ASTM 618 initially with mix design and for each truck load of fly ash delivered from source. Submit test results performed within 6 months of submittal date. Notify the COR immediately when change in source is anticipated.
   1. Testing Laboratory used for fly ash certification/testing shall participate in the Cement and Concrete Reference Laboratory (CCRL) program. Submit most recent CCRL inspection report.

C. After approval of mixes no substitution in material or change in proportions of approval mixes may be made without additional tests and approval of the COR or as specified. Making and testing of preliminary test cylinders may be carried on pending approval of cement providing Contractor and manufacturer certify that ingredients used in making test cylinders are the same. The COR may allow Contractor to proceed with depositing concrete for certain portions of work, pending final approval of cement and approval of design mix.

Cement Factor: Maintain minimum cement factors in Table I regardless of compressive strength developed above minimums. Use Fly Ash as an admixture with maximum of 25 percent replacement by weight in all structural work. Increase this replacement to 40 percent for mass concrete, and reduce it to 10 percent for drilled piers and caissons. Fly ash shall not be used in high-early mix design.

TABLE I - CEMENT AND WATER FACTORS FOR CONCRETE

Concrete Strength		Non-Air-Entrained	Air-Entrained	
Min. 28 Day Comp. Str. MPa (psi)	Min. Cement kg/m^3 (lbs/c. yd)	Max. Water Cement Ratio	Min. Cement kg/m^3 (lbs/c. yd)	Max. Water Cement Ratio
35 (5000)[1,3]	375 (630)	0.45	385 (650)	0.40
30 (4000)[1,3]	325 (550)	0.55	340 (570)	0.50
25 (3000)[1,3]	280 (470)	0.65	290 (490)	0.55
25 (3000)[1,2]	300 (500)	See 4 below	310 (520)	See 4 below

1. If trial mixes are used, the proposed mix design shall achieve a compressive strength 8.3 MPa (1200 psi) in excess of f'c. For concrete strengths above 35 Mpa (5000 psi), the proposed mix design shall achieve a compressive strength 9.7 MPa (1400 psi) in excess of f'c.
2. Lightweight Structural Concrete. Pump mixes may require higher cement values.
3. For concrete exposed to high sulfate content soils maximum water cement ratio is 0.44.
4. Determined by Laboratory in accordance with ACI 211.1 for normal concrete or ACI 211.2 for lightweight structural concrete.

D. Maximum Slump: Maximum slump, as determined by ASTM C143 with tolerances as established by ASTM C94, for concrete to be vibrated shall be as shown in Table II.

TABLE II - MAXIMUM SLUMP, MM (INCHES)

Type of Construction	Normal Weight Concrete	Lightweight Structural Concrete
Reinforced Footings and Substructure Walls	75mm (3 inches)	75 mm (3 inches)
Slabs, Beams, Reinforced Walls, and Building Columns	100 mm (4 inches)	100 mm (4 inches)

E. Slump may be increased by the use of the approved high-range water-reducing admixture (superplasticizer). Tolerances as established by ASTM C94. Concrete containing the high-

range-water-reducing admixture may have a maximum slump of 225 mm (9 inches). The concrete shall arrive at the job site at a slump of 50 mm to 75 mm (2 inches to 3 inches), and 75 mm to 100 mm (3 inches to 4 inches) for lightweight concrete. This should be verified, and then the high-range-water-reducing admixture added to increase the slump to the approved level.

F. Air-Entrainment: Air-entrainment of normal weight concrete shall conform with Table III. Air-entrainment of lightweight structural concrete shall conform with Table IV. Determine air content by either ASTM C173 or ASTM C231.

TABLE III - TOTAL AIR CONTENT
FOR VARIOUS SIZES OF COARSE AGGREGATES (NORMAL CONCRETE)

Nominal Maximum Size of Total Air Content	Coarse Aggregate, mm (Inches) Percentage by Volume
10 mm (3/8 in).6 to 10	13 mm (1/2 in).5 to 9
20 mm (3/4 in).4 to 8	25 mm (1 in).3-1/2 to 6-1/2
40 mm (1 1/2 in).3 to 6	

TABLE IV
AIR CONTENT OF LIGHTWEIGHT STRUCTURAL CONCRETE

Nominal Maximum size of Total Air Content	Coarse Aggregate, mm's (Inches) Percentage by Volume
Greater than 10 mm (3/8 in) 4 to 8	10 mm (3/8 in) or less 5 to 9

G. High early strength concrete, made with Type III cement or Type I cement plus non-corrosive accelerator, shall have a 7-day compressive strength equal to specified minimum 28-day compressive strength for concrete type specified made with standard Portland cement.

H. Lightweight structural concrete shall not weigh more than air-dry unit weight shown. Air-dry unit weight determined on 150 mm by 300 mm (6 inch by 12 inch) test cylinders after seven days standard moist curing followed by 21 days drying at 23 degrees C $\pm$ 1.7 degrees C (73.4 $\pm$ 3 degrees Fahrenheit), and 50 (plus or minus 7) percent relative humidity. Use wet unit weight of fresh concrete as basis of control in field.

I. Concrete slabs placed at air temperatures below 10 degrees C (50 degrees Fahrenheit) use non-corrosive, non-chloride accelerator. Concrete required to be air entrained use approved air entraining admixture. Pumped concrete, synthetic fiber concrete, architectural concrete, concrete required to be watertight, and concrete with a water/cement ratio below 0.50 use high-range water-reducing admixture (superplasticizer).

J. Durability: Use air entrainment for exterior exposed concrete subjected to freezing and thawing and other concrete shown or specified. For air content requirements see Table III or Table IV.

K. Enforcing Strength Requirements: Test as specified in Section 01 45 29, TESTING LABORATORY SERVICES, during the progress of the work. Seven-day tests may be used as indicators of 28-day strength. Average of any three 28-day consecutive strength tests of laboratory-cured specimens representing each type of concrete shall be equal to or greater than specified strength. No single test shall be more than 3.5 MPa (500 psi) below specified strength. Interpret field test results in accordance with ACI 214. Should strengths shown by test specimens fall below required values, the COR may require any one or any combination of the following corrective actions, at no additional cost to the Government:
   1. Require changes in mix proportions by selecting one of the other appropriate trial mixes or changing proportions, including cement content, of approved trial mix.
   2. Require additional curing and protection.
   3. If five consecutive tests fall below 95 percent of minimum values given in Table I or if test results are so low as to raise a question as to the safety of the structure, the COR may

direct Contractor to take cores from portions of the structure. Use results from cores tested by the Contractor retained testing agency to analyze structure.

4. If strength of core drilled specimens falls below 85 percent of minimum value given in Table I, the COR may order load tests, made by Contractor retained testing agency, on portions of building so affected. Load tests in accordance with ACI 318 and criteria of acceptability of concrete under test as given therein.
5. Concrete work, judged inadequate by structural analysis, by results of load test, or for any reason, shall be reinforced with additional construction or replaced, if directed by the COR.

2.4 BATCHING AND MIXING

A. General: Concrete shall be "Ready-Mixed" and comply with ACI 318 and ASTM C94, except as specified. Batch mixing at the site is permitted. Mixing process and equipment must be approved by the COR. With each batch of concrete, furnish certified delivery tickets listing information in Paragraph 16.1 and 16.2 of ASTM C94. Maximum delivery temperature of concrete is 38 degrees C (100 degrees Fahrenheit). Minimum delivery temperature as follows:

Atmospheric Temperature	Minimum Concrete Temperature
-1. degrees to 4.4 degrees C (30 degrees to 40 degrees F)	15.6 degrees C (60 degrees F.)
-17 degrees C to -1.1 degrees C (0 degrees to 30 degrees F.)	21 degrees C (70 degrees F.)

1. Services of aggregate manufacturer's representative shall be furnished during the design of trial mixes and as requested by the COR for consultation during batching, mixing, and placing operations of lightweight structural concrete. Services will be required until field controls indicate that concrete of required quality is being furnished. Representative shall be thoroughly familiar with the structural lightweight aggregate, adjustment and control of mixes to produce concrete of required quality. Representative shall assist and advise the COR.

PART 3 - EXECUTION

3.1 FORMWORK:

A. General: Design in accordance with ACI 347 is the responsibility of the Contractor. The Contractor shall retain a registered Professional Engineer to design the formwork, shores, and reshores.
   1. Form boards and plywood forms may be reused for contact surfaces of exposed concrete only if thoroughly cleaned, patched, and repaired and the COR approves their reuse.
   2. Provide forms for concrete footings unless the COR determines forms are not necessary.
   3. Corrugated fiberboard forms: Place forms on a smooth firm bed, set tight, with no buckled cartons to prevent horizontal displacement, and in a dry condition when concrete is placed.

B. Treating and Wetting: Treat or wet contact forms as follows:
   1. Coat plywood and board forms with non-staining form sealer. In hot weather, cool forms by wetting with cool water just before concrete is placed.
   2. Clean and coat removable metal forms with light form oil before reinforcement is placed. In hot weather, cool metal forms by thoroughly wetting with water just before placing concrete.
   3. Use sealer on reused plywood forms as specified for new material.

C. Size and Spacing of Studs: Size and space studs, wales and other framing members for wall forms so as not to exceed safe working stress of kind of lumber used nor to develop deflection greater than 1/270 of free span of member.

D. Unlined Forms: Use plywood forms to obtain a smooth finish for concrete surfaces. Tightly butt edges of sheets to prevent leakage. Back up all vertical joints solidly and nail edges of adjacent sheets to same stud with 6d box nails spaced not over 150 mm (6 inches) apart.

E. Lined Forms: May be used in lieu of unlined plywood forms. Back up form lining solidly with square edge board lumber securely nailed to studs with all edges in close contact to prevent bulging of lining. No joints in lining and backing may coincide. Nail abutted edges of sheets to same backing board. Nail lining at not over 200 mm (8 inches) on center along edges and with at least one nail to each square foot of surface area; nails to be 3d blued shingle or similar nails with thin flatheads.

F. Architectural Liner: Attach liner as recommended by the manufacturer with tight joints to prevent leakage.

G. Wall Form Ties: Locate wall form ties in symmetrically level horizontal rows at each line of wales and in plumb vertical tiers. Space ties to maintain true, plumb surfaces. Provide one row of ties within 150 mm (6 inches) above each construction joint. Space through-ties adjacent to horizontal and vertical construction joints not over 450 mm (18 inches) on center.
   1. Tighten row of ties at bottom of form just before placing concrete and, if necessary, during placing of concrete to prevent seepage of concrete and to obtain a clean line. Ties to be entirely removed shall be loosened 24 hours after concrete is placed and shall be pulled from least important face when removed.
   2. Coat surfaces of all metal that is to be removed with paraffin, cup grease or a suitable compound to facilitate removal.

H. Inserts, Sleeves, and Similar Items: Flashing reglets, steel strips, masonry ties, anchors, wood blocks, nailing strips, grounds, inserts, wire hangers, sleeves, drains, guard angles, forms for floor hinge boxes, inserts or bond blocks for elevator guide rails and supports, and other items specified as furnished under this and other sections of specifications and required to be in their final position at time concrete is placed shall be properly located, accurately positioned, and built into construction, and maintained securely in place.
   1. Locate inserts or hanger wires for furred and suspended ceilings only in bottom of concrete joists, or similar concrete member of overhead concrete joist construction.
   2. Install sleeves, inserts and similar items for mechanical services in accordance with drawings prepared specially for mechanical services. Contractor is responsible for accuracy and completeness of drawings and shall coordinate requirements for mechanical services and equipment.
   3. Do not install sleeves in beams, joists or columns except where shown or permitted by the COR. Install sleeves in beams, joists, or columns that are not shown, but are permitted by the COR, and require no structural changes, at no additional cost to the Government.
   4. Minimum clear distance of embedded items such as conduit and pipe is at least three times diameter of conduit or pipe, except at stub-ups and other similar locations.
   5. Provide recesses and blockouts in floor slabs for door closers and other hardware as necessary in accordance with manufacturer's instructions.

I. Construction Tolerances:
   1. Set and maintain concrete formwork to assure erection of completed work within tolerances specified and to accommodate installation of other rough and finish materials. Accomplish remedial work necessary for correcting excessive tolerances. Erected work that exceeds specified tolerance limits shall be remedied or removed and replaced, at no additional cost to the Government.
   2. Permissible surface irregularities for various classes of materials are defined as "finishes" in specification sections covering individual materials. They are to be distinguished from tolerances specified which are applicable to surface irregularities of structural elements.

3.2 PLACING REINFORCEMENT

A. General: Details of concrete reinforcement in accordance with ACI 318 unless otherwise shown.

B. Placing: Place reinforcement conforming to CRSI DA4, unless otherwise shown.
   1. Place reinforcing bars accurately and tie securely at intersections and splices with 1.6 mm (16 gauge) black annealed wire. Secure reinforcing bars against displacement during the placing of concrete by spacers, chairs, or other similar supports. Portions of supports, spacers, and chairs in contact with formwork shall be made of plastic in areas that will be exposed when building is occupied. Type, number, and spacing of supports conform to ACI 318. Where concrete slabs are placed on ground, use concrete blocks or other non-corrodible material of proper height, for support of reinforcement. Use of brick or stone supports will not be permitted.
   2. Lap welded wire fabric at least 1 1/2 mesh panels plus end extension of wires not less than 300 mm (12 inches) in structural slabs. Lap welded wire fabric at least 1/2 mesh panels plus end extension of wires not less than 150 mm (6 inches) in slabs on grade.
   3. Splice column steel at no points other than at footings and floor levels unless otherwise shown.

C. Spacing: Minimum clear distances between parallel bars, except in columns and multiple layers of bars in beams shall be equal to nominal diameter of bars. Minimum clear spacing is 25 mm (1 inch) or 1-1/3 times maximum size of coarse aggregate.

D. Splicing: Splices of reinforcement made only as required or shown or specified. Accomplish splicing as follows:
   1. Lap splices: Do not use lap splices for bars larger than Number 36 (Number 11). Minimum lengths of lap as shown.
   2. Welded splices: Splicing by butt-welding of reinforcement permitted providing the weld develops in tension at least 125 percent of the yield strength (fy) for the bars. Welding conform to the requirements of AWS D1.4. Welded reinforcing steel conform to the chemical analysis requirements of AWS D1.4.
      a. Submit test reports indicating the chemical analysis to establish weldability of reinforcing steel.
      b. Submit a field quality control procedure to insure proper inspection, materials and welding procedure for welded splices.
      c. Department of Veterans Affairs retained testing agency shall test a minimum of three splices, for compliance, locations selected by the COR.
   3. Mechanical Splices: Develop in tension and compression at least 125 percent of the yield strength (fy) of the bars. Stresses of transition splices between two reinforcing bar sizes based on area of smaller bar. Provide mechanical splices at locations indicated. Use approved exothermic, tapered threaded coupling, or swaged and threaded sleeve. Exposed threads and swaging in the field not permitted.
      a. Initial qualification: In the presence of the COR, make three test mechanical splices of each bar size proposed to be spliced. Department of Veterans Affairs retained testing laboratory will perform load test.
      b. During installation: Furnish, at no additional cost to the Government, one companion (sister) splice for every 50 splices for load testing. Department of Veterans Affairs retained testing laboratory will perform the load test.

E. Bending: Bend bars cold, unless otherwise approved. Do not field bend bars partially embedded in concrete, except when approved by the COR.

F. Cleaning: Metal reinforcement, at time concrete is placed, shall be free from loose flaky rust, mud, oil, or similar coatings that will reduce bond.

G. Future Bonding: Protect exposed reinforcement bars intended for bonding with future work by wrapping with felt and coating felt with a bituminous compound unless otherwise shown.

3.3 VAPOR BARRIER

A. Except where membrane waterproofing is required, interior concrete slab on grade shall be placed on a continuous vapor barrier.

1. Place 100 mm (4 inches) of fine granular fill over the vapor barrier to act as a blotter for concrete slab.
2. Vapor barrier joints lapped 150 mm (6 inches) and sealed with compatible waterproof pressure-sensitive tape.
3. Patch punctures and tears.

3.4 SLABS RECEIVING RESILIENT COVERING

A. Slab shall be allowed to cure for 6 weeks minimum prior to placing resilient covering. After curing, slab shall be tested by the Contractor for moisture in accordance with ASTM D4263 or ASTM F1869. Moisture content shall be less than 3 pounds per 1000 sf prior to placing covering.

B. In lieu of curing for 6 weeks, Contractor has the option, at his own cost, to utilize the Moisture Vapor Emissions & Alkalinity Control Sealer as follows:
   1. Sealer is applied on the day of the concrete pour or as soon as harsh weather permits, prior to any other chemical treatments for concrete slabs either on grade, below grade or above grade receiving resilient flooring, such as, sheet vinyl, vinyl composition tile, rubber, wood flooring, epoxy coatings and overlays.
   2. Manufacturer's representative will be on the site the day of concrete pour to install or train its application and document. He shall return on every application thereafter to verify that proper procedures are followed.
      a. Apply Sealer to concrete slabs as soon as final finishing operations are complete and the concrete has hardened sufficiently to sustain floor traffic without damage.
      b. Spray apply Sealer at the rate of 20 m^2 (200 square feet) per gallon. Lightly broom product evenly over the substrate and product has completely penetrated the surface.
      c. If within two (2) hours after initial application areas are subjected to heavy rainfall and puddling occurs, reapply Sealer product to these areas as soon as weather condition permits.

3.5 CONSTRUCTION JOINTS

A. Unless otherwise shown, location of construction joints to limit individual placement shall not exceed 24,000 mm (80 feet) in any horizontal direction, except slabs on grade which shall have construction joints shown. Allow 48 hours to elapse between pouring adjacent sections unless this requirement is waived by the COR.

B. Locate construction joints in suspended floors near the quarter-point of spans for slabs, beams or girders, unless a beam intersects a girder at center, in which case joint in girder shall be offset a distance equal to twice width of beam. Provide keys and inclined dowels as shown. Provide longitudinal keys as shown.

C. Place concrete for columns slowly and in one operation between joints. Install joints in concrete columns at underside of deepest beam or girder framing into column.

D. Allow 2 hours to elapse after column is cast before concrete of supported beam, girder or slab is placed. Place girders, beams, grade beams, column capitals, brackets, and haunches at the same time as slab unless otherwise shown.

E. Install polyvinyl chloride or rubber water seals, as shown in accordance with manufacturer's instructions, to form continuous watertight seal.

3.6 EXPANSION JOINTS AND CONTRACTION JOINTS

A. Clean expansion joint surfaces before installing premolded filler and placing adjacent concrete.

B. Install polyvinyl chloride or rubber water seals, as shown in accordance with manufacturer's instructions, to form continuous watertight seal.

C. Provide contraction (control) joints in floor slabs as indicated on the contract drawings. Joints shall be either formed or saw cut, to the indicated depth after the surface has been finished.

Complete saw joints within 4 to 12 hours after concrete placement. Protect joints from intrusion of foreign matter.

3.7 PLACING CONCRETE

A. Preparation:
   1. Remove hardened concrete, wood chips, shavings and other debris from forms.
   2. Remove hardened concrete and foreign materials from interior surfaces of mixing and conveying equipment.
   3. Have forms and reinforcement inspected and approved by the COR before depositing concrete.
   4. Provide runways for wheeling equipment to convey concrete to point of deposit. Keep equipment on runways which are not supported by or bear on reinforcement. Provide similar runways for protection of vapor barrier on coarse fill.

B. Bonding: Before depositing new concrete on or against concrete which has been set, thoroughly roughen and clean existing surfaces of laitance, foreign matter, and loose particles.
   1. Preparing surface for applied topping:
      a. Remove laitance, mortar, oil, grease, paint, or other foreign material by sand blasting. Clean with vacuum type equipment to remove sand and other loose material.
      b. Broom clean and keep base slab wet for at least four hours before topping is applied.
      c. Use a thin coat of one part Portland cement, 1.5 parts fine sand, bonding admixture; and water at a 50: 50 ratio and mix to achieve the consistency of thick paint. Apply to a damp base slab by scrubbing with a stiff fiber brush. New concrete shall be placed while the bonding grout is still tacky.

C. Conveying Concrete: Convey concrete from mixer to final place of deposit by a method which will prevent segregation. Method of conveying concrete is subject to approval of the COR.

D. Placing: For special requirements see Paragraphs, HOT WEATHER and COLD WEATHER.
   1. Do not place concrete when weather conditions prevent proper placement and consolidation, or when concrete has attained its initial set, or has contained its water or cement content more than 1 1/2 hours.
   2. Deposit concrete in forms as near as practicable in its final position. Prevent splashing of forms or reinforcement with concrete in advance of placing concrete.
   3. Do not drop concrete freely more than 3000 mm (10 feet) for concrete containing the high-range water-reducing admixture (superplasticizer) or 1500 mm (5 feet) for conventional concrete. Where greater drops are required, use a tremie or flexible spout (canvas elephant trunk), attached to a suitable hopper.
   4. Discharge contents of tremies or flexible spouts in horizontal layers not exceeding 500 mm (20 inches) in thickness, and space tremies such as to provide a minimum of lateral movement of concrete.
   5. Continuously place concrete until an entire unit between construction joints is placed. Rate and method of placing concrete shall be such that no concrete between construction joints will be deposited upon or against partly set concrete, after its initial set has taken place, or after 45 minutes of elapsed time during concrete placement.
   6. On bottom of members with severe congestion of reinforcement, deposit 25 mm (1 inch) layer of flowing concrete containing the specified high-range water-reducing admixture (superplasticizer). Successive concrete lifts may be a continuation of this concrete or concrete with a conventional slump.
   7. Concrete on metal deck:
      a. Concrete on metal deck shall be minimum thickness shown. Allow for deflection of steel beams and metal deck under the weight of wet concrete in calculating concrete quantities for slab.

1) The Contractor shall become familiar with deflection characteristics of structural frame to include proper amount of additional concrete due to beam/deck deflection.

E. Consolidation: Conform to ACI 309. Immediately after depositing, spade concrete next to forms, work around reinforcement and into angles of forms, tamp lightly by hand, and compact with mechanical vibrator applied directly into concrete at approximately 450 mm (18 inch) intervals. Mechanical vibrator shall be power driven, hand operated type with minimum frequency of 5000 cycles per minute having an intensity sufficient to cause flow or settlement of concrete into place. Vibrate concrete to produce thorough compaction, complete embedment of reinforcement and concrete of uniform and maximum density without segregation of mix. Do not transport concrete in forms by vibration.
   1. Use of form vibration shall be approved only when concrete sections are too thin or too inaccessible for use of internal vibration.
   2. Carry on vibration continuously with placing of concrete. Do not insert vibrator into concrete that has begun to set.

3.8 HOT WEATHER

A. Follow the recommendations of ACI 305 or as specified to prevent problems in the manufacturing, placing, and curing of concrete that can adversely affect the properties and serviceability of the hardened concrete. Methods proposed for cooling materials and arrangements for protecting concrete shall be made in advance of concrete placement and approved by the COR.

3.9 COLD WEATHER

A. Follow the recommendations of ACI 306 or as specified to prevent freezing of concrete and to permit concrete to gain strength properly. Use only the specified non-corrosive, non-chloride accelerator. Do not use calcium chloride, thiocyantes or admixtures containing more than 0.05 percent chloride ions. Methods proposed for heating materials and arrangements for protecting concrete shall be made in advance of concrete placement and approved by the COR.

3.10 PROTECTION AND CURING

A. Conform to ACI 308: Initial curing shall immediately follow the finishing operation. Protect exposed surfaces of concrete from premature drying, wash by rain and running water, wind, mechanical injury, and excessively hot or cold temperatures. Keep concrete not covered with membrane or other curing material continuously wet for at least 7 days after placing, except wet curing period for high-early-strength concrete shall be not less than 3 days. Keep wood forms continuously wet to prevent moisture loss until forms are removed. Cure exposed concrete surfaces as described below. Other curing methods may be used if approved by the COR.
   1. Liquid curing and sealing compounds: Apply by power-driven spray or roller in accordance with the manufacturer's instructions. Apply immediately after finishing. Maximum coverage 10m^2/L (400 square feet per gallon) on steel troweled surfaces and 7.5m^2/L (300 square feet per gallon) on floated or broomed surfaces for the curing/sealing compound.
   2. Plastic sheets: Apply as soon as concrete has hardened sufficiently to prevent surface damage. Utilize widest practical width sheet and overlap adjacent sheets 50 mm (2 inches). Tightly seal joints with tape.
   3. Paper: Utilize widest practical width paper and overlap adjacent sheets 50 mm (2 inches). Tightly seal joints with sand, wood planks, pressure-sensitive tape, mastic or glue.

3.11 REMOVAL OF FORMS

A. Remove in a manner to assure complete safety of structure after the following conditions have been met.
   1. Where structure as a whole is supported on shores, forms for beams and girder sides, columns, and similar vertical structural members may be removed after 24 hours,

provided concrete has hardened sufficiently to prevent surface damage and curing is continued without any lapse in time as specified for exposed surfaces.

2. Take particular care in removing forms of architectural exposed concrete to insure surfaces are not marred or gouged, and that corners and arises are true, sharp and unbroken.

B. Control Test: Use to determine if the concrete has attained sufficient strength and curing to permit removal of supporting forms. Cylinders required for control tests taken in accordance with ASTM C172, molded in accordance with ASTM C31, and tested in accordance with ASTM C39. Control cylinders cured and protected in the same manner as the structure they represent. Supporting forms or shoring not removed until strength of control test cylinders have attained at least 70 percent of minimum 28-day compressive strength specified. Exercise care to assure that newly unsupported portions of structure are not subjected to heavy construction or material loading.

C. Reshoring: Reshoring is required if superimposed load plus dead load of the floor exceeds the capacity of the floor at the time of loading. In addition, for flat slab/plate, reshoring is required immediately after stripping operations are complete and not later than the end of the same day. Reshoring accomplished in accordance with ACI 347 at no additional cost to the Government.

3.12 CONCRETE SURFACE PREPARATION

A. Metal Removal: Unnecessary metal items cut back flush with face of concrete members.

B. Patching: Maintain curing and start patching as soon as forms are removed. Do not apply curing compounds to concrete surfaces requiring patching until patching is completed. Use cement mortar for patching of same composition as that used in concrete. Use white or gray Portland cement as necessary to obtain finish color matching surrounding concrete. Thoroughly clean areas to be patched. Cut out honeycombed or otherwise defective areas to solid concrete to a depth of not less than 25 mm (1 inch). Cut edge perpendicular to surface of concrete. Saturate with water area to be patched, and at least 150 mm (6 inches) surrounding before placing patching mortar. Give area to be patched a brush coat of cement grout followed immediately by patching mortar. Cement grout composed of one part Portland cement, 1.5 parts fine sand, bonding admixture, and water at a 50:50 ratio, mix to achieve consistency of thick paint. Mix patching mortar approximately 1 hour before placing and remix occasionally during this period without addition of water. Compact mortar into place and screed slightly higher than surrounding surface. After initial shrinkage has occurred, finish to match color and texture of adjoining surfaces. Cure patches as specified for other concrete. Fill form tie holes which extend entirely through walls from unexposed face by means of a pressure gun or other suitable device to force mortar through wall. Wipe excess mortar off exposed face with a cloth.

C. Upon removal of forms, clean vertical concrete surface that is to receive bonded applied cementitious application with wire brushes or by sand blasting to remove unset material, laitance, and loose particles to expose aggregates to provide a clean, firm, granular surface for bond of applied finish.

3.13 CONCRETE FINISHES

A. Vertical and Overhead Surface Finishes:

1. Unfinished areas: Vertical and overhead concrete surfaces exposed in pipe basements, elevator and dumbwaiter shafts, pipe spaces, pipe trenches, above suspended ceilings, manholes, and other unfinished areas will not require additional finishing.
2. Interior and exterior exposed areas to be painted: Remove fins, burrs and similar projections on surfaces flush, and smooth by mechanical means approved by the COR, and by rubbing lightly with a fine abrasive stone or hone. Use ample water during rubbing without working up a lather of mortar or changing texture of concrete.
3. Interior and exterior exposed areas finished: Give a grout finish of uniform color and smooth finish treated as follows:
   a. After concrete has hardened and laitance, fins and burrs removed, scrub concrete with wire brushes. Clean stained concrete surfaces by use of a hone stone.

b. Apply grout composed of one part of Portland cement, one part fine sand, smaller than a 600 µm (No. 30) sieve. Work grout into surface of concrete with cork floats or fiber brushes until all pits, and honeycombs are filled.
c. After grout has hardened slightly, but while still plastic, scrape grout off with a sponge rubber float and, about 1 hour later, rub concrete vigorously with burlap to remove any excess grout remaining on surfaces.
d. In hot, dry weather use a fog spray to keep grout wet during setting period. Complete finish of area in same day. Make limits of finished areas at natural breaks in wall surface. Leave no grout on concrete surface overnight.

4. Textured: Finish as specified. Maximum quantity of patched area 0.2 m^2 (2 square feet) in each 93 m^2 (1000 square feet) of textured surface.

B. Slab Finishes:

1. Monitoring and Adjustment: Provide continuous cycle of placement, measurement, evaluation and adjustment of procedures to produce slabs within specified tolerances. Monitor elevations of structural steel in key locations before and after concrete placement to establish typical deflection patterns for the structural steel. Determine elevations of cast-in-place slab soffits prior to removal of shores. Provide information to the COR and floor consultant for evaluation and recommendations for subsequent placements.
2. Set perimeter forms to serve as screed using either optical or laser instruments. For slabs on grade, wet screeds may be used to establish initial grade during strike-off, unless the COR determines that the method is proving insufficient to meet required finish tolerances and directs use of rigid screed guides. Where wet screeds are allowed, they shall be placed using grade stakes set by optical or laser instruments. Use rigid screed guides, as opposed to wet screeds, to control strike-off elevation for all types of elevated (non slab-on-grade) slabs. Divide bays into halves or thirds by hard screeds. Adjust as necessary where monitoring of previous placements indicates unshored structural steel deflections to other than a level profile.
3. Place slabs monolithically. Once slab placement commences, complete finishing operations within same day. Slope finished slab to floor drains where they occur, whether shown or not.
4. Use straightedges specifically made for screeding, such as hollow magnesium straightedges or power strike-offs. Do not use pieces of dimensioned lumber. Strike off and screed slab to a true surface at required elevations. Use optical or laser instruments to check concrete finished surface grade after strike-off. Repeat strike-off as necessary. Complete screeding before any excess moisture or bleeding water is present on surface. Do not sprinkle dry cement on the surface.
5. Immediately following screeding, and before any bleed water appears, use a 3000 mm (10 foot) wide highway straightedge in a cutting and filling operation to achieve surface flatness. Do not use bull floats or darbys, except that darbying may be allowed for narrow slabs and restricted spaces.
6. Wait until water sheen disappears and surface stiffens before proceeding further. Do not perform subsequent operations until concrete will sustain foot pressure with maximum of 6 mm (1/4 inch) indentation.
7. Scratch Finish: Finish base slab to receive a bonded applied cementitious application as indicated above, except that bull floats and darbys may be used. Thoroughly coarse wire broom within two hours after placing to roughen slab surface to insure a permanent bond between base slab and applied materials.
8. Float Finish: Slabs to receive unbonded toppings, steel trowel finish, fill, mortar setting beds, or a built-up roof, and ramps, stair treads, platforms (interior and exterior), and equipment pads shall be floated to a smooth, dense uniform, sandy textured finish. During floating, while surface is still soft, check surface for flatness using a 3000 mm (10 foot) highway straightedge. Correct high spots by cutting down and correct low spots by filling in with material of same composition as floor finish. Remove any surface projections and re-float to a uniform texture.

9. Steel Trowel Finish: Concrete surfaces to receive resilient floor covering or carpet, monolithic floor slabs to be exposed to view in finished work, future floor roof slabs, applied toppings, and other interior surfaces for which no other finish is indicated. Steel trowel immediately following floating. During final troweling, tilt steel trowel at a slight angle and exert heavy pressure to compact cement paste and form a dense, smooth surface. Finished surface shall be smooth, free of trowel marks, and uniform in texture and appearance.
10. Broom Finish: Finish exterior slabs, ramps, and stair treads with a bristle brush moistened with clear water after surfaces have been floated. Brush in a direction transverse to main traffic. Match texture approved by the COR from sample panel.
11. Finished slab flatness (FF) and levelness (FL) values comply with the following minimum requirements:
    a. Areas covered with carpeting, or not specified otherwise in b. below:
        1) Slab on Grade:
            a) Specified overall value: F_F 25/F_L 20
            b) Minimum local value: F_F 17/F_L 15
        2) Level suspended slabs (shored until after testing) and topping slabs:
            a) Specified overall value: FF 25/FL 20
            b) Minimum local value FF 17/FL 15
        3) Unshored suspended slabs:
            a) Specified overall value: FF 25
            b) Minimum local value: FF 17
        4) Level tolerance such that 80 percent of all points fall within a 20 mm (3/4 inch) envelope +10 mm, -10 mm (+3/8 inch, -3/8 inch) from the design elevation.
    b. Areas that will be exposed, receive thin-set tile or resilient flooring, or roof areas designed as future floors:
        1) Slab on grade:
            a) Specified overall value: FF 36/FL 20
            b) Minimum local value: FF 24/FL 15
        2) Level suspended slabs (shored until after testing) and topping slabs
            a) Specified overall value: FF 30/FL 20
            b) Minimum local value: FF 24/FL 15
        3) Unshored suspended slabs:
            a) Specified overall value: FF 30
            b) Minimum local value: FF 24
        4) Level tolerance such that 80 percent of all points fall within a 20 mm (3/4 inch) envelope +10 mm, -10 mm (+3/8 inch, -3/8 inch) from the design elevation.
    c. "Specified overall value" is based on the composite of all measured values in a placement derived in accordance with ASTM E1155.
    d. "Minimum local value" (MLV) describes the flatness or levelness below which repair or replacement is required. MLV is based on the results of an individual placement and applies to a minimum local area. Minimum local area boundaries may not cross a construction joint or expansion joint. A minimum local area will be bounded by construction and/or control joints, or by column lines and/or half-column lines, whichever is smaller.
12. Measurements
    a. Department of Veterans Affairs retained testing laboratory will take measurements as directed by the COR, to verify compliance with FF, FL, and other finish requirements. Measurements will occur within 72 hours after completion of concrete placement (weekends and holidays excluded). Make measurements before shores or forms are removed to insure the "as-built" levelness is accurately assessed. Profile data for above characteristics may be collected using a laser level or any Type II apparatus (ASTM E1155, "profileograph" or "dipstick").

Contractor's surveyor shall establish reference elevations to be used by Department of Veterans Affairs retained testing laboratory.

b. Contractor not experienced in using FF and FL criteria is encouraged to retain the services of a floor consultant to assist with recommendations concerning adjustments to slab thicknesses, finishing techniques, and procedures on measurements of the finish as it progresses in order to achieve the specific flatness and levelness numbers.

13. Acceptance/ Rejection:
    a. If individual slab section measures less than either of specified minimum local F_F/F_L numbers, that section shall be rejected and remedial measures shall be required. Sectional boundaries may be set at construction and contraction (control) joints, and not smaller than one-half bay.
    b. If composite value of entire slab installation, combination of all local results, measures less than either of specified overall F_F/F_L numbers, then whole slab shall be rejected and remedial measures shall be required.
14. Remedial Measures for Rejected Slabs: Correct rejected slab areas by grinding, planing, surface repair with underlayment compound or repair topping, retopping, or removal and replacement of entire rejected slab areas, as directed by the COR, until a slab finish constructed within specified tolerances is accepted.

3.14 SURFACE TREATMENTS:

A. Use on exposed concrete floors and concrete floors to receive carpeting except those specified to receive non-slip finish.

B. Liquid Densifier/Sealer: Apply in accordance with manufacturer's directions just prior to completion of construction.

C. Non-Slip Finish: Except where safety nosing and tread coverings are shown, apply non-slip abrasive aggregate to treads and platforms of concrete steps and stairs, and to surfaces of exterior concrete ramps and platforms. Broadcast aggregate uniformly over concrete surface at rate of application of 8 percent per 1/10th m^2 (7.5 percent per square foot) of area. Trowel concrete surface to smooth dense finish. After curing, rub treated surface with abrasive brick and water to slightly expose abrasive aggregate.

3.15 APPLIED TOPPING

A. Separate concrete topping on floor base slab of thickness and strength shown. Topping mix shall have a maximum slump of 200 mm (8 inches) for concrete containing a high-range water-reducing admixture (superplasticizer) and 100 mm (4 inches) for conventional mix. Neatly bevel or slope at door openings and at slabs adjoining spaces not receiving an applied finish.

B. Placing: Place continuously until entire section is complete, struck off with straightedge, leveled with a highway straightedge or highway bull float, floated and troweled by machine to a hard dense finish. Slope to floor drains as required. Do not start floating until free water has disappeared and no water sheen is visible. Allow drying of surface moisture naturally. Do not hasten by "dusting" with cement or sand.

3.16 RESURFACING FLOORS

A. Remove existing flooring areas to receive resurfacing to expose existing structural slab and extend not less than 25 mm (1 inch) below new finished floor level. Prepare exposed structural slab surface by roughening, broom cleaning, and dampening. Apply specified bonding grout. Place topping while the bonding grout is still tacky.

3.17 RETAINING WALLS

A. Use air-entrained concrete.

B. Expansion and contraction joints, waterstops, weep holes, reinforcement and railing sleeves installed and constructed as shown.

C. Exposed surfaces finished to match adjacent concrete surfaces, new or existing.

D. Place porous backfill as shown.

3.18 PRECAST CONCRETE ITEMS

A. Precast concrete items, not specified elsewhere. Cast using 25 MPa (3000 psi) air-entrained concrete to shapes and dimensions shown. Finish to match corresponding adjacent concrete surfaces. Reinforce with steel for safe handling and erection.

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SECTION 03 93 00

CONCRETE REHABILITATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies repair to cast-in-place structural concrete and materials and mixes for other crack and delamination repair; by pressure injection of cracks with an epoxy resin adhesive.

1.2 RELATED WORK

A. Section 01 45 29, TESTING LABORATORY SERVICES: Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.

B. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS

C. Section 03 30 00, CAST IN PLACE CONCRETE

1.3 TESTING AGENCY FOR CONCRETE MIX DESIGN

A. Testing agency for the trial concrete mix design retained and reimbursed by the Contractor and approved by COR. For all other testing, refer to Section 01 45 29 Testing Laboratory Services.

B. Testing agency maintaining active participation in Program of Cement and Concrete Reference Laboratory (CCRL) of National Institute of Standards and Technology. Accompany request for approval of testing agency with a copy of Report of Latest Inspection of Laboratory Facilities by CCRL.

C. Testing agency shall furnish equipment and qualified technicians to establish proportions of ingredients for concrete mixes.

1.4 QUALITY ASSURANCE

A. Manufacturing qualifications: The manufacturer of the specified product shall be ISO 9001/9002 certified and have in existence a recognized ongoing quality assurance program independently audited on a regular basis.

B. Contractor qualifications: Contractor shall be qualified in the field of concrete repair and protection with a successful track record of 5 years or more. Contractor shall maintain qualified personnel who have received product training by a manufacturer's representative.

C. Install materials in accordance with all safety and weather conditions required by the manufacturer, or as modified by applicable rules and regulations of local, state and federal authorities having jurisdiction. Consult Material Safety Data Sheets for complete handling recommendations.

1.5 TOLERANCES

A. Slab Finishes: ACI 117, Section 4.5.6, F-number method in accordance with ASTM E1155, except as follows:
   1. Test entire slab surface, including those areas within 600 mm (2 feet) of construction joints and vertical elements that project through slab surface.
   2. Maximum elevation change which may occur within 600 mm (2 feet) of any column or wall element is 6 mm (0.25 inches).
   3. Allow sample measurement lines that are perpendicular to construction joints to extend past joint into previous placement no further than 1500 mm (5 feet).

1.6 REGULATORY REQUIREMENTS

A. ACI SP-66 – ACI Detailing Manual.

B. ACI 318 - Building Code Requirements for Reinforced Concrete.

C. ACI 301 – Standard Specifications for Structural Concrete.

1.7 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES. All items indicated below are required submittals requiring Contracting Officer's Representative (COR) review and approval

B. Submit manufacturer's literature, to include: Product Data Sheets and appropriate Material Safety Data Sheets (MSDS).

C. Provide a written warranty from the manufacturer against defects of materials for a period of one (1) year, beginning with date of substantial completion of the project.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Conform to ACI 304. Store aggregate separately for each kind or grade, to prevent segregation of sizes and avoid inclusion of dirt and other materials.

B. Deliver other packaged materials for use in concrete in original sealed containers, plainly marked with manufacturer's name and brand, and protect from damage until used.

C. Store all materials off the ground and protect from rain, freezing or excessive heat until ready for use.

D. Condition the specified product as recommended by the manufacturer.

1.9 PRE-CONCRETE CONFERENCE

A. General: At least 15 days prior to submittal of concrete repair, conduct a meeting to review proposed methods of concrete construction to achieve the required results.

B. Agenda: Includes but is not limited to:
1. Submittals.
2. Coordination of work.
3. Availability of material.
4. Concrete mix design including admixtures.
5. Methods of placing, finishing, and curing.
6. Finish criteria required to obtain required flatness and levelness.
7. Timing of floor finish measurements.
8. Material inspection and testing.

C. Attendees: Include but not limited to representatives of Contractor; subcontractors involved in supplying, conveying, placing, finishing, and curing concrete; lightweight aggregate manufacturer; admixture manufacturers; COR; Consulting Engineer; Department of Veterans Affairs retained testing laboratories for concrete testing and finish (F-number) verification.

D. Minutes of the meeting: Contractor shall take minutes and type and distribute the minutes to attendees within five days of the meeting.

1.10 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

B. American Concrete Institute (ACI):

117-10 ..... Specifications for Tolerances for Concrete Construction and Materials and Commentary

211.1-91(R2009) ..... Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete

211.2-98(R2004) ..... Standard Practice for Selecting Proportions for Structural Lightweight Concrete

318/318-19 ..... Building Code Requirements for Structural Concrete and Commentary

347R-14..... Guide to Formwork for Concrete

SP-66-04 ..... ACI Detailing Manual

C. ASTM International (ASTM):

C881/C881M-20 ..... Standard Specification for Epoxy Resin Base Bonding Systems for Concrete

C1107/1107M-20 ..... Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)

C1315-19..... Standard Specification for Liquid Membrane Forming Compounds Having Special Properties for Curing and Sealing Concrete

D6/D6M-95(

D1751-18..... Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)

D4263-83(2018) ..... Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.

E1155-20..... Standard Test Method for Determining F_F Floor Flatness and F_L Floor Levelness Numbers

F1249-20 ..... Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor

F1869-16a ..... Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

D. Concrete Reinforcing Steel Institute (CRSI):

Handbook 2008

PS 20-20 ..... American Softwood Lumber Standard

E. U. S. Army Corps of Engineers Handbook for Concrete and Cement:

CRD C513 ..... Rubber Waterstops

CRD C572 ..... Polyvinyl Chloride Waterstops

PART 2 - PRODUCTS

2.1 BASIS OF DESIGN:

A. Sikadur 52, as manufactured by Sika Corporation, 1682 Marion Williamsport Road, Marion, Ohio 43302 is considered to conform to the requirements of this specification.

B. Sikadur Injection Gel, as manufactured by Sika Corporation, 1682 Marion Williamsport Road, Marion, Ohio 43302 is considered to conform to the requirements of this specification

C. Equal Product from other Manufacturers must meet specification requirements.

2.2 MATERIALS

A. Epoxy resin adhesive for pressure injection of cracks shall be Sikadur 52:
   1. Component “A” shall be a modified epoxy resin of the diglycidiether bisphenol A Type or containing suitable viscosity control agents. It shall not contain butyl glycidyl ether.
   2. Component “B” shall be primarily a reaction product of a selected amine blend with an epoxy resin of the diglycidiether bisphenol A Type containing suitable viscosity control agents, pigments, and accelerators.
   3. The ratio of component A: component B shall be 2:1 by volume
   4. The material shall not contain asbestos.

B. Epoxy resin adhesive for sealing of cracks & porting devices shall be Sikadur Injection Gel.:
   1. Component “A” shall be a modified epoxy resin of the diglycidiether bisphenol A Type or containing suitable viscosity control agents. It shall not contain butyl glycidyl ether.
   2. Component “B” shall be primarily a reaction product of a selected amine blend with an epoxy resin of the diglycidiether bisphenol A Type containing suitable viscosity control agents, pigments, and accelerators.
   3. The ratio of component A: component B shall be 1:1 by volume
   4. The material shall not contain asbestos.

C. Porting devices as required for either manual or automated application. Porting devices for automated application shall be supplied from manufacturer of the pressure injection equipment.

2.3 PERFORMANCE CRITERIA

A. Properties of the mixed epoxy resin adhesive used for the pressure injection grouting::
   1. Pot Life: min. 30 minutes (60 gram mass) @ 73° F
   2. Tack-Free Time:
      a. 90 degF (32 deg C) 1.5 to 2 hours
      b. 75 Deg F (24 deg C) 3 to 3.5 hours
      c. 40 deg F (5 deg C) 14-16 hours
   3. Viscosity: Approx. 200 cps.
   4. Color: Clear, pale yellow

B. Properties of the cured epoxy resin adhesive used for pressure injection of grout:
   1. Compressive Strength (ASTM D-695)
      a. 3 day: 10,000 psi (68.9 MPa)
      b. 7 day: 11,300 psi (77.9 MPa)
      c. 28 day: 12,000 psi (82.7 MPa)
   2. Compressive Modulus, psi : .min.
      a. 7 day 350,000 psi (2400 Mpa)
   3. Shear Strength (ASTM D-732)
      a. 14 day: 4,300 psi (29.6 MPa)
   4. Flexural Strength (ASTM D-790)
      a. 14 day: 5,400 psi (37.2 MPa)
   5. Tangent Modulus of Elasticity in Bending
      a. 14 day: 380,000 psi (2600 Mpa)
   6. Bond Strength (ASTM C-882), 14 day (moist cure)
      a. Hardened Concrete to Hardened Concrete 2,200 psi (15 Mpa)
   7. Water Absorption (ASTM D-570), 7 day
      a. 24 hour immersion 1.50%
   8. Tensile properties (ASTM D-638)
      a. 7 day Tensile Strength 7,900 psi (54 Mpa)
      b. Elongation at Break 3.1%
      c. 14 day Modulus of Elasticity 200,000 psi (1400 Mpa)

C. Properties of the mixed epoxy resin adhesive used for sealing of cracks & porting devices::
   1. Pot Life: min. 30 minutes (60 gram mass) @ 73° F
   2. Tack-Free Time:

a. 75 deg F (24degC) 2 to 3.5 hours
b. 40 deg F (5 degC) 14-16 hours
3. Consistency: Smooth, Non-Sag paste
4. Color: Gray

D. Properties of the cured epoxy resin adhesive used for sealing of cracks & porting devices:
1. Compressive Strength (ASTM D-695) @ 73F
a. 1 day: 8,000 psi (55.1 MPa)
b. 3 day: 10,000 psi (68.9 MPa)
c. 28 day: 10,000 psi (68.9 MPa)
2. Compressive Modulus, psi.
a. 7 day 270,000 psi (Mpa)
3. Shear Strength (ASTM D-732)
a. 14 day: 3,700 psi (25.5 MPa)
4. Flexural Strength (ASTM D-790)
a. 14 days: 6,700 psi (46.2 MPa)
5. Tangent Modulus of Elasticity in Bending
a. 14 day 750,000 psi
6. Bond Strength (ASTM C-882) ,14 day (moist cure)
a. Hardened Concrete to Hardened Concrete 2,600 psi (17.9 Mpa)
7. Water Absorption (ASTM D-570),max
a. 24 hour immersion 0.60%
8. Tensile properties (ASTM D-638) min
a. 7 day Tensile Strength 7,100 psi (48.9 Mpa)
b. Elongation at break 10%

Note: Tests above were performed with material & curing conditions at 73F &45-55% relative humidity.

PART 3 - EXECUTION

3.1 JOB CONDITIONS

A. Environmental Conditions: Do not apply material if it is raining or snowing or if such conditions appear to be imminent. Minimum application temperature 40ºF (5ºC) and rising.

B. Protection: Precautions should be taken to avoid damage to any surface near the work zone due to mixing and handling of the specified product.

3.2 MIXING AND APPLICATION

A. Mixing the epoxy resin adhesive for sealing the cracks & porting devices: Premix each component. Proportion one parts by volume of Component “A” to one part Component “B” into a clean, dry mixing pail. Mix thoroughly for 3 minutes with a jiffy paddle on a low-speed (400-600 rpm) drill. Mix only that quantity of material that can be used within its potlife (25-35 minutes 73F).

B. Mixing of the epoxy resin adhesive used for the pressure injection grouting:
1. Manual: Premix each component. Proportion two parts by volume of Component “A” to one part Component “B” into a clean, dry mixing pail. Mix thoroughly for 3 minutes with a jiffy paddle on a low-speed (400-600 rpm) drill. Mix only that quantity of material that can be used within its potlife (20-30 minutes 73F).

C. Placement procedure:
1. The epoxy resin adhesive for sealing the cracks & porting device: Set the porting devices as required by the equipment manufacturer. Spacing of the porting devices shall be accomplished as required to achieve the travel of the epoxy resin for the pressure injection grouting between ports and fill the cracks to the maximum. On structures open on both sides, provide porting devices on opposite sides at staggered elevations. Apply

the mixed epoxy resin adhesive for sealing over cracks and around each porting device to provide an adequate seal to prevent the escape of the epoxy resin adhesive for the injection grouting. Where required by the Engineer, apply the epoxy resin adhesive for sealing in such a manner that minimal defacing or discoloration of the substrate shall result.

2. The epoxy resin adhesive for the pressure injection grouting:

Manual: Load the mixed epoxy resin adhesive for grouting into a disposable caulking cartridge or bulk-loading caulking gun. Inject the prepared cracks with a constant pressure in order to achieve maximum filling & penetration without the inclusion of air pockets or voids in the epoxy resin adhesive. Begin the pressure injection at the widest part of the crack being injected and continue until there is the appearance of epoxy resin adhesive at an adjacent port, thus indicating travel. When travel is indicated, to discontinue or continue the pressure injection from that port should be made by the contractor based on his experience, with the approval of the engineer. Continue procedure until pressure injectable cracks has been filled.

Automated: Dispense the epoxy resin adhesive for grouting under constant pressure in accordance with procedures recommended by the equipment manufacturer as required to achieve maximum filling and penetration of the prepared cracks without the inclusion of air pockets or voids in the epoxy resin adhesive. The pressure injection of single or multiple ports, by use of a manifold system, is possible. This decision should be made by the contractor, with the approval of the Engineer. Continue the approved procedure until all pressure injectable cracks have been filled.

D. If penetration of any cracks is impossible, consult the Engineer before discontinuing the injection procedure. If modification of the proposed procedure is required to fill the cracks, submit said modification in writing to the Engineer for acceptance prior to proceeding.

E. Adhere to all limitations and cautions for the epoxy resin adhesive in the manufacturers current printed literature.

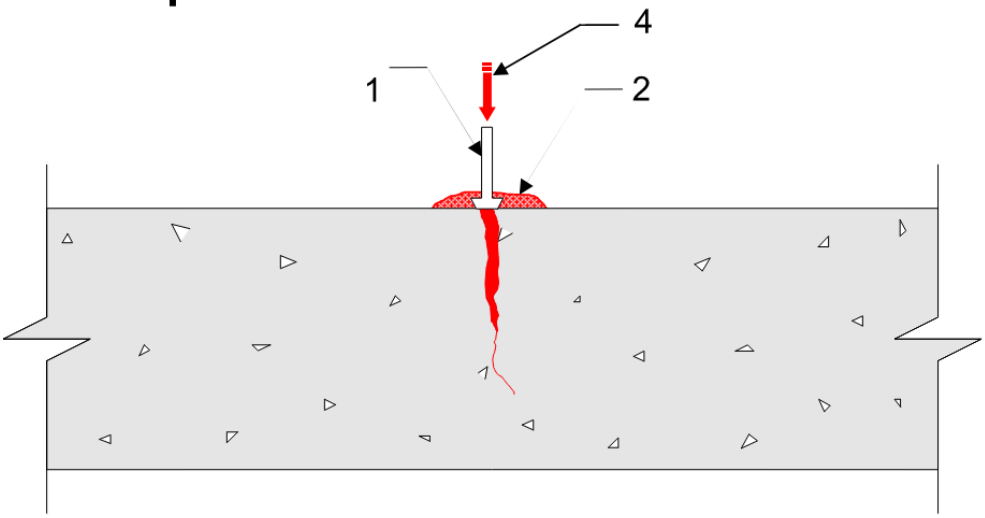
3.3 CLEANING

A. After the epoxy resin adhesive for grouting has cured, the epoxy resin adhesive for sealing cracks and porting devices shall be removed as required by the Engineer. Clean the substrate in a manner to produce a finish appearance acceptable to the Owner.

B. The uncured epoxy resin adhesive can be cleaned from tools with approved solvent. The cured epoxy resin adhesive can only be removed mechanically.

C. Leave finished work and work area in a neat, clean condition without evidence of spillovers onto adjacent areas.

SC020 Sikadur 52/Sikadur Injection Gel Crack Filler/ Cap Seal



1. Set porting devices over cracks.
2. Place mixed Sikadur Injection Gel epoxy resin adhesive over cracks and around each injection port a minimum of 1" wide by a ¼" thick.
3. Allow sufficient time for epoxy resin adhesive cap seal to set before injecting.
4. When the cap seal has cured, inject Sikadur 52 with steady pressure.
5. Use automated injection equipment or manual method.

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SECTION 04 01 00

MAINTENANCE OF MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Repointing existing damaged masonry joints.
2. Replacing existing damaged masonry units.

1.2 RELATED WORK

A. Section 04 05 13, MASONRY MORTARING: Mortars for new masonry.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. ASTM International (ASTM):
1. C67/C67M-20 Sampling and Testing Brick and Structural Clay Tile.
2. C144-18 Aggregate for Masonry Mortar.
3. C150/C150M-20 Specification for Portland Cement.
4. C207-18 - Hydrated Lime for Masonry Purposes
5. C216-19 - Facing Brick (Solid Masonry Units Made from Clay or Shale)
6. C270-19ae1 Mortar for Unit Masonry
7. C295/C295M-19 Petrographic Examination of Aggregates for Concrete

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:
1. Description of each product.
2. Replacement units indicating manufacturer recommendation for each application.

C. Samples:
1. Pointing Mortar: Molded, 150 mm (6 inches) long for each type, texture, and color.
2. Replacement Brick – if not enough existing brick salvaged to complete repair, provide new brick of closest match possible. Provide minimum of 3 samples of brick/mortar for evaluation by COR.
3. Provide mockup of brick repair at 2’x2’ area of repair location for final approval prior to commencement of full wall enclosure.

D. Test reports:
1. Preconstruction test results of existing masonry mortar and units.
2. Recommended mortar mix and mortar materials sources.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:
1. Documented experience in completion of work, similar in design, material, and extent specified.

B. Preconstruction Testing:
1. Existing Brick: according to ASTM C67.
2. Existing Mortar: according to ASTM C295/C295M.
   a. Recommend mortar mix compatible with existing and mortar material sources required to match existing color and texture.

1.6 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.

B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.

C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

A. Store materials covered, protected from weather, and elevated above grade.
   1. Prevent contamination of aggregates.

B. Protect products from damage during handling and construction operations.

1.8 FIELD CONDITIONS

A. Environment:
   1. Cold Weather Requirements: Maintain mortar ingredients and substrate within temperature range between 4 degrees C (40 degrees F) and 49 degrees C (120 degrees F) when outside temperature is less than 4 degrees C (40 degrees F).
   2. Hot Weather Requirements: Protect mortar-joint from evaporation of moisture from mortar material. When required, provide adequately shaded work area.

1.9 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Mortar Components:
   1. Hydrated Lime: ASTM C207, Type S.
   2. Aggregate: ASTM C144.
   3. Portland Cement: ASTM C150/C150M, Type I.
   4. Water: Potable, free of substances that are detrimental to grout, masonry, and metal.

2.2 PRODUCTS - GENERAL

A. Provide each product from one manufacturer and from one production run.

2.3 REPLACEMENT MASONRY UNITS

A. Face Brick:
   1. ASTM C216, matching existing.
   2. Efflorescence: Rated slight efflorescent when tested according to ASTM C67.

B. Other Masonry Units: Match existing.

2.4 MIXES

A. Tuck Pointing Mortar: ASTM C270; Appendix X3.
   1. Type N.

2.5 ACCESSORIES

A. Cleaning Agent: Soapless, non-acidic, detergent, specially prepared for cleaning brick and stone concrete masonry.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.

B. Protect existing construction and completed work from damage.
   1. Protect from mortar droppings and cleaning operations.

C. Remove existing fixtures and fittings concealing masonry joints to permit repointing and repair.

3.2 EXISTING MORTAR JOINTS

A. Cut out existing bed and head mortar joints, to uniform depth of 19 mm (3/4 inches), or to sound mortar without damaging edges and faces of existing masonry units to remain.

B. Remove dust and debris from joints.
   1. Do not rinse when temperature is below freezing.

3.3 TUCK POINTING

A. Dampen joints immediately before tuck pointing. Allow masonry units to absorb surface water.

B. Tightly pack tuck pointing mortar into joints in thin layers, 6 mm (1/4 inch) thick, maximum.

C. Allow layer to become slightly hardened before applying next layer.

D. Pack final layer flush with surfaces of masonry units.

3.4 MASONRY UNIT REPLACEMENT

A. Cut out mortar joints surrounding masonry units requiring replacement.
   1. Remove existing masonry units creating opening for replacement masonry unit installation.
   2. Remove mortar, dust, and debris from opening perimeter surfaces.
   3. Prevent debris from falling into cavity.

B. Dampen surfaces of surrounding existing masonry before installing replacement masonry units.
   1. Allow existing masonry to absorb surface moisture before installing replacement units.
   2. Butter contact surfaces of existing masonry and replacement masonry units with mortar.
   3. Center replacement masonry units in opening and press into position.
   4. Remove excess mortar.
   5. Tuck point replacement masonry units to ensure full head and bed joints.

3.5 JOINT TOOLING

A. Tool repointed and replaced masonry joints when mortar becomes slightly hardened.

B. Produce smooth, compacted, joint matching existing.

3.6 CLEANING

A. Remove mortar splatter from exposed surfaces immediately.

B. Clean exposed masonry surfaces on completion.

C. Remove mortar droppings and other foreign substances from wall surfaces.

D. Wet surfaces with clean water.

E. Wash with cleaning agent.

F. Brush masonry surfaces with stiff fiber brushes while washing.

G. Immediately after washing, rinse with clean water.
   1. Remove traces of detergent, foreign streaks or stains.

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SECTION 04 05 13

MASONRY MORTARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Masonry mortar installed by other masonry sections.

1.2 RELATED REQUIREMENTS

A. Mortar used in Section:
1. Section 04 01 00, MAINTENANCE OF MASONRY.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. ASTM International (ASTM):
1. C40/C40M-11 - Organic Impurities in Fine Aggregates for Concrete.
2. C91/C91M-12 - Masonry Cement.
3. C144-11 -Aggregate for Masonry Mortar.
4. C150/C150M-15 - Portland Cement.
5. C207-06(2011) - Hydrated Lime for Masonry Purposes.
6. C270-14a - Mortar of Unit Masonry.
7. C595/C595M-15e1 - Blended Hydraulic Cements.
8. C780-15 - Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
9. C979/C979M-10 - Pigments for Integrally Colored Concrete.
10. C1329/C1329M-15 - Mortar Cement.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:
1. Description of each product.

C. Test Reports: Certify each product complies with specifications.
1. Mortar.
2. Admixtures.

D. Certificates: Certify each product complies with specifications.
1. Portland cement.
2. Masonry cement.
3. Mortar cement.
4. Hydrated lime.
5. Fine aggregate.
6. Color admixture.

E. Qualifications: Substantiate qualifications comply with specifications.
1. Testing laboratory.

1.5 QUALITY ASSURANCE

A. Preconstruction Testing:
1. Engage independent testing laboratory to tests and submit reports.
   a. Deliver samples to laboratory in number and quantity required for testing.
2. Test mortar and materials specified.

3. Mortar:
   a. Test for compressive strength and water retention according to ASTM C270.
   b. Minimum Mortar compressive strengths 28 days:
      1) Type M: 17.2 MPa (2,500 psi).
      2) Type S: 12.4 MPa (1,800 psi).
      3) Type N: 5.1 MPa (750 psi).
4. Non Staining Cement: Test for water soluble alkali.
   a. Water Soluble Alkali: Maximum 0.03 percent.
5. Sand: Test for deleterious substances, organic impurities, soundness and grading.

1.6 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.

B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.

C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

A. Store masonry materials under waterproof covers on planking clear of ground.
   1. Protect loose, bulk materials from contamination.

B. Protect products from damage during handling and construction operations.

1.8 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Hydrated Lime: ASTM C207, Type S.

B. Aggregate for Masonry Mortar: ASTM C144 and as follows:
   1. Light colored sand for mortar for laying face brick.
   2. White plastering sand meeting sieve analysis for mortar joints for pointing except that 100 percent passes No. 8 sieve, and maximum 5 percent retained on No. 16 sieve.
   3. Test sand for color value according to ASTM C40/C40M. Sand producing color darker than specified standard is unacceptable.

C. Blended Hydraulic Cement: ASTM C595/C595M, Type IS, IP.

D. Masonry Cement: ASTM C91/C91M. Type N, S, Or M.
   1. Use white masonry cement whenever white mortar is specified.

E. Mortar Cement: ASTM C1329/C1329M, Type N, S or M.

F. Portland Cement: ASTM C150/C150M, Type I.
   1. Use white Portland cement wherever white mortar is specified.

G. Pigments: ASTM C979/C979M; inorganic, inert, mineral pigments only, unaffected by atmospheric conditions, nonfading, alkali resistant, and water insoluble.

H. Water: Potable, free of substances that are detrimental to mortar, masonry, and metal.

2.2 PRODUCTS - GENERAL

A. Provide each product from one manufacturer and from one production run.

2.3 MIXES

A. Tuck Pointing Mortar for Repair Work: Tuck pointing mortar specified in Section 04 01 00, MAINTENANCE OF MASONRY.

B. Masonry Mortar: ASTM C270.
   1. Admixtures:
      a. Do not use mortar admixtures, and color admixtures unless approved by Contracting Officer's Representative.
      b. Do not use antifreeze compounds.

C. Colored Mortar:
   1. Maintain uniform mortar color for exposed work, throughout. Match color of existing adjacent mortar.
   2. Alteration Work Mortar Color: Match existing mortar..

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.

B. Protect existing construction and completed work from damage.

3.2 MIXING

A. Measure ingredients by volume using known capacity container.

B. Mix for 3 to 5 minutes in a mechanically operated mortar mixer.

C. Mix water with dry ingredients in sufficient amount to provide a workable mixture which will adhere to vertical surfaces of masonry units.

D. Mortar Stiffened Because of Water Loss Through Evaporation:
   1. Re-temper by adding water to restore to proper consistency and workability.
   2. Discard mortar reaching initial set or unused within two hours of mixing.

E. Pointing Mortar:
   1. Mix dry ingredients with enough water to produce damp mixture of workable consistency retaining shape when formed into ball.
   2. Allow mortar to stand in dampened condition for 60 to 90 minutes.
   3. Add water to bring mortar to a workable consistency before use.

3.3 MORTARING

A. Type S Mortar: Use for masonry containing vertical reinforcing bars (non-engineered).

B. Brick Veneer Over Frame Back Up Walls: Use Type S Portland cement-lime mortar.

C. Type N Mortar: Use for other masonry work.

D. Type N Mortar: Use for pointing items and tuck pointing specified.

3.4 FIELD QUALITY CONTROL

A. Field Tests: Performed by testing laboratory specified in Section 01 45 29, TESTING LABORATORY SERVICES.
   1. Take and test samples during progress of work according to ASTM C780.

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SECTION 04 20 00

UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Concrete masonry unit (CMU) assemblies for:
   1. Exterior walls.

1.2 RELATED REQUIREMENTS

A. Sealants and Sealant Installation: Section 07 92 00, JOINT SEALANTS.

B.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. American Concrete Institute (ACI):
   1. 315-99 - Details and Detailing of Concrete Reinforcement.
   2. 530.1/ASCE 6/TMS 602-13 - Specification for Masonry Structures.

C. ASTM International (ASTM):
   1. A615/A615M-15ae1 - Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
   2. A951/A951M-14 - Steel Wire for Masonry Joint Reinforcement.
   3. A1064/A1064M-15 - Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
   4. C34-13 - Structural Clay Load-Bearing Wall tile.
   5. C55-14a - Concrete Building Brick.
   6. C56-13 - Structural Clay Nonloadbearing Tile.
   7. C62-13a - Building Brick (Solid Masonry Units Made from Clay or Shale).
   8. C67-14 - Sampling and Testing Brick and Structural Clay Tile.
   9. C90-14 - Load-Bearing Concrete Masonry Units.
   10. C126-15 - Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units.
   11. C216-15 - Facing Brick (Solid Masonry Units Made From Clay or Shale).
   12. C612-14 - Mineral Fiber Block and Board Thermal Insulation.
   13. C744-14 - Prefaced Concrete and Calcium Silicate Masonry Units.
   14. D1056-14 - Flexible Cellular Materials - Sponge or Expanded Rubber.
   15. D2240-05(2010) - Rubber Property-Durometer Hardness.
   16. F1667-15 - Driven Fasteners: Nails, Spikes, and Staples.

D. American Welding Society (AWS):
   1. D1.4/D1.4M-11 - Structural Welding Code - Reinforcing Steel.

E. Brick Industry Association (BIA):
   1. TN 11B-88 - Guide Specifications for Brick Masonry, Part 3.

F. Federal Specifications (Fed. Spec.):
   1. FF-S-107C(2) - Screws, Tapping and Drive.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:

1. Fabrication, bending, and placement of reinforcing bars. Comply with ACI 315. Show bar schedules, diagrams of bent bars, stirrup spacing, lateral ties and other arrangements and assemblies.
2. Special masonry shapes, profiles, and placement.
3. Masonry units for typical window and door openings, and, for special conditions as affected by structural conditions.

C. Manufacturer's Literature and Data:
1. Description of each product.
2. Installation instructions.

D. Samples:
1. Face brick: Sample panel, 200 mm by 400 mm (8 inches by 16 inches,) showing full color range and texture of bricks, bond, and proposed mortar joints.
2. Concrete masonry units, when exposed in finish work.
3. Anchors and Ties: Each type.
4. Joint Reinforcing: 1200 mm (48 inches) long each type.

E. Sustainable Construction Submittals:
1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.

F. Certificates: Certify products comply with specifications.
1. Face brick.
2. Solid and load-bearing concrete masonry units, including fire-resistant rated units.

G. Delegated Design Drawings and Calculations: Signed and sealed by responsible design professional.

1.5 QUALITY ASSURANCE

A. Welders and Welding Procedures Qualifications: AWS D1.4/D1.4M.

B. Mockups:
1. Before starting masonry, build a mockup panel minimum 1800 mm by 1800 mm (6 feet by 6 feet) with 600 mm (24 inch) 90 degree return for outside corner.
   a. Use masonry units from random cubes of units delivered on site.
   b. Include structural backup, reinforcing, ties, and anchors.
2. Mockup panel must be approved by Contracting Officer's Representative to set workmanship and aesthetic quality for masonry work. Approval must be received prior to commencing any further masonry work.
3. Clean sample panel to test cleaning methods.
4. Mockup Panel location may be located such that it becomes a portion of the final wall.
5. Remove mockup panel when directed by Contracting Officer's Representative, if not included in final wall

1.6 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.

B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.

C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

A. Store products above grade, protected from contamination.

B. Protect products from damage during handling and construction operations.

1.8 FIELD CONDITIONS

A. Hot and Cold Weather Requirements: Comply with ACI 530.1/ASCE 6/TMS 602.

1.9 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

A. Delegated Design: Prepare submittal documents including design calculations and drawings signed and sealed by registered design professional, licensed in state where work is located.

2.2 PRODUCTS - GENERAL

A.

B. Provide each product from one manufacturer and from one production run

C. Sustainable Construction Requirements:
   1. Brick Recycled Content: 16 percent total recycled content, minimum.
   2. Steel Recycled Content: 30 percent total recycled content, minimum.

2.3 UNIT MASONRY PRODUCTS

A. Brick:
   1. Face Brick:
      a. ASTM C216, Grade SW, Type FBS.
      b. Brick when tested according to ASTM C67: Classified slightly efflorescent or better.
      c. Size:
         1) To match Existing.
   2. Building Brick: ASTM C62, Grade MW for backup and interior work; Grade SW where in contact with earth.
   3. One Face Exposed: Grade S, Type I.
   4. Two Faces Exposed: Grade S, Type II.

B. Concrete Masonry Units (CMU):
   1. Hollow and Solid Load-Bearing Concrete Masonry Units: ASTM C90.
      a. Unit Weight: .
      b. Fire rated units for fire rated partitions.
   2. Sizes: Modular, 200 mm by 400 mm (8 inches by 16 inches) nominal face dimension; thickness as indicated on drawings.
   3. For molded faces used as a finished surface, use concrete masonry units with uniform fine to medium surface texture unless specified otherwise.

C. Concrete Brick: ASTM C55.

2.4 ANCHORS, TIES, AND REINFORCEMENT

A. Steel Reinforcing Bars: ASTM A615/A615M; Grade 60, deformed bars.

B. Joint Reinforcement:
   1. Form from wire complying with ASTM A951/A951M.
   2. Hot dipped galvanized after fabrication.
   3. Width of joint reinforcement 40 mm (1.6 inches) less than nominal thickness of masonry wall or partition.
   4. Cross wires welded to longitudinal wires.
   5. Joint reinforcement minimum 3000 mm (10 feet) long, factory cut.
   6. Joint reinforcement with crimp formed drip is not acceptable.
   7. Maximum spacing of cross wires 400 mm (16 inch) to longitudinal wires.

8. Ladder Design:
   a. Longitudinal wires deformed diameter wire.
   b. Cross wires 4 mm (0.16 inch) diameter.
9. Trussed Design:
   a. Longitudinal and cross wires minimum 4 mm (0.16 inch nominal) diameter.
   b. Longitudinal wires deformed.
10. Multiple Wythes and Cavity Wall Ties:
   a. Longitudinal wires 4 mm (0.16 inch), two in each wythe with ladder truss wires 4 mm (0.16 inch) overlay, welded to each longitudinal wire.
   b. Longitudinal wires 4 mm (0.16 inch) with U shape 4 mm (0.16 inch) rectangular ties extending into other wythe minimum 75 mm (3 inches) spaced 400 mm on center (16 inches). Adjustable type with U shape tie designed to receive 4 mm (0.16 inch) pintle projecting into other wythe 75 mm (3 inches min.).

C. Adjustable Veneer Anchor for Framed Walls:
1. Two piece, adjustable anchor and tie.
2. Anchor and tie may be either loop or angle type; provide only one type throughout.
3. Loop Type:
   a. Anchor: Screw-on galvanized steel anchor strap 2.75 mm (0.11 inch) by 19 mm (3/4 inch) wide by 225 mm (9 inches) long, with 9 mm (0.35 inch) offset and 100 mm (4 inch) adjustment. Provide 5 mm (0.20 inch) hole at each end for fasteners.
   b. Ties: Triangular tie, fabricated of 5 mm (0.20 inch) diameter galvanized cold drawn steel wire. Ties long enough to engage anchor and be embedded minimum 50 mm (2 inches) into bed joint of masonry veneer.
4. Angle Type:
   a. Anchor: Minimum 2 mm (16 gage) thick galvanized steel angle shaped anchor strap. Provide hole in vertical leg for fastener. Provide hole near end of outstanding leg to suit upstanding portion of tie.
   b. Tie: Fabricate from 5 mm (0.20 inch) diameter galvanized cold drawn steel wire. Form "L" shape to be embedded minimum 50 mm (2 inches) into the bed joint of masonry veneer and provide upstanding leg to fit through hole in anchor and be long enough to allow 50 mm (2 inches) of vertical adjustment.

D. Dovetail Anchors:
1. Corrugated steel dovetail anchors formed of 1.5 mm (0.06 inch) thick by 25 mm (1 inch) wide galvanized steel, 90 mm (3-1/2 inches) long where used to anchor 100 mm (4 inch) nominal thick masonry units, 140 mm (5-1/2 inches) long for masonry units more than 100 mm (4 inches) thick.
2. Triangular wire dovetail anchor 100 mm (4 inch) wide formed of 4 mm (9 gage) steel wire with galvanized steel dovetail insert. Anchor length to extend minimum 75 mm (3 inches) into masonry, 25 mm (1 inch) into 40 mm (1-1/2 inch) thick units.
3. Form dovetail anchor slots from 0.6 mm (0.02 inch) thick galvanized steel (with felt or fiber filler).

E. Individual Ties:
1. Rectangular ties: Form from 5 mm (3/16 inch) diameter galvanized steel rod to rectangular shape minimum 50 mm (2 inches) wide by sufficient length for ends of ties to extend within 25 mm (1 inch) of each face of wall. Ties that are crimped to form drip are not acceptable.
2. Adjustable Cavity Wall Ties:
   a. Adjustable wall ties may be furnished at Contractor's option.
   b. Two piece type permitting up to 40 mm (1-1/2 inch) adjustment.
   c. Form ties from 5 mm (3/16 inch) diameter galvanized steel wire.
   d. Form one piece to rectangular shape 105 mm (4-1/8 inches) wide by length required to extend into bed joint 50 mm (2 inches).

e. Form other piece to 75 mm (3 inch) long by 75 mm (3 inch) wide shape, having 75 mm (3 inch) long bent section for engaging 105 mm (4-1/8 inch) wide piece to form adjustable connection.

F. Wall Ties, (Mesh or Wire):
1. Mesh wall ties formed of ASTM A1064/A1064M, W0.5, 2 mm, (0.08 inch) galvanized steel wire 13 mm by 13 mm (1/2 inch by 1/2 inch) mesh, 75 mm (3 inches) wide by 200 mm (8 inches) long.
2. Rectangular wire wall ties formed of W1.4, 3 mm, (0.12 inch) galvanized steel wire 50 mm (2 inches) wide by 200 mm (8 inches) long.

G. Corrugated Wall Tie:
1. Form from 1.5 mm (0.06 inch) thick corrugated, galvanized steel 30 mm (1-1/4 inches) wide by lengths to extend minimum 100 mm (4 inches) into joints of masonry plus 38 mm (1-1/2 inch) turn-up.
2. Provide 5 mm (3/16 inch) hole in turn-up for fastener attachment.

H. Adjustable Steel Column Anchor:
1. Two piece anchor consisting of a 6 mm (1/4 inch) diameter steel rod to be welded to steel with offset ends, rod to permit 100 mm (4 inch) vertical adjustment of wire anchor.
2. Triangular shaped wire anchor 100 mm (4 inches) wide formed from 5 (3/16 inch) diameter galvanized wire, to extend minimum 75 mm (3 inches) into joints of masonry.

I. Adjustable Steel Beam Anchor:
1. Z or C type steel strap, 30 mm (1 1/4 inches) wide, 3 mm (1/8 inch) thick.
2. Flange hook minimum 38 mm (1 1/2 inches) long.
3. Length to embed in masonry minimum 50 mm (2 inches) in 100 mm (4 inch) nominal thick masonry and 100 mm (4 inches) in thicker masonry.
4. Bend masonry end minimum 40 mm (1 1/2 inches).

J. Ridge Wall Anchors:
1. Form from galvanized steel minimum 25 mm (1 inch) wide by 5 mm (3/16 inch) thick by 600 mm (24 inches) long, plus 50 mm (2 inch) bends.
2. Other lengths as indicated on drawings.

2.5 ACCESSORIES

A. Shear Keys:
1. Solid extruded cross-shaped section of rubber, neoprene, or polyvinyl chloride, with durometer hardness of approximately 80 when tested according to ASTM D2240, and minimum shear strength of 3.5 MPa (500 psi).
2. Shear Key Dimensions: Nominal 70 mm by 8 mm for long flange and 38 mm by 16 mm for short flange (2-3/4 inches by 5/16 inch for long flange, and 1-1/2 inches by 5/8 inch for short flange).

B. Weeps:
1. Weep Hole Wicks: Glass fiber ropes, 10 mm (3/8 inch) minimum diameter, 300 mm (12 inches) long.
2. Weep Tubing: Round, polyethylene, 9 mm (3/8 inch) diameter, 100 mm (4 inches) long.
3. Weep Hole: Flexible PVC louvered configuration with rectangular closure strip at top.

C. Cavity Drain Material: Open mesh polyester sheets or strips to prevent mortar droppings from clogging the cavity.

D. Preformed Compressible Joint Filler:
1. Thickness and depth to fill joint.
2. Closed Cell Neoprene: ASTM D1056, Type 2, Class A, Grade 1, B2F1.
3. Non-Combustible Type: ASTM C612, Type 5, Max. Temp.1800 degrees F.

E. Box Board:
1. Mineral Fiber Board: ASTM C612, Type 1.

2. 25 mm (1 inch) thickness.
3. Other spacing material having similar characteristics is acceptable subject to Contracting Officer's Representative's approval.

F. Masonry Cleaner:
1. Detergent type cleaner selected for each type masonry.
2. Acid cleaners are not acceptable.
3. Use soapless type specially prepared for cleaning brick or concrete masonry as appropriate.

G. Fasteners:
1. Concrete Nails: ASTM F1667, Type I, Style 11, 19 mm (3/4 inch) minimum length.
2. Masonry Nails: ASTM F1667, Type I, Style 17, 19 mm (3/4 inch) minimum length.
3. Screws: FS-FF-S-107, Type A, AB, SF thread forming or cutting.

H. Welding Materials: AWS D1.4/D1.4M, type to suit application.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

A. Install products according to manufacturer's instructions and approved submittal drawings.
1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

B. Keep finish work free from mortar smears or spatters, and leave neat and clean.

C. Wall Openings:
1. Fill hollow metal frames built into masonry walls and partitions solid with mortar as laying of masonry progresses.
2. When items are not available when walls are built, prepare openings for subsequent installation.

D. Tooling Joints:
1. Do not tool until mortar has stiffened enough to retain thumb print when thumb is pressed against mortar.
2. Tool while mortar is soft enough to be compressed into joints and not raked out.
3. Finish joints in exterior face masonry work with jointing tool, and provide smooth, water-tight concave joint unless specified otherwise.
4. Tool Exposed interior joints in finish work concave unless specified otherwise.

E. Partition Height:
1. Extend partitions minimum 100 mm (4 inches) above suspended ceiling or to overhead construction where no ceiling occurs.
2. Extend following partitions to overhead construction.
   a. Full height partitions, and fire partitions and smoke partitions indicated on drawings.
   b. Both walls at expansion joints.
   c. Corridor walls.
   d. Walls at stairway and stair halls, elevators, dumbwaiters, trash and laundry chute shafts, and other vertical shafts.
   e. Walls at refrigerator space.
   f. Reinforced masonry partitions.
3. Extend finished masonry partitions minimum 100 mm (4 inches) above suspended ceiling and continue with concrete masonry units or structural clay tile to overhead construction:

F. Lintels:
1. Lintels are not required for openings less than 1000 mm (40 inches) wide that have hollow metal frames.

2. Openings 1025 mm (41 inches) wide to 1600 m (63 inches) wide without structural steel lintel or frames, require lintel formed of concrete masonry lintel or bond beam units or structural facing tile lintel units filled with grout and reinforced with one No. 16 (No. 5) rod top and bottom for each 100 mm (4 inches) of nominal thickness unless shown otherwise.
3. Precast concrete lintels of 25 MPa (3,000 psi) concrete, same thickness as partition, and with one No. 16 (No. 5) deformed bar top and bottom for each 100 mm (4 inches) of nominal thickness, is acceptable in lieu of reinforced CMU masonry lintels.
4. Use steel lintels, for openings greater than 1600 m (63 inches) wide, brick masonry openings, and elevator openings unless shown otherwise.
5. Doors having overhead concealed door closers require steel lintel, and pocket for closer box.
6. Lintel Bearing Length: Minimum 100 mm (4 inches) at both ends.
7. Build masonry openings or arches over wood or metal centering and supports when steel lintels are not used.

G. Wetting and Wetting Test:
1. Test and wet brick and clay tile according to BIA TN 11B.
2. Do not wet concrete masonry units or glazed structural facing tile before laying.

H. Temporary Formwork: Provide formwork and shores as required for temporary support of reinforced masonry elements.

I. Construct formwork to conform to shape, line and dimensions indicated on drawings. Make sufficiently tight to prevent mortar, grout, or concrete leakage. Brace, tie and support formwork as required to maintain position and shape during construction and curing of reinforced masonry.

J. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other reasonable temporary construction loads.

K. Minimum Curing Times Before Removing Shores and Forms:
1. Girders and Beams: 10 days.
2. Slabs: 7 days.
3. Reinforced Masonry Soffits: 7 days.

3.2 INSTALLATION - ANCHORAGE

A. Veneer to Framed Walls:
1. Install adjustable veneer anchors.
2. Fasten anchor to stud through sheathing with self-drilling and tapping screw, one at both ends of loop type anchor.
3. Space anchors maximum 400 mm (16 inches) on center vertically at each stud.

B. Masonry Facing to Backup and Cavity Wall Ties:
1. Use individual ties for new work.
2. Stagger ties in alternate courses, and space at 400 mm (16 inches) maximum vertically, and 400 mm (16 inches) horizontally.
3. At openings, provide additional ties spaced maximum 900 mm (36 inches) apart vertically around perimeter of opening, and within 300 mm (12 inches) from edge of opening.
4. Anchor new masonry facing to existing masonry with adjustable cavity wall ties spaced at 400 mm (16 inch) maximum vertical intervals and at every second masonry unit horizontally. Fasten ties to masonry with masonry nails.
5. Option: Install joint reinforcing for multiple wythes and cavity wall ties spaced maximum 400 mm (16 inches) vertically.
6. Tie interior and exterior wythes of reinforced masonry walls together with individual ties. Provide ties at intervals maximum 400 mm (16 inches) on center horizontally, and 400 mm (16 inches) on center vertically. Lay ties in the same line vertically in order to facilitate vibrating of the grout pours.

C. Anchorage of Abutting Masonry:
   1. Anchor interior 100 mm (4 inch) thick masonry partitions to exterior masonry walls with wall ties. Space ties at 600 mm (24 inches) maximum vertical intervals. Extend ties 100 mm (4 inches) minimum into masonry.
   2. Anchor interior masonry bearing walls or interior masonry partitions over 100 mm (4 inches) thick to masonry walls with rigid wall anchors spaced at 400 mm (16 inch) maximum vertical intervals.
   3. Anchor abutting masonry walls and partitions to concrete with dovetail anchors. Install dovetail slots vertically in concrete at centerline of abutting wall or partition. Locate dovetail anchors at 400 mm (16 inch) maximum vertical intervals. Secure anchors to existing wall with two 9 mm (3/8 inch) by 75 mm (3 inch) expansion bolts or two power-driven fasteners.
   4. Anchor abutting interior masonry partitions to existing concrete and existing masonry construction, with adjustable wall ties. Extend ties minimum 100 mm (4 inches) into joints of new masonry. Fasten ties to existing concrete and masonry construction, with powder actuated drive pins, nail or other means that provides rigid anchorage. Install anchors at 400 mm (16 inch) maximum vertical intervals.

D. Masonry Furring:
   1. Anchor masonry furring less than 100 mm (4 inches) nominal thick to masonry walls or to concrete with adjustable wall ties or dovetail anchors.
   2. Space at maximum 400 mm (16 inches) on center in both directions.

E. Anchorage to Steel Beams or Columns:
   1. Use adjustable beam anchors on each flange.
   2. At columns weld steel rod to steel columns at 300 mm (12 inch) intervals, and place wire ties in masonry courses at 400 mm (16 inches) maximum vertically.

3.3 INSTALLATION - REINFORCEMENT

A. Joint Reinforcement:
   1. Install joint reinforcement in CMU wythe of combination brick and CMU, cavity walls, and single wythe concrete masonry unit walls or partitions.
   2. Reinforcing is acceptable in lieu of individual ties for anchoring brick facing to CMU backup in exterior masonry walls.
   3. Locate joint reinforcement in mortar joints at 400 mm (16 inch) maximum vertical intervals.
   4. Additional joint reinforcement is required in mortar joints at both 200 mm (8 inches) and 400 (16 inches) above and below windows, doors, louvers and similar openings in masonry.
   5. Wherever brick masonry is backed up with stacked bond masonry, install multiple wythe joint reinforcement in every two courses of CMU backup, and in corresponding joint of facing brick.

B. Steel Reinforcing Bars:
   1. Install reinforcing bars in cells of hollow masonry units where required for vertical reinforcement and in bond beam units for horizontal reinforcement. Install in wall cavities of reinforced masonry walls where indicated on drawings.
   2. Bond Beams:
      a. Form Bond beams of load-bearing concrete masonry units filled with grout and reinforced with two No. 15m (No. 5) reinforcing bars unless shown otherwise. Do not cut reinforcement.
      b. Brake bond beams only at expansion joints and at control joints, if shown.
   3. Stack Bond:
      a. Locate additional joint reinforcement in vertical and horizontal joints as indicated on drawings.
      b. Anchor vertical reinforcement into foundation or wall or bond beam below.

c. Provide temporary bracing for walls over 8 feet tall until permanent horizontal bracing is completed.

4. Grout openings:
   a. Leave cleanout holes in double wythe walls during construction by omitting units at base of one side of wall.
   b. Locate 75 mm by 75 mm (3 inches. by 3 inches.) min. cleanout holes at location of vertical reinforcement.
   c. Keep grout space clean of mortar accumulation and debris. Clean as work progresses and immediately before grouting.

3.4 INSTALLATION - BRICK EXPANSION AND CMU CONTROL JOINTS

A. Provide brick expansion joint (BEJ) and CMU control joints (CJ) where indicated on drawings.
   1. Horizontal Expansion Joints:
      a. Locate as indicated.
      b. Where not indicated:
         1) Locate immediately below shelf angles.
         2) For brick infill, place between the top of brickwork and structural frame.
         3) Parapets which do not have a shelf angle (where parapet veneer bears directly on veneer of floor below):
            a) Lay brick normally in full bed joint of mortar.
            b) Rake out the face of joint to a depth of 3/4 IN 19 MM while still plastic.
            c) Install backer rod and sealant.
   2. Vertical Expansion Joints (BEJ) and CMU Control Joints (CJ):
      a. Locate where indicated.
      b. Where not indicated:
         1) Corners:
            a) Provide vertical CJ's within 2 FT 600 MM of corners.
      c. Further subdivide remaining portions of walls (between corners) as follows:
         1) Walls with Openings: Provide vertical CJ's at maximum 20 FT 6 M O.C.
         2) Walls without Openings: Provide vertical CJ's at maximum 25 FT 7.5 MM O.C.
      d. If brick used above or below concrete masonry, concrete masonry spacing governs.
      e. If brick used with concrete masonry backup, concrete masonry spacing governs.
      f. Parapets:
         1) At parapets, extend primary CJ's thru parapets to wall caps.
         2) Provide an additional vertical CJ's halfway between primary vertical CJ's.
            a) Intermediate CJ's are not required when distance between primary CJ's is less than 15 FT 4.5m O.C.
         3) Extend intermediate parapet CJ's down from cap to logical termination at nearest horizontal CJ.
      g. Walls at building Expansion Joints:
         1) Provide vertical BEJ's at building structural expansion joint locations.
   3.

B. Keep joint free of mortar and other debris.

C. Joints occur in masonry walls:
   1. Install preformed compressible joint filler in brick wythe.
   2. Install cross shaped shear keys in concrete masonry unit wythe with preformed compressible joint filler on both sides of shear key.

D. Use standard notched concrete masonry units (sash blocks) made in full and half-length units where shear keys are used to create a continuous vertical joint.

E. Interrupt joint reinforcement at expansion and control joints.

F. Fill opening in exposed face of expansion and control joints with sealant as specified in Section 07 92 00, JOINT SEALANTS.

3.5 INSTALLATION - BUILDING EXPANSION AND SEISMIC JOINTS

A. Keep expansion and seismic joints open and free of mortar. Remove mortar and other debris.

B. Install non-combustible, compressible type joint filler to fill space completely except where sealant is shown on joints in exposed finish work.

C. Fill opening in exposed face of expansion and seismic joints with sealant as specified in Section 07 92 00, JOINT SEALANTS.

3.6 INSTALLATION - ISOLATION JOINT

A. Where full height walls and partitions lie parallel or perpendicular to and under structural beams and shelf angles, provide minimum 9 mm (3/8 inch) separation between walls and partitions and bottom of beams and shelf angles.

B. Insert continuous full width strip of non-combustible type compressible joint filler.

C. Fill opening in exposed face of isolation joints with sealant as specified in Section 07 92 00, JOINT SEALANTS.

3.7 INSTALLATION - BRICKWORK

A. Lay clay brick according to BIA TN 11B.

B. Laying:
1. Lay brick in one-half running bond with bonded corners, unless indicated otherwise.Match bond of existing building on alterations and additions.
2. Maintain bond pattern throughout.
3. Do not use brick smaller than half-brick at any angle, corner, break, and jamb.
4. Where length of cut brick is greater than one half length, maintain vertical joint location.
5. Lay exposed brickwork joints symmetrical about center lines of openings.
6. Do not structurally bond multi-wythe brick walls, unless indicated on drawings.
7. Before starting work, lay facing brick on foundation wall and adjust bond to openings, angles, and corners.
8. Lay brick for sills with wash and drip.
9. Build solid brickwork as required for anchorage of items.

C. Joints:
1. Exterior And Interior Joint Widths: Lay for three equal joints in 200 mm (8 inches) vertically, unless shown otherwise.
2. Rake joints for pointing with colored mortar when colored mortar is not full depth.
3. Arches:
   a. Flat arches (jack arches) lay with camber of 1 in 200 (1/16 inch per foot) of span.
   b. Face radial arches with radial brick with center line of joints on radial lines.
   c. Form Radial joints of equal width.
   d. Bond arches into backing with metal ties in every other joint.

D. Weep Holes:
1. Install weep holes at 600 mm (24 inches) on center in bottom of vertical joints of exterior masonry veneer or cavity wall facing over foundations, bond beams, and other water stops in wall.
2. Form weep holes using wicks made of mineral fiber insulation strips turned up 200 mm (8 inches) in cavity. Anchor top of strip to backup to securely hold in place.
3. Install sand or pea gravel in cavity approximately 75 mm (3 inches) high between weep holes.

E. Cavity Walls:
1. Keep air space clean of mortar accumulations and debris.

2. Lay the interior wythe of the masonry wall full height where dampproofing or air barrier is required on cavity face. Coordinate to install dampproofing orair barrier before laying outer wythe.
3. Insulated Cavity Type Exterior Walls:
   a. Install insulation against cavity face of inner masonry wythe.
   b. Place insulation between rows of ties or joint reinforcing. Adhere insulation to masonry surface with a bonding agent as recommended by insulation manufacturer.
   c. Lay outer masonry wythe up with air space between insulation and masonry units.
4. Veneer Framed Walls:
   a. Build with 100 mm (4 inches) of face brick over sheathed stud wall with air space.
   b. Keep air space clean of mortar accumulations and debris.

3.8 INSTALLATION - CONCRETE MASONRY UNITS

A. Types and Uses:
1. Provide special concrete masonry shapes as required, including lintel and bond beam units, sash units, and corner units. Provide solid concrete masonry units, where full units cannot be installed, or where needed for anchorage of accessories.
2. Provide solid load-bearing concrete masonry units or grout cell of hollow units at jambs of openings in walls, where structural members impose loads directly on concrete masonry, and where shown.
3. Do not install brick jambs in exposed finish work.
4. Install concrete building brick only as filler in backup material where not exposed.
5. Construct fire resistance in fire rated partitions meeting fire ratings indicated on drawings.
6. Structural Clay Tile Units (Option):
   a. Structural clay tile units load-bearing or non-load bearing as required, may be installed in lieu of concrete masonry units, only, but not as an exposed surface, foundation walls or where otherwise noted.
   b. Set units as specified for concrete masonry units.
   c. Install brick or load-bearing structural clay tile units, with cores set vertically, and filled with grout where structural members impose concentrated load directly on structural clay tile masonry.

B. Laying:
1. Lay concrete masonry units with 9 mm (3/8 inch) joints, with a bond overlap of minimum 1/4 of unit length, except where stack bond is indicated on drawings.
2. Do not wet concrete masonry units before laying.
3. Bond external corners of partitions by overlapping alternate courses.
4. Lay first course in a full mortar bed.
5. Set anchorage items as work progress.
6. Where ends of anchors, bolts, and other embedded items, project into voids of units, completely fill voids with mortar or grout.
7. Provide 6 mm (1/4 inch) open joint for sealant between existing construction, exterior walls, concrete work, and abutting masonry partitions.
8. Lay concrete masonry units with full face shell mortar beds and fill head joint beds for depth equivalent to face shell thickness.
9. Lay concrete masonry units so cores of units, that are to be filled with grout, are vertically continuous with joints of cross webs of such cores completely filled with mortar. Unobstructed core openings minimum 50 mm (2 inches) by 75 mm (3 inches).
10. Do not wedge masonry against steel reinforcing. Minimum 13 mm (1/2 inch) clear distance between reinforcing and masonry units.
11. Install deformed reinforcing bars of sizes indicated on drawings.
12. At time of placement, ensure steel reinforcement is free of loose rust, mud, oil, and other contamination capable of affecting bond.
13. Place steel reinforcement at spacing indicated on drawings before grouting.
14. Minimum clear distance between parallel bars: One bar diameter.

15. Hold vertical steel reinforcement in place vertically by centering clips, caging devices, tie wire, or other approved methods.
16. Support vertical bars near each end and at maximum 192 bar diameter on center.
17. Splice reinforcement or attach reinforcement to dowels by placing in contact and securing with wire ties.
18. Stagger splices in adjacent horizontal reinforcing bars. Lap reinforcing bars at splices a minimum of 40 bar diameters.
19. Grout cells of concrete masonry units, containing reinforcing bars, solid as specified.
20. Install cavity and joint reinforcement as masonry work progresses.
21. Rake joints 6 to 10 mm (1/4 to 3/8 inch) deep for pointing with colored mortar when colored mortar is not full depth.

C. Waterproofing Parging:
1. Parge earth side of concrete masonry unit basement walls with mortar applied in two coats, each coat 6 mm (1/4 inch) thick.
2. Clean wall surfaces to receive parging of dirt, oil, or grease, and moisten before application of first coat.
3. Roughen first coat when partially set, permit to hardened for 24 hours, and moisten before application of second coat.
4. Keep second coat damp for minimum 48 hours.
5. Thicken parging and round to form a cove at the junction of outside wall face and footing.

3.9 : (NOT USED)POINTING

A. Fill joints with pointing mortar using rubber float trowel to apply mortar solidly into raked joints.

B. Wipe off excess mortar from joints of glazed masonry units with dry cloth.

C. Tool exposed joints to smooth concave joint.

D. At joints with existing work, match existing joint.

3.10 GROUTING

A. Preparation:
1. Clean grout space of mortar droppings before placing grout.
2. Close cleanouts.
3. Install vertical solid masonry dams across grout space for full height of wall at intervals of maximum 9000 mm (30 feet). Do not bond dam units into wythes as masonry headers.
4. Verify reinforcing bars are installed as indicated on drawings.

B. Placing:
1. Place grout in grout space in lifts as specified.
2. Consolidate each grout lift after free water has disappeared but before plasticity is lost.
3. Do not slush with mortar or use mortar with grout.
4. Interruptions:
   a. When grouting must be stopped for more than an hour, top off grout 40 mm (1-1/2 inches) below top of last masonry course.
   b. Grout from dam to dam on high lift method.
   c. Longitudinal run of masonry may be stopped off only by raking back one-half masonry unit length in each course and stopping grout 100 mm (4 inches) back of rake on low lift method.

C. Puddling Method:
1. Consolidate by puddling with grout stick during and immediately after placing.
2. Grout cores of concrete masonry units containing reinforcing bars solid as masonry work progresses.

D. Low Lift Method:
1. Construct masonry to 1.5 m (5 feet) maximum height before grouting.

2. Grout in one continuous operation and consolidate grout by mechanical vibration and reconsolidate after initial water loss and settlement has occurred.

E. High Lift Method:
1. Do not pour grout until masonry wall has cured minimum of 4 hours.
2. Place grout in 1.5 m (5 feet) maximum lifts.
3. Exception:
   a. Where following conditions are met, place grout in 3.86 m (12.67 feet) maximum lifts.
   b. Masonry has cured minimum of 4 hours.
   c. Grout slump is maintained between 250 and 275 mm (10 and 11 inches).
   d. No intermediate reinforced bond beams are placed between top and bottom of grout lift.
4. When vibrating succeeding lifts, extend vibrator 300 to 450 mm (12 to 18 inches) into preceding lift.

3.11 PLACING REINFORCEMENT

A. General: Clean reinforcement of loose rust, mill scale, earth, ice or other materials which will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on drawings or approved submittal drawings, or bars with reduced cross-section due to excessive rusting or other causes.

B. Position reinforcement accurately at spacing indicated on drawings. Support and secure vertical bars against displacement. Install horizontal reinforcement as masonry work progresses. Where vertical bars are shown in close proximity, provide clear distance between bars of minimum one bar diameter or 25 mm (1 inch), whichever is greater.

C. For columns, piers and pilasters, maintain clear distance between vertical bars as indicated on drawings, minimum 1.5 bar diameters or 38 mm (1-1/2 inches), whichever is greater. Provide lateral ties as indicated on drawings.

D. Splice reinforcement bars only where indicated on drawings, unless approved by Contracting Officer's Representative. Provide lapped splices. In splicing vertical bars or attaching to dowels, lap ends, place in contact and wire tie.

E. Provide minimum lap as indicated on approved submittal drawings, or if not indicated, minimum 48 bar diameters.

F. Weld splices where indicated on drawings according to AWS D1.4/D1.4M.

G. Embed metal ties in mortar joints as work progresses, with minimum mortar cover of 15 mm (5/8 inch) on exterior face of walls and 13 mm (1/2 inch) at other locations.

H. Embed prefabricated horizontal joint reinforcement as work progresses, with minimum cover of 15 mm (5/8 inch) on exterior face of walls and 13 mm (1/2 inch) at other locations. Lap joint reinforcement minimum 150 mm (6 inches) at ends. Use prefabricated “L” and “T” sections to provide continuity at corners and intersections. Cut and bend joint reinforcement for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.

I. Anchoring: Anchor reinforced masonry work to supporting structure as indicated on drawings.

J. Anchor reinforced masonry walls at intersections with non-reinforced masonry.

3.12 INSTALLATION OF REINFORCED CONCRETE UNIT MASONRY

A. Do not wet concrete masonry units (CMU).

B. Lay CMU units with full-face shell mortar beds. Fill vertical head joints (end joints between units) solidly with mortar from face of unit to distance behind face equal to thickness of longitudinal face shells. Solidly bed cross-webs of starting courses in mortar. Maintain head and bed 9 mm (3/8 inch) joint widths.

C. Where solid CMU units are shown, lay with full mortar head and bed joints.

D. Walls:
1. Pattern Bond: Lay CMU wall units in 1/2-running bond with vertical joints in each course centered on units in courses above and below, unless otherwise indicated. Bond and interlock each course at corners and intersections. Use special-shaped units where shown, and as required for corners, jambs, sash, control joints, lintels, bond beams and other special conditions.
2. Maintain vertical continuity of core or cell cavities, which are to be reinforced and grouted, to provide minimum clear dimension indicated and to provide minimum clearance and grout coverage for vertical reinforcement bars. Keep cavities free of mortar. Solidly bed webs in mortar where adjacent to reinforced cores or cells.
3. Where horizontally reinforced beams (bond beams) are indicated on drawings, use special units or modify regular units to allow for placement of continuous horizontal reinforcement bars. Place small mesh expanded metal lath or wire screening in mortar joints under bond beam courses over cores or cells of non-reinforced vertical cells, or provide units with solid bottoms.

E. Columns, Piers and Pilasters:
1. Use CMU units of size, shape and number of vertical core spaces shown. If not shown, use units which provide minimum clearances and grout coverage for number and size of vertical reinforcement bars shown.
2. Provide pattern bond shown, or if not shown, alternate head joints in vertical alignment.
3. Where bonded pilaster construction is shown, lay wall and pilaster units together to maximum grout pour height specified.

F. Grouting:
1. Use fine grout for filling spaces less than 100 mm (4 inches) in one or both horizontal directions.
2. Use coarse grout for filling 100 mm (4 inch) spaces or larger in both horizontal directions.
3. Grouting Technique: At Contractor’s option, use either low-lift or high-lift grouting techniques.

G. Low-Lift Grouting:
1. Provide minimum clear dimension of 50 mm (2 inches) and clear area of 5160 sq. mm (8 sq. inches) in vertical cores to be grouted.
2. Place vertical reinforcement before grouting of CMU. Extend above elevation of maximum pour height as required for splicing. Support in position at vertical intervals not exceeding 192 bar diameters nor 3 m (10 feet).
3. Lay CMU to maximum pour height. Do not exceed 1.5 m (5 feet) height, or if bond beam occurs below 1.5 m (5 feet) height, stop pour 38 mm (1-1/2 inches) below top of bond beam.
4. Rod or vibrate grout during placing. Place grout continuously; do not interrupt pouring of grout for more than one hour. Terminate grout pours 38 mm (1-1/2 inches) below top course of pour.
5. Bond Beams: Stop grout in vertical cells 38 mm (1-1/2 inches) below bond beam course. Place horizontal reinforcement in bond beams; lap at corners and intersections as indicated on drawings. Place grout in bond beam course before filling vertical cores above bond beam.

H. High-Lift Grouting:
1. Do not use high-lift grouting technique for grouting of CMU unless minimum cavity dimension and area is 75 mm (3 inches) and 6450 sq. mm (10 sq. inches), respectively.
2. Provide cleanout holes in first course at vertical cells which are to be filled with grout.
3. Use units with one face shell removed and provide temporary supports for units above, or use header units with concrete brick supports, or cut openings in one face shell.
4. Construct masonry to full height of maximum grout pour before placing grout.
5. Limit grout lifts to maximum height of 1.5 m (5 feet) and grout pour to maximum height of 7.3 m (24 feet), for single wythe hollow concrete masonry walls, unless otherwise indicated.

6. Place vertical reinforcement before grouting. Place before or after laying masonry units, to suit application. Tie vertical reinforcement to dowels at base of masonry where shown and thread CMU over or around reinforcement. Support vertical reinforcement at intervals not exceeding 192 bar diameters nor 3 m (10 feet).
7. Where individual bars are placed after laying masonry, place wire loops extending into cells as masonry is laid and loosen before mortar sets. After insertion of reinforcement bar, pull loops and bar to proper position and tie free ends.
8. Where reinforcement is prefabricated into cage units before placing, fabricate units with vertical reinforcement bars and lateral ties of the size and spacing indicated.
9. Place horizontal beam reinforcement as masonry units are laid.
10. Embed lateral tie reinforcement in mortar joints where indicated. Place as masonry units are laid, at vertical spacing shown.
11. Where lateral ties are shown in contact with vertical reinforcement bars, embed additional lateral tie reinforcement in mortar joints. Place as indicated on drawings, or if not shown, provide as required to prevent grout blowout or rupture of CMU face shells, but provide minimum 4.1 mm diameter (0.16 inch) wire ties spaced 400 mm (16 inches) on center for members with 500 mm (20 inches) or less side dimensions, and 200 mm (8 inches) on center for members with side dimensions exceeding 500 mm (20 inches).
12. Preparation of Grout Spaces: Before grouting, inspect and clean grout spaces. Remove dust, dirt, mortar droppings, loose pieces of masonry and other foreign materials from grout spaces. Clean reinforcement and adjust to proper position. Clean top surface of structural members supporting masonry to ensure bond. After final cleaning and inspection, close cleanout holes and brace closures to resist grout pressures.
13. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist displacement of masonry units and breaking of mortar bond. Install shores and bracing, if required, before starting grouting operations.
14. Limit grout pours to sections which can be completed in one working day with maximum one hour interruption of pouring operation. Place grout in lifts which do not exceed 1.5 m (5 feet). Allow minimum 30 minutes and maximum one hour between lifts. Mechanically consolidate each lift.
15. Place grout in lintels or beams over openings in one continuous pour.
16. Where bond beam occurs more than one course below top of pour, fill bond beam course to within 25 mm (1 inch) of vertically reinforced cavities, during construction of masonry.
17. When more than one pour is required to complete a given section of masonry, extend reinforcement beyond masonry as required for splicing. Pour grout to within 38 mm (1-1/2 inches) of top course of first pour. After grouted masonry is cured, lay masonry units and place reinforcement for second pour section before grouting. Repeat sequence if more pours are required.

3.13 CONSTRUCTION TOLERANCES

A. Lay masonry units plumb, level and true to line within tolerances according to ACI 530.1/ASCE 6/TMS 602 and as follows:

B. Maximum variation from plumb:
   1. In 3000 mm (10 feet) - 6 mm (1/4 inch).
   2. In 6000 mm (20 feet) - 9 mm (3/8 inch).
   3. In 12,000 mm (40 feet) or more - 13 mm (1/2 inch).

C. Maximum variation from level:
   1. In any bay or up to 6000 mm (20 feet) - 6 mm (1/4 inch).
   2. In 12,000 mm (40 feet) or more - 13 mm (1/2 inch).

D. Maximum variation from linear building lines:
   1. In any bay or up to 6000 mm (20 feet) - 13 mm (1/2 inch).
   2. In 12,000 mm (40 feet) or more - 19 mm (3/4 inch).

E. Maximum variation in cross-sectional dimensions of columns and thickness of walls from dimensions shown:

1. Minus 6 mm (1/4 inch).
2. Plus 13 mm (1/2 inch).

F. Maximum variation in prepared opening dimensions:
1. Accurate to minus 0 mm (0 inch).
2. Plus 6 mm (1/4 inch).

3.14 CLEANING AND REPAIR

A. General:
1. Clean exposed masonry surfaces on completion.
2. Protect adjoining construction materials and landscaping during cleaning operations.
3. Cut out defective exposed new joints to depth of approximately 19 mm (3/4 inch) and repoint.
4. Remove mortar droppings and other foreign substances from wall surfaces.

B. Brickwork:
1. First wet surfaces with clean water, then wash down with detergent solution. Do not use muriatic acid.
2. Brush with stiff fiber brushes while washing, and immediately wash with clean water.
3. Remove traces of detergent, foreign streaks, or stains of any nature.

C. Concrete Masonry Units:
1. Immediately following setting, brush exposed surfaces free of mortar or other foreign matter.
2. Allow mud to dry before brushing.

3.15 FIELD QUALITY CONTROL

A. Water Penetration Testing:
1. Seven days before plastering or painting, in presence of Contracting Officer's Representative, test solid exterior masonry walls for water penetration.
2. Direct water on masonry for a period of one hour when wind velocity is less than five miles per hour.
3. Should moisture appear on inside of walls tested, make additional tests at other areas as directed by Contracting Officer's Representative.
4. Correct areas showing moisture on inside of walls, and repeat test at repaired areas, to ensure moisture penetration has been stopped.
5. Make water test at following locations:
   a. Two places on Building Number 14.

- - E N D - -

SECTION 04 72 00

CAST STONE MASONRY

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies manufactured concrete units to simulate a natural stone.

B. Installation of cast stone units.

1.2 RELATED WORK

A. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS

B. Section 04 05 13, MASONRY MORTARING, Setting and pointing mortar.

C. Section 04 05 16, MASONRY GROUTING, Setting and pointing mortar.

D. Section 07 92 00, JOINT SEALANTS, Joint sealant and application.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. All items indicated below are required submittals requiring Contracting Officer's Representative (COR) review and approval.

B. Samples:
1. Cast stone, sample panel, size 100 by 300 by 300 mm (4 by 12 by 12 inches) each color and finish.
2. Show finish on two 100 mm (4-inch) edges and 300 by 300 mm (12 by 12 inch) surface.

C. Shop Drawings:
1. Cast stone showing exposed faces, profiles, cross sections, anchorage, reinforcing, jointing and sizes.
2. Setting drawings with setting mark.

D. Certificates: Test results indicating that the cast stone meets specification requirements and proof of plant certification.

E. Submit manufacturers test results of cast stone previously made by manufacturer.

F. Laboratory Data: Description of testing laboratories facilities and qualifications of its principals and key personnel.

G. List of jobs furnished by the manufacturer, which were similar in scope and at least three (3) years of age.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Store cast stone under waterproof covers on planking clear of ground.

B. Protect from handling, dirt, stain, and water damage.

C. Mark production units with the identification marks as shown on the shop drawings.

D. Package units and protect them from staining or damage during shipping and storage.

E. Provide an itemized list of product to support the bill of lading.

1.5 WARRANTY

A. Warranty exterior masonry walls against moisture leaks, any defects and subject to terms of "Warranty of Construction", FAR clause 52.246-21, except that warranty period shall be two years.

1.6 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by the basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

B. Cast Stone Institute Technical Manual and Cast Stone Institute standard specifications.

C. ASTM International(ASTM):

A167-99(R2009)	Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
A615/A615M-20	Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement
A1064/A1064M-18a	Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
C33/C33M-18	Standard Specification for Concrete Aggregates
C150/C150M-20	Standard Specification for Portland Cement
C503/C503M-15	Standard Specification for Marble Dimension Stone (Exterior)
C568/C568M-15	Standard Specification for Limestone Dimension Stone
C615/C615M-18e1	Standard Specification for Granite Dimension Stone
C616/C616M-15	Standard Specification for Quartz-Based Dimension Stone
C979/C979M-16	Standard Specification for Pigments for Integrally Colored Concrete
C1194-19	Standard Test Method for Compressive Strength of Architectural Cast Stone
C1195-19a	Standard Test Method for Absorption of Architectural Cast Stone
C1364-19	Standard Specification for Architectural Cast Stone.
D2244-16	Standard Practice for Calculation of Color Differences from Instrumentally Measured Color Coordinates.

1.7 QUALITY ASSURANCE

A. The Manufacturer:
1. Must have 5 years minimum continuous operating experience and have facilities for manufacturing cast stone as described herein. Manufacturer shall have sufficient plant facilities to produce the shapes, quantities and size of cast stone required in accordance with the project schedule.
2. Must be a member of the Cast Stone Institute.
3. Must have a certified plant (certification by the Cast Stone Institute).

B. Stone setter: Must have 5 years' experience setting cast or natural building stone.

C. Testing: One (1) sample from production units may be selected at random from the field for each 500 cubic feet (14 meters squared) delivered to the job:
1. Three (3) field cut cube specimens from each of these sample shall have an average minimum compressive strength of not less than 85 percent with no single specimen testing less than 75 percent of design strength as specified.
2. Three (3) field cut cube specimens from each of these samples shall have an average maximum cold-water absorption of 6 percent.
3. Field specimens shall be tested in accordance with ASTMC 1194 and C 1195.
4. Manufacturer shall submit a written list of projects similar and at least three (3) years of age, along with owner, architect and contractor references.

1.8 MANUFACTURING TOLERANCES

A. Cross section dimensions shall not deviate by more than + 1/8 inch (3 mm) from approved dimension.

B. Length of units shall not deviate by more than length /360 or + 1/8 inch (3mm), whichever is greater, not to exceed + 1/4 inch (6 mm). Maximum length of any unit shall not exceed 15 times the average thickness of such unit unless otherwise agreed by the manufacturer.

C. Warp bow or twist of units shall not exceed length/360 or + 1/8 inch (3 mm), whichever is greater.

D. Location of dowel holes, anchor slots, flashing grooves, false joints and similar features – On formed sides of unit, 1/8 inch (3 mm), on unformed sides of unit, 3/8 inch (9 mm) maximum deviation.

1.9 MOCK-UP

A. Provide full size unit(s) for use in construction of sample wall. The mock-up becomes the standard of workmanship for the project.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL CAST STONE

A. Comply with ASTM C 1364

B. Physical properties: Provide the following:
1. Compressive Strength – ASTM C 1194: 6,500 psi (45 Mpa) minimum for products at 28 days.
2. Absorption – ASTM C 1195: 6 percent maximum by the cold water method, or 10 percent maximum by the boiling method for products as 28 days.
3. Air Content – ASTM C173 or C231, for wet cast product shall be 4-8 percent for units exposed to freeze-thaw environments. Air entrainment is not required for vibrant dry tamp (VDT) products.
4. Freeze thaw - ASTM C 1364L The cumulative percent weight loss (CPWL) shall be less than 5 percent after 300 cycles of freezing and thawing.
5. Linear Shrinkage - ASTM C 426L Shrinkage shall not exceed 0.065 percent.

C. Job site testing – One (1) sample from production units may be selected at random from the field for each 500 cubic feet (14 cubic meters) delivered to the job site:
1. Three (3) field cut cube specimens from each of these samples shall have an average minimum compressive strength of not less than 85 percent with no single specimen testing less than 75 percent of design strength as allowed by ACI 318.
2. Three (3) field cut cube specimens from each of these samples shall have an average maximum cold-water absorption of 6 percent.
3. Field specimens shall be tested in accordance with ASTM C 1194 and C 1195.

2.2 RAW MATERIALS

A. Portland cement – Type I or Type III, white and/or grey, ASTM C 150.

B. Coarse aggregates – Granite, quartz or limestone, ASTM C 33, except for gradation, and are optional for the vibrant dry tamp (VDT) casting method.

C. Fine aggregates – Manufactured or natural sands, ASTM C 33, except for gradation.

D. Colors – Inorganic iron oxide pigments, ASTM C 979 except that carbon black pigments shall not be used.

E. Admixtures- Comply with the following:

1. ASTM C 260 for air-entraining admixtures.
2. ASTM C 494/C 495 M Types A-G for water reducing, retarding, accelerating and high range admixtures.
3. Other admixtures: integral water repellents and other chemicals, for which no ASTM Standard exists, shall be previously established as suitable for use in concrete by proven field performance or through laboratory testing.
4. ASTM C 618 mineral admixtures of dark and variable colors shall not be used in surfaces intended to be exposed to view.
5. ASTM C 989 granulated blast furnace slag may be used to improve physical properties. Tests are required to verify these features.

F. Water – Potable

G. Reinforcing bars:
1. ASTM A 615/A 615M. Grade 40 or 60 steel galvanized or epoxy coated when cover is less than 1.5 inch (37 mm).
2. Welded Wire Fabric: ASTM A 1064 where applicable for wet cast units.

H. All anchors, dowels and other anchoring devices and shims shall be standard building stone anchors commercially available in a non-corrosive material such as zinc plated, galvanized steel, brass, or stainless steel Type 302 or 304.

2.3 COLOR AND FINISH

A. Match existing.

B. All surfaces intended to be exposed to view shall have a fine-grained texture similar to natural stone, with no air voids in excess of 1/32 inch (0.8 mm) and the density of such voids shall be less than 3 occurrences per any 1 inch (25 mm) and not obvious under direct daylight illumination at a 5 feet (1.5 meters) distance.

C. Units shall exhibit a texture approximately equal to the approved sample when viewed under direct daylight illumination at a 10 feet (3 meters) distance.

D. ASTM D 2244 permissible variation in color between units of comparable age subjected to similar weathering exposure.
1. Total color difference – not greater than 6 units.
2. Total hue difference-not greater than 2 units.

2.4 REINFORCING

A. Reinforce the units as required by the drawings and for safe handling and structural stress.

B. Minimum reinforcing shall be 0.25 percent of the cross section area.

C. Reinforcement shall be non-corrosive where faces exposed to weather are covered with less than 1.5inch (38 mm) of concrete material. All reinforcement shall have minimum coverage of twice the diameter of the bars.

D. Minor chipping resulting from shipment and delivery shall not be grounds for rejection. Minor chips shall not be obvious under direct daylight illumination from a 20 foot (6 meter) distance.

E. The occurrence of crazing or efflorescence shall not constitute a cause for rejection.

F. Remove cement film, if required, from exposed surface prior to packaging for shipment.

G. CURING

H. Cure units in a warm curing chamber 100 degrees F (37.8 degrees C) at 95 percent relative humidity for approximately 12 hours, or cure in a 95 percent moist environment at a minimum 70 degrees F (21.1 degrees C) for 16 hours after casting. Additional yard curing at 95 percent relative humidity shall be 350-degree-days (i.e. 7 days @ 50 degrees F (10.0 degrees C) or 5 days @ 70 degrees F (21.0 degrees C) prior to shipping. Form cured units shall be protected from moisture evaporation with curing blankets or curing compounds after casting.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Installing contractor shall check cast stone materials for fit and finish prior to installation. Do not set unacceptable units.

3.2 SETTING TOLERANCES

A. Comply with Cast Stone Institute Technical Manual.

B. Set stones 1/8 inch (3 mm) or less, within the plane of adjacent units.

C. Joints, plus – 1/6 inch (1.5 mm), minus – 1/8 inch (3 mm).

3.3 JOINTING

A. Joint size:
1. At stone/brick joints 3/8 inch (9.5 cm).
2. At stone/stone joints in vertical position 1/4 inch (6 mm) (3/8 inch (9.5 mm) optional).
3. Stone/stone joint exposed on top 3/8 inch (.5 mm).

B. Joint Materials:
1. Mortar, Type N, ASTM C 270.
2. Use a full bed of mortar at all bed joints.
3. Flush vertical joints full with mortar.
4. Leave all joints with exposed tops or under relieving angles open for sealant.
5. Leave head joints in coping and projecting components open for sealant.

C. Location of joints:
1. As shown on shop drawings.
2. At control and expansion joints unless otherwise shown.

3.4 SETTING

A. Drench units with clean water prior to setting.

B. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.

C. Set units in full bed of mortar, unless otherwise detailed.

D. Rake mortar joints 3/4 inch (18 mm) for pointing.

E. Remove excess mortar from unit faces immediately after setting.

F. Tuck point unit joints to match existing conditions.

3.5 JOINT PROTECTION

A. Comply with requirements of Section 07 92 00, JOINT SEALANTS.

B. Prime ends of units, insert properly sized backing rod and install required sealant.

3.6 REPAIR AND CLEANING

A. Repair chips with touchup materials furnished by manufacturer.

B. Saturate units to be cleaned prior to applying an approved masonry cleaner.

C. Consult with manufacturer for appropriate cleaners.

3.7 INSPECTION AND ACCEPTANCE

A. Inspect finished installation according to Bulletin #36 published by the Cast Stone Institute.

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SECTION 05 12 00

STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Structural steel shapes, plates, and bars.
2. Structural pipe.
3. Bolts, nuts, and washers.

1.2 RELATED REQUIREMENTS

A. Materials Testing And Inspection During Construction: Section 01 45 29, TESTING LABORATORY SERVICES.

B. Fireproofing: Section 07 81 00, APPLIED FIREPROOFING.

C. Painting: Section 09 91 00, PAINTING.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. American Institute of Steel Construction (AISC):
1. AISC Manual - Steel Construction Manual, 14th Ed.
2. 303-10 - Code of Structural Steel Buildings and Bridges.
3. 360-10: Specification for Structural Steel Buildings.

C. The American Society of Mechanical Engineers (ASME):
1. B18.22.1-09 - Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers.

D. American Welding Society (AWS):
1. D1.1/D1.1M-15 - Structural Welding Code - Steel.

E. ASTM International (ASTM):
1. A6/A6M-14 - General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.
2. A36/A36M-14 - Carbon Structural Steel.
3. A53/A53M-12 - Pipe, Steel, Black and Hot-Dip, Zinc-Coated, Welded and Seamless.
4. A123/A123M-15 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
5. A242/A242M-13 - High-Strength Low-Alloy Structural Steel.
6. A283/A283M-13 - Low and Intermediate Tensile Strength Carbon Steel Plates.
7. A307-14 - Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.
8. A500/A500M-13 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing and Rounds and Shapes.
9. A501/A501M-14 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing and Rounds and Shapes.
10. A572/A572M-15 - High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
11. A992/A992M-15 - Structural Shapes.
12. F2329/F2329M-15 - Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy steel Bolts, Screws, washers, Nuts, and Special Threaded Fasteners.
13. F3125/F3125M-15 - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions

F. Master Painters Institute (MPI):
1. No. 18 - Primer, Zinc Rich, Organic.

G. Military Specifications (Mil. Spec.):
   1. MIL-P-21035 - Paint, High Zinc Dust Content, Galvanizing, Repair.

H. Occupational Safety and Health Administration (OSHA):
   1. 29 CFR 1926.752(e) - Guidelines For Establishing The Components Of A Site-Specific Erection Plan.
   2. 29 CFR 1926-2001 - Safety Standards for Steel Erection.

I. Research Council on Structural Connections (RCSC) of The Engineering Foundation:
   1. Specification for Structural Joints Using ASTM F3125 Bolts.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:
   1. Show size, configuration, and fabrication and installation details.

C. Sustainable Construction Submittals:
   1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.

D. Test Reports: Certify products comply with specifications.
   1. Welders' qualifying tests.

E. Certificates: Certify each product complies with specifications.
   1. Structural steel.
   2. Steel connections.
   3. Welding materials.
   4. Shop coat primer paint.

F. Qualifications: Substantiate qualifications comply with specifications.
   1. Fabricator with project experience list.
   2. Installer with project experience list.
   3. Welders and welding procedures.

G. Delegated Design Drawings and Calculations: Signed and sealed by responsible Architect/Engineer.
   1. Connection calculations.

H. Record Surveys: Signed and sealed by responsible surveyor or engineer.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: AISC Quality Certification participant designated as AISC Certified Plant, Category STD.
   1. Regularly fabricates specified products.
   2. Fabricated specified products with satisfactory service on five similar installations for minimum five years.
      a. Project Experience List: Provide contact names and addresses for completed projects.

B. Installer Qualifications: AISC Quality Certification Program participant designated as AISC-Certified Erector, Category ACSE.
   1. Regularly installs specified products.
   2. Installed specified products with satisfactory service on five similar installations for minimum five years.
      a. Project Experience List: Provide contact names and addresses for completed projects.

C. Before commencement of Work, ensure steel erector provides written notification required by OSHA 29 CFR 1926.752(e). Submit a copy of the notification to Contracting Officer's Representative.

D. Welders and Welding Procedures Qualifications: AWS D1.1/D1.1M.

1.6 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

A. Delegated Design: Prepare submittal documents including design calculations and drawings signed and sealed by registered design professional, licensed in state where project is located.

B. Design structural steel framing connections complying with specified performance:
   1. Load Capacity: Resist loads indicated on drawings. Account for connection and member loads and eccentricities.
      a. Request additional design criteria when necessary to complete connection design.
   2. Configuration: Design and detail all connections for each member size, steel grade and connection type to resist the loads and reactions indicated on the drawings or specified herein. Use details consistent with details shown on drawings, supplementing where necessary. The details shown on drawings are conceptual and do not indicate the required weld sizes or number of bolts unless specifically noted. Use rational engineering design and standard practice in detailing, accounting for all loads and eccentricities in both the connection and the members. Promptly notify the Contracting Officer Representative of any location where the connection design criteria is not clearly indicated. The design of all connections is subject to the review and acceptance of the Contracting Officer's Representative. Submit structural calculations prepared and sealed by a qualified engineer registered in the state where the project is located. Submit calculations for review before preparation of detail drawings.

2.2 MATERIALS

A. W-Shapes:
   1. ASTM A992/A992M.
   2. ASTM A572/A572M; Grade50
   3. ASTM A529; Grade 50

B. Channel and Angles:
   1. ASTM A36/A36M.

C. Plates and Bars:
   1. ASTM A36/A36M.
   2. ASTM A572/A572M; Grade 50

D. Hollow Structural Sections:
   1. ASTM A500/A500M.
   2. ASTM A501/A501M.

E. Structural Pipe: ASTM A53/A53M, Grade B.

F. Bolts, Nuts and Washers: Galvanized for galvanized framing and plain finish for other framing.
   1. High-strength bolts, including nuts and washers: ASTM F3125.
   2. Bolts and nuts, other than high-strength: ASTM A307, Grade A.
   3. Plain washers, other than those in contact with high-strength bolt heads and nuts: ASME B18.22.1.

G. Welding Materials: AWS D1.1, type to suit application.

2.3 PRODUCTS - GENERAL

A. Sustainable Construction Requirements:
   1. Steel Recycled Content: 30 percent total recycled content, minimum.
   2. Low Pollutant-Emitting Materials: Comply with VOC limits specified in Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for the following products:
      a. Paints and coatings.

2.4 FABRICATION

A. Fabricate structural steel according to Chapter M, AISC 360.

B. Shop and Field Connections:
   1. Weld connections according to AWS D1.1/D1.1M. Welds shall be made only by welders and welding operators who have been previously qualified by tests as prescribed in AWS D1.1 to perform type of work required.
   2. High-Strength Bolts: High-strength bolts tightened to a bolt tension minimum 70 percent of their minimum tensile strength. Tightening done with properly calibrated wrenches, by turn-of-nut method or by use of direct tension indicators (bolts or washers). Tighten bolts in connections identified as slip-critical using Direct Tension Indicators. Twist-off torque bolts are not an acceptable alternate fastener for slip critical connections.

2.5 FINISHES

A. Shop Priming:
   1. Prime paint structural steel according to AISC 303, Section 6.
      a. Interstitial Space Structural Steel: Prime paint, unless indicated to receive sprayed on fireproofing.

B. Shop Finish Painting: Apply primer and finish paint as specified in Section 09 91 00, PAINTING.

C. Do not paint:
   1. Surfaces within 50 mm (2 inches) of field welded joints.
   2. Surfaces indicated to be encased in concrete.
   3. Surfaces receiving sprayed on fireproofing.
   4. Beam top flanges receiving shear connector studs applied.

D. Structural Steel Galvanizing: ASTM A123/A123M, hot dipped, after fabrication. Touch-up after erection: Clean and wire brush any abraded and other spots worn through zinc coating, including threaded portions of bolts and welds and touch-up with galvanizing repair paint.
   1. Galvanize structural steel framing installed at exterior locations.

E. Bolts, Nuts, and Washers Galvanizing: ASTM F2329, hot-dipped.

2.6 ACCESSORIES

A. General: Shop paint steel according to AISC 303, Section 6.

B. Finish Paint System: Primer and finish as specified in Section 09 91 00, PAINTING.

C. Galvanizing Repair Paint: MPI No. 18.

PART 3 - EXECUTION

3.1 ERECTION

A. Erect structural steel according to AISC 303 and AISC 360.

B. Set structural steel accurately at locations and elevations indicated on drawings.

C. Maintain erection tolerances of structural steel within AISC 303 requirements.
   1. Pour Stop Elevation Tolerance: 6 mm (1/4 inch), maximum, before concrete placement.

D. Weld and bolt connections as specified for shop connections.

3.2 FIELD PAINTING

A. After welding, clean and prime weld areas to match adjacent finish.

B. Touch-up primer damaged by construction operations.

C. Apply galvanizing repair paint to galvanized coatings damaged by construction operations.

D. Finish Painting: As specified in Section 09 91 00, PAINTING.

3.3 FIELD QUALITY CONTROL

A. Record Survey:
   1. Engage registered land surveyor or registered civil engineer as specified in Section 01 00 00, GENERAL REQUIREMENTS to perform survey.
   2. Measure and record structural steel framing plumbness, level, and alignment after completing bolting and welding and before installation of work supported by structural steel.
   3. Identify deviations from allowable tolerances specified in AISC Manual.

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SECTION 05 50 00

METAL FABRICATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies items and assemblies fabricated from structural steel shapes and other materials as shown and specified.

B. Items specified.
1. Support for Wall and Ceiling Mounted Items: (SD055000-01, SD055000-02, SD102113-01, SD102600-01, SD123100-01 & SD123100-02)
2. Frames
3.
4. Loose Lintels
5. Shelf Angles
6. Plate Door Sill
7. Safety Nosings
8. Railings:

1.2 RELATED WORK

A. Railings attached to steel stairs: Section 05 51 00, METAL STAIRS.

B. Prime and finish painting: Section 09 91 00, PAINTING.

C. Stainless steel corner guards: Section 10 26 00, WALL AND DOOR PROTECTION.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

Grating, each type	Floor plate
Trap door	Wheel guards
Ceiling hatch	Sidewalk Access door
Manhole Covers	Safety nosing

C. Shop Drawings:
1. Each item specified, showing complete detail, location in the project, material and size of components, method of joining various components and assemblies, finish, and location, size and type of anchors.
2. Mark items requiring field assembly for erection identification and furnish erection drawings and instructions.
3. Provide templates and rough-in measurements as required.

D. Manufacturer's Certificates:
1. Anodized finish as specified.
2. Live load designs as specified.

E. Design Calculations for specified live loads including dead loads.

F. Furnish setting drawings and instructions for installation of anchors to be preset into concrete and masonry work, and for the positioning of items having anchors to be built into concrete or masonry construction.

1.4 QUALITY ASSURANCE

A. Each manufactured product shall meet, as a minimum, the requirements specified, and shall be a standard commercial product of a manufacturer regularly presently manufacturing items of type specified.

B. Each product type shall be the same and be made by the same manufacturer.

C. Assembled product to the greatest extent possible before delivery to the site.

D. Include additional features, which are not specifically prohibited by this specification, but which are a part of the manufacturer's standard commercial product.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society of Mechanical Engineers (ASME):
B18.6.1-97 ..... Wood Screws

B18.2.2-87(R2010)..... Square and Hex Nuts

C. American Society for Testing and Materials (ASTM):
A36/A36M-14 ..... Structural Steel

A47-99(R2014)..... Malleable Iron Castings

A48-03(R2012)..... Gray Iron Castings

A53-12..... Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

A123-15..... Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

A240/A240M-15 ..... Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications.

A269-15..... Seamless and Welded Austenitic Stainless Steel Tubing for General Service

A307-14e1..... Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength

A391/A391M-07(R2015) ..... Grade 80 Alloy Steel Chain

A786/A786M-15 ..... Rolled Steel Floor Plate

B221-14..... Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

B456-11..... Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium

B632-08..... Aluminum-Alloy Rolled Tread Plate

C1107-13..... Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

D3656-13..... Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns

F436-16..... Hardened Steel Washers

F468-06(R2015)..... Nonferrous Bolts, Hex Cap Screws, Socket Head Cap Screws and Studs for General Use

F593-13..... Stainless Steel Bolts, Hex Cap Screws, and Studs

F1667-15..... Driven Fasteners: Nails, Spikes and Staples

F3125 / F3125M ..... Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength

D. American Welding Society (AWS):
D1.1-15..... Structural Welding Code Steel
D1.2-14..... Structural Welding Code Aluminum
D1.3-18..... Structural Welding Code Sheet Steel

E. National Association of Architectural Metal Manufacturers (NAAMM)
AMP 521-01(R2012) ..... Pipe Railing Manual
AMP 500-06 ..... Metal Finishes Manual
MBG 531-09(R2017)..... Metal Bar Grating Manual
MBG 532-09 ..... Heavy Duty Metal Bar Grating Manual

F. Structural Steel Painting Council (SSPC)/Society of Protective Coatings:
SP 1-15 ..... No. 1, Solvent Cleaning
SP 2-04 ..... No. 2, Hand Tool Cleaning
SP 3-04 ..... No. 3, Power Tool Cleaning

G. Federal Specifications (Fed. Spec):
RR-T-650E ..... Treads, Metallic and Nonmetallic, Nonskid

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

A. In addition to the dead loads, design fabrications to support the following live loads unless otherwise specified.

B. Railings and Handrails: 900 N (200 pounds) in any direction at any point.

2.2 MATERIALS

A. Structural Steel: ASTM A36.

B. Stainless Steel: ASTM A240, Type 302 or 304.

C. Aluminum, Extruded: ASTM B221, Alloy 6063-T5 unless otherwise specified. For structural shapes use alloy 6061-T6 and alloy 6061-T4511.

D. pattern.

E. Malleable Iron Castings: A47.

F. Primer Paint: As specified in Section 09 91 00, PAINTING.

G. Stainless Steel Tubing: ASTM A269, type 302 or 304.

H. Modular Channel Units:
1. Factory fabricated, channel shaped, cold formed sheet steel shapes, complete with fittings bolts and nuts required for assembly.
2. Form channel within turned pyramid shaped clamping ridges on each side.
3. Provide case hardened steel nuts with serrated grooves in the top edges designed to be inserted in the channel at any point and be given a quarter turn so as to engage the channel clamping ridges. Provide each nut with a spring designed to hold the nut in place.

4. Factory finish channels and parts with oven baked primer when exposed to view. Channels fabricated of ASTM A525, G90 galvanized steel may have primer omitted in concealed locations. Finish screws and nuts with zinc coating.
5. Fabricate snap-in closure plates to fit and close exposed channel openings of not more than 0.3 mm (0.0125 inch) thick stainless steel.

I. Grout: ASTM C1107, pourable type.

J. Insect Screening: ASTM D3656.

2.3 HARDWARE

A. Rough Hardware:
1. Furnish rough hardware with a standard plating, applied after punching, forming and assembly of parts; galvanized, cadmium plated, or zinc-coated by electro-galvanizing process. Galvanized G-90 where specified.
2. Use G90 galvanized coating on ferrous metal for exterior work unless non-ferrous metal or stainless is used.

B. Fasteners:
1. Bolts with Nuts:
   a. ASME B18.2.2.
   b. ASTM A307 for 415 MPa (60,000 psi) tensile strength bolts.
   c. ASTM F468 for nonferrous bolts.
   d. ASTM F593 for stainless steel.
2. Screws: ASME B18.6.1.
3. Washers: ASTM F436, type to suit material and anchorage.
4. Nails: ASTM F1667, Type I, style 6 or 14 for finish work.

2.4 FABRICATION GENERAL

A. Material
1. Use material as specified. Use material of commercial quality and suitable for intended purpose for material that is not named or its standard of quality not specified.
2. Use material free of defects which could affect the appearance or service ability of the finished product.

B. Size:
1. Size and thickness of members as shown.
2. When size and thickness is not specified or shown for an individual part, use size and thickness not less than that used for the same component on similar standard commercial items or in accordance with established shop methods.

C. Connections
1. Except as otherwise specified, connections may be made by welding, riveting or bolting.
2. Field riveting will not be approved.
3. Design size, number and placement of fasteners, to develop a joint strength of not less than the design value.
4. Holes, for rivets and bolts: Accurately punched or drilled and burrs removed.
5. Size and shape welds to develop the full design strength of the parts connected by welds and to transmit imposed stresses without permanent deformation or failure when subject to service loadings.
6. Use Rivets and bolts of material selected to prevent corrosion (electrolysis) at bimetallic contacts. Plated or coated material will not be approved.
7. Use stainless steel connectors for removable members machine screws or bolts.

D. Fasteners and Anchors
1. Use methods for fastening or anchoring metal fabrications to building construction as shown or specified.

2. Where fasteners and anchors are not shown, design the type, size, location and spacing to resist the loads imposed without deformation of the members or causing failure of the anchor or fastener, and suit the sequence of installation.
3. Use material and finish of the fasteners compatible with the kinds of materials which are fastened together and their location in the finished work.
4. Fasteners for securing metal fabrications to new construction only, may be by use of threaded or wedge type inserts or by anchors for welding to the metal fabrication for installation before the concrete is placed or as masonry is laid.
5. Fasteners for securing metal fabrication to existing construction or new construction may be expansion bolts, toggle bolts, power actuated drive pins, welding, self drilling and tapping screws or bolts.

E. Workmanship
1. General:
   a. Fabricate items to design shown.
   b. Furnish members in longest lengths commercially available within the limits shown and specified.
   c. Fabricate straight, true, free from warp and twist, and where applicable square and in same plane.
   d. Provide holes, sinkages and reinforcement shown and required for fasteners and anchorage items.
   e. Provide openings, cut-outs, and tapped holes for attachment and clearances required for work of other trades.
   f. Prepare members for the installation and fitting of hardware.
   g. Cut openings in gratings and floor plates for the passage of ducts, sumps, pipes, conduits and similar items. Provide reinforcement to support cut edges.
   h. Fabricate surfaces and edges free from sharp edges, burrs and projections which may cause injury.
2. Welding:
   a. Weld in accordance with AWS.
   b. Welds shall show good fusion, be free from cracks and porosity and accomplish secure and rigid joints in proper alignment.
   c. Where exposed in the finished work, continuous weld for the full length of the members joined and have depressed areas filled and protruding welds finished smooth and flush with adjacent surfaces.
   d. Finish welded joints to match finish of adjacent surface.
3. Joining:
   a. Miter or butt members at corners.
   b. Where frames members are butted at corners, cut leg of frame member perpendicular to surface, as required for clearance.
4. Anchors:
   a. Where metal fabrications are shown to be preset in concrete, weld 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 150 mm (6 inches) long with 25 mm (one inch) hooked end, to back of member at 600 mm (2 feet) on center, unless otherwise shown.
   b. Where metal fabrications are shown to be built into masonry use 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 250 mm (10 inches) long with 50 mm (2 inch) hooked end, welded to back of member at 600 mm (2 feet) on center, unless otherwise shown.
5. Cutting and Fitting:
   a. Accurately cut, machine and fit joints, corners, copes, and miters.
   b. Fit removable members to be easily removed.
   c. Design and construct field connections in the most practical place for appearance and ease of installation.
   d. Fit pieces together as required.

e. Fabricate connections for ease of assembly and disassembly without use of special tools.
f. f. Joints firm when assembled.
g. Conceal joining, fitting and welding on exposed work as far as practical.
h. Do not show rivets and screws prominently on the exposed face.
i. The fit of components and the alignment of holes shall eliminate the need to modify component or to use exceptional force in the assembly of item and eliminate the need to use other than common tools.

F. Finish:
1. Finish exposed surfaces in accordance with NAAMM AMP 500 Metal Finishes Manual.
2. Aluminum: NAAMM AMP 501.
   a. Mill finish, AA-M10, as fabricated, use unless specified otherwise.
   b. Clear anodic coating, AA-C22A41, chemically etched medium matte, with Architectural Class 1, 0.7 mils or thicker.
   c. Colored anodic coating, AA-C22A42, chemically etched medium matte with Architectural Class 1, 0.7 mils or thicker.
   d. Painted: AA-C22R10.
3. Steel and Iron: NAAMM AMP 504.
   a. Zinc coated (Galvanized): ASTM A123, G90 unless noted otherwise.
   b. Surfaces exposed in the finished work:
      1) Finish smooth rough surfaces and remove projections.
      2) Fill holes, dents and similar voids and depressions with epoxy type patching compound.
   c. Shop Prime Painting:
      1) Surfaces of Ferrous metal:
         a) Items not specified to have other coatings.
         b) Galvanized surfaces specified to have prime paint.
         c) Remove all loose mill scale, rust, and paint, by hand or power tool cleaning as defined in SSPC-SP2 and SP3.
         d) Clean of oil, grease, soil and other detrimental matter by use of solvents or cleaning compounds as defined in SSPC-SP1.
         e) After cleaning and finishing apply one coat of primer as specified in Section 09 91 00, PAINTING.
      2) Non ferrous metals: Comply with MAAMM-500 series.
4. Stainless Steel: NAAMM AMP-504 Finish No. 4.
5. Chromium Plating: ASTM B456, satin or bright as specified, Service Condition No. SC2.

G. Protection:
1. Insulate aluminum surfaces that will come in contact with concrete, masonry, plaster, or metals other than stainless steel, zinc or white bronze by giving a coat of heavy-bodied alkali resisting bituminous paint or other approved paint in shop.
2. Spot prime all abraded and damaged areas of zinc coating which expose the bare metal, using zinc rich paint on hot-dip zinc coat items and zinc dust primer on all other zinc coated items.

2.5 SUPPORTS

A. General:
1. Fabricate ASTM A36 structural steel shapes as shown.
2. Use clip angles or make provisions for welding hangers and braces to overhead construction.
3. Field connections may be welded or bolted.

B. For Wall Mounted Items:
1. For items supported by metal stud partitions.
2. Steel strip or hat channel minimum of 1.5 mm (0.0598 inch) thick.

3. Steel strip minimum of 150 mm (6 inches) wide, length extending one stud space beyond end of item supported.
4. Steel hat channels where shown. Flange cut and flatted for anchorage to stud.
5. Structural steel tube or channel for grab bar at water closets floor to structure above with clip angles or end plates formed for anchors.
6. Use steel angles for thru wall counters. Drill angle for fasteners at ends and not over 100 mm (4 inches) on center between ends.

2.6 FRAMES

A. Channel Door Frames:
1. Fabricate of structural steel channels of size shown.
2. Miter and weld frames at corners.
3. Where anchored to masonry or embedded in concrete, weld to back of frame at each jamb, 5 mm (3/16 inch) thick by 44 mm (1-3/4 inch) wide steel strap anchors with ends turned 50 mm (2 inches), and of sufficient length to extend at least 300 mm (12 inches) into wall. Space anchors 600 mm (24 inches) above bottom of frame and 600 mm (24 inches) o.c. to top of jamb. Weld clip angles to bottom of jambs and provide holes for expansion bolts.
4. Where anchored to concrete or masonry in prepared openings, drill holes at jambs for anchoring with expansion bolts. Weld clip angles to bottom of frame and provide holes for expansion bolt anchors as shown. Drill holes starting 600 mm (24 inches) above bottom of frame and 600 mm (24 inches) o.c. to top of jamb and at top of jamb. Provide pipe spacers at holes welded to channel.
5. Where closure plates are shown, continuously weld them to the channel flanges.
6. Weld continuous 19 x 19 x 3 mm (3/4 x 3/4 x 1/8 inch) thick steel angles to the interior side of each channel leg at the head and jambs to form a caulking groove.
7. Prepare frame for installation of hardware specified in Section 08 71 00, DOOR HARDWARE.
   a. Cut a slot in the lock jamb to receive the lock bolt.
   b. Where shown use continuous solid steel bar stops at perimeter of frame, weld or secure with countersunk machine screws at not more than 450 mm (18 inches) on center.

2.7 LOOSE LINTELS

A. Furnish lintels of sizes shown. Where size of lintels is not shown, provide the sizes specified.

B. Fabricate lintels with not less than 150 mm (6 inch) bearing at each end for nonbearing masonry walls, and 200 mm (8 inch) bearing at each end for bearing walls.

C. Provide one angle lintel for each 100 mm (4 inches) of masonry thickness as follows except as otherwise specified or shown.
1. Openings 750 mm to 1800 mm (2-1/2 feet to 6 feet) - 100 x 90 x 8 mm (4 x 3-1/2 x 5/16 inch).
2. Openings 1800 mm to 3000 mm (6 feet to 10 feet) - 150 x 90 x 9 mm (6 x 3-1/2 x 3/8 inch).

D. For 150 mm (6 inch) thick masonry openings 750 mm to 3000 mm (2-1/2 feet to 10 feet) use one angle 150 x 90 x 9 mm (6 x 3-1/2 x 3/8 inch).

E. Provide bearing plates for lintels where shown.

F. Weld or bolt upstanding legs of double angle lintels together with 19 mm (3/4 inch bolts) spaced at 300 mm (12 inches) on centers.

G. Insert spreaders at bolt points to separate the angles for insertion of metal windows, louver, and other anchorage.

H. Where shown or specified, punch upstanding legs of single lintels to suit size and spacing of anchor bolts.

I. Elevator Entrance:
   1. Fabricate lintel from plate bent to channel shape, and provide a minimum of 100 mm (4 inch) bearing each end.
   2. Cut away the front leg of the channel at each end to allow for concealment behind elevator hoistway entrance frame.

2.8 SHELF ANGLES

A. Fabricate from steel angles of size shown.

B. Fabricate angles with horizontal slotted holes for 19 mm (3/4 inch) bolts spaced at not over 900 mm (3 feet) on centers and within 300 mm (12 inches) of ends.

C. Provide adjustable malleable iron inserts for embedded in concrete framing.

2.9 PLATE DOOR SILL

A. Fabricate of checkered plate as detailed.
   1. Aluminum Plate: ASTM B632, 3 mm (0.125 inch) thick.
   2. Steel Plate: ASTM A786, 3 mm (0.125 inch thick), galvanized G90.

B. Fabricate for anchorage with flat head countersunk bolts at each end and not over 300 mm (12 inches), o.c.

2.10 SAFETY NOSINGS

A. Fed. Spec. RR-T-650, Type C.
   1. Aluminum: Class 2, Style 2.
   2. Cast iron: Class 4.

B. Fabricate nosings for exterior use from cast aluminum, and nosings for interior use from either cast aluminum or cast iron. Use one Class throughout.

C. Fabricate nosings approximately 100 mm (4 inches) wide with not more than 9 mm (3/8 inch) nose.

D. Provide nosings with integral type anchors spaced not more than 100 mm (4 inches) from each end and intermediate anchors spaced approximately 375 mm (15 inches) on center.

E. Fabricate nosings to extend within 100 mm (4 inches) of ends of concrete stair treads except where shown to extend full width.

F. Fabricate nosings to extend full width between stringers of metal stairs and full width of door openings.

G. On curved steps fabricate to terminate at point of curvature of steps having short radius curved ends.

2.11 RAILINGS

A. In addition to the dead load design railing assembly to support live load specified.

B. B. Fabrication General:
   1. Provide continuous welded joints, dressed smooth and flush.
   2. Standard flush fittings, designed to be welded, may be used.
   3. Exposed threads will not be approved.
   4. Form handrail brackets to size and design shown.
   5. Exterior Post Anchors.
      a. Fabricate tube or pipe sleeves with closed ends or plates as shown.
      b. Where inserts interfere with reinforcing bars, provide flanged fittings welded or threaded to posts for securing to concrete with expansion bolts.
      c. Provide heavy pattern sliding flange base plate with set screws at base of pipe or tube posts.
   6. Interior Post Anchors:

a. Provide flanged fittings for securing fixed posts to floor with expansion bolts, unless shown otherwise.
b. Weld or thread flanged fitting to posts at base.
c. For securing removable posts to floor, provide close fitting sleeve insert or inverted flange base plate with stud bolts or rivets concrete anchor welded to the base plate.
d. Provide sliding flange base plate on posts secured with set screws.
e. Weld flange base plate to removable posts set in sleeves.

C. Handrails:
1. Close free ends of rail with flush metal caps welded in place except where flanges for securing to walls with bolts are shown.
2. Make provisions for attaching handrail brackets to wall, posts, and handrail as shown.

D. Steel Pipe Railings:
1. Fabricate of steel pipe with welded joints.
2. Number and space of rails as shown.
3. Space posts for railings not over 1800 mm (6 feet) on centers between end posts.
4. Form handrail brackets from malleable iron.
5. Fabricate removable sections with posts at end of section.
6. Chains:
a. Chains: ASTM A391, Grade 63, straight link style, normal size chain bar 8 mm (5/16 inch) diameter, eight links per 25 mm (foot) and with boat type snap hook on one end, and through type eye bolt on other end.
b. Fabricate eye bolt for attaching chain to pipe posts, size not less than 9 mm (3/8 inch) diameter.
c. Fabricate anchor at walls, for engagement of snap hook of either a 9 mm (3/8 inch) diameter eye bolt or punched angle.
d. Galvanize chain and bolts after fabrication.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set work accurately, in alignment and where shown, plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.

B. Items set into concrete or masonry.
1. Provide temporary bracing for such items until concrete or masonry is set.
2. Place in accordance with setting drawings and instructions.
3. Build strap anchors, into masonry as work progresses.

C. Set frames of gratings, covers, corner guards, trap doors and similar items flush with finish floor or wall surface and, where applicable, flush with side of opening.

D. Field weld in accordance with AWS.
1. Design and finish as specified for shop welding.
2. Use continuous weld unless specified otherwise.

E. Install anchoring devices and fasteners as shown and as necessary for securing metal fabrications to building construction as specified. Power actuated drive pins may be used except for removable items and where members would be deformed or substrate damaged by their use.

F. Spot prime all abraded and damaged areas of zinc coating as specified and all abraded and damaged areas of shop prime coat with same kind of paint used for shop priming.

G. Isolate aluminum from dissimilar metals and from contact with concrete and masonry materials as required to prevent electrolysis and corrosion.

H. Secure escutcheon plate with set screw.

3.2 INSTALLATION OF SUPPORTS

A. Anchorage to structure.
   1. Secure angles or channels and clips to overhead structural steel by continuous welding unless bolting is shown.
   2. Secure supports to concrete inserts by bolting or continuous welding as shown.
   3. Secure supports to mid height of concrete beams when inserts do not exist with expansion bolts and to slabs, with expansion bolts. unless shown otherwise.
   4. Secure steel plate or hat channels to studs as detailed.

B. Supports for Wall Mounted items:
   1. Locate center of support at anchorage point of supported item.
   2. Locate support at top and bottom of wall hung cabinets.
   3. Locate support at top of floor cabinets and shelving installed against walls.
   4. Locate supports where required for items shown.

3.3 DOOR FRAMES

A. Secure clip angles at bottom of frames to concrete slab with expansion bolts as shown.

B. Level and plumb frame; brace in position required.

C. At masonry, set frames in walls so anchors are built-in as the work progresses unless shown otherwise.

D. Set frames in formwork for frames cast into concrete.

E. Where frames are set in prepared openings, bolt to wall with spacers and expansion bolts.

3.4 OTHER FRAMES

A. Set frame flush with surface unless shown otherwise.

B. Anchor frames at ends and not over 450 mm (18 inches) on centers unless shown otherwise.

C. Set in formwork before concrete is placed.

3.5 STEEL LINTELS

A. Use lintel sizes and combinations shown or specified.

B. Install lintels with longest leg upstanding, except for openings in 150 mm (6 inch) masonry walls install lintels with longest leg horizontal.

C. Install lintels to have not less than 150 mm (6 inch) bearing at each end for nonbearing walls, and 200 mm (8 inch) bearing at each end for bearing walls.

3.6 SHELF ANGLES

A. Anchor shelf angles with 19 mm (3/4 inch) bolts unless shown otherwise in adjustable malleable iron inserts, set level at elevation shown.

B. Provide expansion space at end of members.

3.7 PLATE DOOR SILL

A. Install after roofing base flashing and counter flashing work is completed.

B. Set in sealant and bolt to curb.

3.8 SAFETY NOSINGS

A. Except as specified and where preformed rubber treads are shown or specified install safety nosings at the following:
   1. Exterior concrete steps.
   2. Door sills of areaway entrances curbs.

3. Exposed edges of curbs of door sills at transformer and service rooms.
4. Interior concrete steps, including concrete filled treads of metal stairs of service stairs.

B. Install flush with horizontal and vertical surfaces.

C. Install nosing to within 100 mm (4 inches) of ends of concrete stair treads, except where shown to extend full width.

D. Extend nosings full width of door openings.

E. Extend nosings, full width between stringers of metal stairs, and terminate at point of curvature of steps having short radius curved ends.

3.9 RAILINGS

A. Steel Posts:
1. Secure fixed posts to concrete with expansion bolts through flanged fittings except where sleeves are shown with pourable grout.
2. Install sleeves in concrete formwork.
3. Set post in sleeve and pour grout to surface. Apply beveled bead of urethane sealant at perimeter of post or under flange fitting as specified in Section 07 92 00, JOINT SEALANTS-on exterior posts.
4. Secure removable posts to concrete with either machine screws through flanged fittings which are secured to inverted flanges embedded in and set flush with finished floor, or set posts in close fitting pipe sleeves without grout.
5. Secure sliding flanged fittings to posts at base with set screws.
6. Secure fixed flanged fittings to concrete with expansion bolts.
7. Secure posts to steel with welds.

B. Aluminum Railing, Stainless Steel Railing, and Ornamental Railing Posts:
1. Install pipe sleeves in concrete formwork.
2. Set posts in sleeve and pour grout to surface on exterior locations and to within 6 mm (1/4 inch) of surface for interior locations except to where posts are required to be removable.
3. Apply beveled bead of urethane sealant over sleeve at post perimeter for exterior posts and flush with surface for interior posts as specified in Section 07 92 00, JOINT SEALANTS.

C. Anchor to Walls:
1. Anchor rails to concrete or solid masonry with machine screws through flanged fitting to steel plate.
   a. Anchor steel plate to concrete or solid masonry with expansion bolts.
   b. Anchor steel plate to hollow masonry with toggle bolts.
2. Anchor flanged fitting with toggle bolt to steel support in frame walls.

D. Chains:
1. Eye bolt chains to pipe posts.
2. Eye bolt anchoring at walls.
   a. Expansion bolt to concrete or solid masonry.
   b. Toggle bolt to hollow masonry of frame wall installed support.

E. Handrails:
1. Anchor brackets for metal handrails as detailed.
2. Install brackets within 300 mm (12 inches) of return of walls, and at evenly spaced intermediate points not exceeding 1200 mm (4 feet) on centers unless shown otherwise.
3. Expansion bolt to concrete or solid masonry.
4. Toggle bolt to installed supporting frame wall and to hollow masonry unless shown otherwise.

3.10 CLEAN AND ADJUSTING

A. Adjust movable parts including hardware to operate as designed without binding or deformation of the members centered in the opening or frame and, where applicable, contact surfaces fit tight and even without forcing or warping the components.

B. Clean after installation exposed prefinished and plated items and items fabricated from stainless steel, aluminum and copper alloys, as recommended by the metal manufacture and protected from damage until completion of the project.

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SECTION 05 51 00

METAL STAIRS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies steel stairs with railings.

B. Types:
   1. Closed riser stairs with concrete filled treads and platforms.
   2. Industrial stairs: Closed riser stairs.

1.2 RELATED WORK

A. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS: Sustainable Design Requirements.

B. Section 03 30 00, CAST-IN-PLACE CONCRETE: Concrete fill for treads and platforms.

C. Section 05 50 00, METAL FABRICATIONS: Wall handrails.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Sustainable Design Submittals, as described below:
   1. Postconsumer and preconsumer recycled content as specified in PART 2 - PRODUCTS.

C. Shop Drawings: Show design, fabrication details, installation, connections, material, and size of members.

D. Fabrication qualifications.

E. Installer qualifications.

F. Calculations.

G. Welding qualifications.

1.4 QUALITY ASSURANCE

A. Fabricator: A firm with a minimum of three (3) years' experience in type of work required by this section. Submit fabricator qualifications.

B. Installer: A firm with a minimum of three (3) years' experience in type of work required by this section. Submit installer qualifications.

C. Calculations: Provide professionally prepared calculations and certification of performance of this work, signed and sealed by a Professional Engineer registered in the state where the work is located. Perform structural design of the stair including supports for the metal stair frame. Indicate how Design Criteria as specified have been incorporated into the design.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M and AWS D1.3/D1.3M.

1.5 APPLICATION PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation.

B. American Society of Mechanical Engineers (ASME):

B18.2.1-12 ..... Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series)

B18.2.3.8M-81(R2005)..... Metric Heavy Lag Screws

B18.6.1-81(R2008)..... Wood Screws (Inch Series)

B18.6.3-13 ..... Machine Screws, Tapping Screws, and Metallic Drive Screws (Inch Series)

B18.6.5M-10 ..... Metric Thread Forming and Thread Cutting Tapping Screws

B18.6.7M-10 ..... Metric Machine Screws

B18.22M-81(R2010)..... Metric Plain Washers

B18.21.1-09 ..... Washers: Helical Spring-Lock, Tooth Lock, and Plain Washer (Inch Series)

C. ASTM International (ASTM):

A36/A36M-19 ..... Structural Steel

A47/A47M-99e1R2018) ..... Ferritic Malleable Iron Castings

A48/A48M-03(R2016) ..... Gray Iron Castings

A53/A53M-20 ..... Pipe, Steel, Black and Hot-Dipped Zinc-Coated Welded and Seamless

A123/A123M-17 ..... Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

A153/A153M-16a ..... Zinc Coating (Hot-Dip) on Iron and Steel Hardware

A307-14e1 ..... Carbon Steel Bolts, Studs and Threaded Rod 60,000 PSI Tensile Strength

A653/A653M-20 ..... Steel Sheet, Zinc Coated (Galvanized) or Zinc Alloy Coated (Galvannealed) by the Hot-Dip Process

A786/A786M-15 ..... Rolled Steel Floor Plates

A1008/A1008M-20 ..... Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength, Low-Alloy

A1011/A1011M-18 ..... Steel, Sheet and Strip, Strip, Hot-Rolled Carbon, Structural, High-Strength, Low-Alloy

F3125 / F3125M ..... Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength

D. American Welding Society (AWS):

D1.1/D1.1M-15 ..... Structural Welding Code-Steel

D1.3/D1.3M-18 ..... Structural Welding Code-Sheet Steel

E. The National Association of Architectural Metal Manufactures (NAAMM) Manuals:

MBG 531-17 ..... Metal Bar Gratings

AMP521-01(R2012) ..... Pipe Railing Manual, Including Round Tube

F. American Iron and Steel Institute (AISI):

S100-12 ..... Design of Cold-Formed Steel Structural Members

G. National Fire Protection Association (NFPA):

101-18 .....Life Safety Code

H. Society for Protective Coatings (SSPC):
Paint 25(1997; E 2004) .....Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel, Type I and Type II

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

A. Design stairs to support live load of 4.79 kN/square meter (100 pound force/ square feet) and a concentrated load of 1.33 kN (300 pound force) applied on an area of 2580 square mm (4 square inch).
   1. Uniform and concentrated loads need not be assumed to act concurrently.
   2. Provide stair framing capable of withstanding stresses resulting from railing loads in addition to the loads specified above. Limit deflection of treads, platforms, and framing members to L/360 or 6.4 mm (1/4 inch), whichever is less.

B. Provide structural design, fabrication and assembly in accordance with requirements of NAAMM Metal Stairs Manual, except as otherwise specified or shown.

C. Design Grating treads in accordance with NAAMM Metal Bar Grating Manual.

D. Design handrails and top rails of guards to support uniform load of not 0.73 kN/meter (50 pound force/feet) applied in any direction and a concentrated load of 0.89 kN (200 pound force) applied in any direction. Uniform and concentrated loads need not be assumed to act concurrently.

E. Infill of guards to support concentrated load of 0.22 kN (50 pound force) applied horizontally on an area of 0.093 square meter (one square feet).

F. Design fire stairs to conform to NFPA 101.

2.2 MATERIALS

A. Steel Pipe: ASTM A53/A53M, Standard Weight, zinc coated.

B. Steel Grating: Metal bar type grating NAAMM BG.

C. Sheet Steel: ASTM A1008/A1008M.

D. Structural Steel: ASTM A36/A36M.

E. Steel Floor Plate: ASTM A786/A786M.

F. Steel Decking: Form from zinc coated steel conforming to ASTM A653/A653M, with properties conforming to AISI S100 Specification for the Design of Cold-Formed Steel Structural Members.

G. Steel Plate: ASTM A1011/A1011M.

H. Iron Castings: ASTM A48/A48M, Class 30.

I. Malleable Iron Castings: ASTM A47/A47M.

J. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 30 percent.

2.3 FABRICATION GENERAL

A. Fasteners:
   1. Conceal bolts and screws wherever possible.
   2. Use countersunk heads on exposed bolts and screws with ends of bolts and screws dressed flush after nuts are set.

3. Galvanized zinc-coated fasteners in accordance with ASTM A153/A153M and used for exterior applications or where built into exterior walls or floor systems. Select fasteners for the type, grade, and class required for the installation of steel stair items.
4. Standard/regular hexagon-head bolts and nuts be conforming to ASTM A307, Grade A.
5. Square-head lag bolts conforming to ASME B18.2.3.8M, ASME B18.2.1.
6. Machine screws cadmium-plated steel conforming to ASME B18.6.7M, ASME B18.6.3.
7. Wood screws, flat-head carbon steel conforming to ASME B18.6.5M, ASME B18.6.1.
8. Plain washers, round, general-assembly-grade, carbon steel conforming to ASME B18.22M, ASME B18.21.1.
9. Lockwashers helical spring, carbon steel conforming to ASME B18.2.1, ASME B18.2.3.8M.

B. Welding:
1. Structural steel, AWS D1.1/D1.1M, and sheet steel, AWS D1.3/D1.3M.
2. Where possible, locate welds on unexposed side.
3. Grind exposed welds smooth and true to contour of welded member.
4. Remove welding splatter.

C. Remove sharp edges and burrs.

D. Fit stringers to head channel and close ends with steel plates welded in place where shown.

E. Fit face stringer to newel post by tenoning into newel post, or by notching and fitting face stringer to side of newel where shown.

F. Shop Prime Painting: Shop prime steelwork with red oxide primer in accordance with SSPC Paint 25.
1. Hot dip galvanize steelwork as indicated in accordance with ASTM A123/A123M. Touch up abraded surfaces and cut ends of galvanized members with zinc-dust, zinc-oxide primer, or an approved galvanizing repair compound.

G. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 0.8 mm (1/32 inch), and bend metal corners to the smallest radius possible without causing grain separation or otherwise impairing the work.

H. Continuously weld corners and seams in accordance with the recommendations of AWS D1.1/D1.1M. Grind smooth exposed welds and flush to match and blend with adjoining surfaces.

I. Form exposed connections with hairline joints that are flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of the type indicated or, if not indicated, use Phillips flathead (countersunk) screws or bolts.

J. Provide and coordinate anchorage of the type indicated with the supporting structure. Fabricate anchoring devices, space as indicated and required to provide adequate support for the intended use of the work.

K. Use hot-rolled steel bars for work fabricated for bar stock unless work is indicated or specified as fabricated from cold-finished or cold-rolled stock.

L. Soffit Clips: Provide clips with holes for attaching metal furring for gypsum wallboard soffits.

2.4 RAILINGS

A. Fabricate railings, including handrails, from steel pipe.
1. Connections may be standard fittings designed for welding, or coped or mitered pipe with full welds.
2. Wall handrails are provided under Section 05 50 00, METAL FABRICATIONS.

B. Return ends of handrail to wall and close free end.

C. Provide standard terminal castings where fastened to newel.

D. Space intermediate posts not over 1828 mm (6 feet) on center between end post or newel post.

E. Fabricate handrail brackets from cast malleable iron.

F. Provide standard terminal fittings at ends of post and rails.

2.5 CLOSED RISER STAIRS

A. Provide treads, risers, platforms, railings, stringers, headers and other supporting members.

B. Fabricate pans for treads and platforms, and risers from sheet steel.

C. Form risers with sanitary cove.

D. Fabricate stringers, headers, and other supporting members from structural steel.

E. Construct newel posts of steel tubing having wall thickness not less than 5 mm (3/16-inch), with forged steel caps and drops.

2.6 INDUSTRIAL STAIRS

A. Provide treads, platforms, railings, stringers and other supporting members as shown.

B. Treads and platforms of checkered steel floor plate:
   1. Turn floor plate down to form nosing on treads and edge of platform at head of stairs.
   2. Support tread and platforms with angles welded to plate.
   3. Do not leave exposed fasteners on top of treads or platform surfaces.
   4. Provide flat sheet steel risers for stairs with steel plate treads where shown.

C. Treads and platforms of steel grating:
   1. Fabricate steel grating treads and platforms in accordance with requirements of NAAMM MBG 531-09.
   2. Provide end-banding bars, except where carrier angle are used at tread ends.
   3. Support treads by use of carrier plates or carrier angle. Use carrier plate end banding bars on exterior stairs.
   4. Provide abrasive nosing on treads and edge of platforms at head of stairs.
   5. Provide toe plates on platforms where shown.

PART 3 - EXECUTION

3.1 STAIR INSTALLATION

A. Provide hangers, and struts required to support the loads imposed.

B. Perform job site welding and bolting as specified for shop fabrication.

C. Set stairs and other members in position and secure to structure as shown.

D. Install stairs plumb, level and true to line.

E. Provide steel closure plate to fill gap between the stringer and surrounding wall. Weld and apply primer, ready to accept paint finish.

3.2 RAILING INSTALLATION

A. Install standard terminal fittings at ends of posts and rails.

B. Secure brackets, posts and rails to steel by welds, and to masonry or concrete with expansion sleeves and bolts, except secure posts at concrete by setting in sleeves filled with commercial non-shrink grout.

C. Set rails horizontal or parallel to rake of stairs to within 3 mm in 3658 mm (1/8-inch in 12 feet).

D. Set posts plumb and aligned to within 3 mm in 3658 mm (1/8-inch in 12 feet).

3.3 FIELD PRIME PAINTING

A. Touch-up abraded areas with same primer paint used for shop priming.

B. Touch up abraded galvanized areas.

- - - E N D - - -

SECTION 06 06 60

PLASTIC FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the Plastic Fabrication as shown and specified in the described system(s):
   1. Partitions

B. Related Sections include the following:
   1. Section 12 32 00, MANUFACTURED WOOD CASEWORK.

1.3 SUBMITTALS

A. General: Submit the following in accordance with conditions of contact and Division 1 specification section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data: Submit manufacturer's product data; include product description, fabrication information, and compliance with specified performance requirements.

C. Submit product test reports from a qualified independent 3rd party testing agency indicating each type and class of panel system complies with the project performance requirements, based on comprehensive testing of current products. Previously completed test reports will be acceptable if for current manufacturer and indicative of products used on this project.
   1. Test reports required are:
      a. Rate of Burning (ASTM D 635)
      b. Self-Ignition Temperature (ASTM D 1929)
      c. Density of Smoke (ASTM D 2843)
      d. Flame Spread and Smoke Developed testing (ASTM E 84)
      e. Room Corner Burn Test (NFPA 286)
      f. Extent of Burning (UL 94)
      g. Impact strength (ASTM D 3763)
      h. Safety glazing impact resistance (ANSI Z97.1-2004)
      i. UPITT Test for Combustion Product Toxicity
      j. Passes NFPA 269/ASTM1678 for Combustion Product Toxicity
      k. Dynamic environmental testing (ASTM standards D 5116 or D 6670)
      l. UL Yellowcard

D. Building Approvals: Plastic Fabrications are to have been evaluated and must be registered with and comply to requirements of the following jurisdictions:
   1. Los Angeles Department of Building and Safety (Product must have a LARR Los Angeles Research Report number) for use as Light-transmitting Panels
   2. ICC-ES Report for Light Transmitting Plastics and Interior Finishes

E. Shop Drawings: Include plans, elevations, sections, panel dimensions, details, and attachments to other work.

F. Samples for Initial Selection:
   1. Submit minimum 2-inch by 2-inch samples. Indicate full color, texture and pattern variation.

G. Samples for Verification:
   1. Submit minimum 4-inch by 4-inch sample for each type, texture, pattern and color of solid plastic fabrication.

H. Maintenance Data: Submit manufacturer's care and maintenance data, including care, repair and cleaning instructions. Include in Project closeout documents.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications
1. Materials and systems shall be manufactured by a company continuously and regularly employed in the manufacture of specified materials for a period of at least five (5) consecutive years and which can show evidence of those materials being satisfactorily used on at least six (6) projects of similar size, scope and location. At least three (3) of the projects shall have been successful for use five (5) years or longer.
2. Manufactured panels must be produced from a minimum of 40% pre-consumer recycle content. This recycle content must be certified by a recognized 3rd party certification group, such as Scientific Certification Systems (SCS).
3. Completely PVC – Free product
4. Manufacturer must have a 3rd party completed Life Cycle Analysis
5. Manufacturer must have an Environmental Product Declaration (EPD).

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver Plastic Fabrications, systems and specified items in manufacturer's standard protective packaging.

B. Do not deliver Plastic Fabrications, system, components and accessories to Project site until areas are ready for installation.

C. Store materials in a flat orientation in a dry place that is not exposed to exterior elements.

D. Handle materials to prevent damage to finished surfaces. Provide protective coverings to prevent damage or staining following installation for duration of project.

E. Before installing Plastic Fabrications, permit them to reach room temperature.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install Solid Polymer Fabrications until spaces are enclosed and weatherproof, and ambient temperatures and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.7 WARRANTY

A. Manufacturer's Special Warranty on Plastic Fabrications: Manufacturer's standard form agreeing to repair or replace units that fail in material or workmanship within the specified warranty period.

B. Warranty Period: 1 year after the date of substantial completion.

C. The warranty shall not deprive the owner of other rights or remedies the Owner may have under other provisions of the Contract Documents, and is in addition to and runs concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Manufacturer: 3form, LLC., Salt Lake City, Utah, USA / telephone 801-649-2500

2.2 MATERIALS

A. Varia Ecoresin™ Sheet
1. Engineered co-polyester resin produced in the USA
2. Sheet Size: Maximum 4' x 10'
3. Thickness: Minimum 1/16"

4. Basis of Design Product: The design of Plastic Fabrications is based on Varia Ecoresin™ as provided by 3form, LLC. Products from other manufacturers must be approved by the COR prior to bidding in accordance with the Instructions to Bidders and Section 01 00 00.

B. Interlayer Materials: Compatible with polyesters and bonding process to create a monolithic sheet of material when complete.

C. Sheet minimum performance attributes:
1. Rate of Burning (ASTM D 635). Material must attain CC1 Rating for a nominal thickness of 1.5 mm (0.060 in.) and greater.
2. Self-Ignition Temperature (ASTM D 1929). Material must have a Self-ignition temperature greater than 650°F.
3. Density of Smoke (ASTM D 2843). Material must have a smoke density less than 75%.
4. Flame spread and Smoke developed testing (ASTM E 84). Material must be able to meet a level of Class A (Flame spread less than 25 and smoke less than 450) at thickness of 1/8",3/16" and 1".
5. Room Corner Burn Test (NFPA 286). Material must meet Class A criteria at ¼" (walls only) and 3/8" (walls only/standoffs only) thickness as described by the 2012 International Building Code.
6. Extent of Burning (UL 94). Must submit UL card.
7. Impact strength. Minimum impact strength test as measured by ASTM D 3763 of 20 ft. lbs. (for durability, shipping, installation, and use).
8. Safety Glazing. Material must attain a Class A impact rating in accordance with ANSI Z97.1-2004 at 1/8" thickness.
9. UPITT Test for Combustion Product Toxicity: Product must be recorded as "not more toxic than wood".
10. NFPA 269/ASTM 1678 test for toxicity: Product must have a best predicted LC_{50} value ≤ 80.8 g/m3 Product must have a best predicted corrected for post-flashover conditions LC_{50} value ≤ 19.0 g/m3
11. Dynamic environmental testing (ASTM standards D 5116 or D 6670). Panels must not have detectable VOC off-gassing agents and must be have Greenguard™ Indoor Air Quality Children and Schools certified.
12. Panels must be produced from a minimum of 40% pre-consumer recycle content. This recycle content must be certified by a recognized 3rd party certification group, such as Scientific Certification Systems (SCS).
13. Building Approvals: Plastic Fabrications are to have been evaluated and must be registered with and comply to requirements of the following jurisdictions:
14. New York Department of Buildings (Product must have an MEA Materials and Equipment Acceptance number) for use as Interior Finishes
    a. Los Angeles Department of Building and Safety (Product must have a LARR Los Angeles Research Report number) for use as Light-transmitting Panels
    b. ICC-ES Report for Interior Finishes and Light Transmitting plastics

2.3 FABRICATION

A. General: Fabricate Plastic Fabrications to designs, sizes and thicknesses indicated and to comply with indicated standards. Sizes, profiles and other characteristics are indicated on the drawings.

B. Comply with manufacturer's written recommendations for fabrication.

C. Machining: Acceptable means of machining are listed below. Ensure that material is not chipped or warped by machining operations.
1. Sawing: Select equipment and blades suitable for type of cut required.
2. Drilling: Drills specifically designed for use with plastic products.
3. Milling: Climb cut where possible.
4. Routing
5. Tapping

D. Forming: Form products to shapes indicated using the appropriate method listed below. Comply with manufacturer's written instructions.
   1. Cold Bending
   2. Hot Bending
   3. Thermoforming: Acceptable only on uncoated material.
   4. Drape Forming
   5. Matched Mold Forming
   6. Mechanical Forming

E. Laminating: Laminate to substrates indicated using adhesives and techniques recommended by manufacturer.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide products of material, size, and shape required for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaner: Type recommended by manufacturer.

C. Fasteners: Use screws designed specifically for plastics. Self-threading screws are acceptable for permanent installations. Provide threaded metal inserts for applications requiring frequent disassembly such as light fixtures.

D. Bonding Cements: May be achieved with solvents or adhesives, suitable for use with product and application.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where installation of Plastic Fabrications will occur, with Installer present, for compliance with manufacturer's requirements. Verify that substrates and conditions are satisfactory for installation and comply with requirements specified.

3.2 INSTALLATION

A. General: Comply with manufacturer's written instructions for the installation of Plastic Fabrications.

B. Manufacturer's shop to fabricate items to the greatest degree possible.

C. Utilize fasteners, adhesives and bonding agents recommended by manufacturer for type of installation indicated. Material that is chipped, warped, hazed or discolored as a result of installation or fabrication methods will be rejected.

D. Install components plumb, level and rigid, scribed to adjacent finishes, in accordance with approved shop drawings and product data.

E. Form field joints using manufacturer's recommended procedures. Locate seams in panels so that they are not directly in line with seams in substrates.

F. We recommend that installation is completed by a 3form Certified Installer. Contact 3form for more information or to get a quote.

3.3 CLEANING AND PROTECTION

A. Protect surfaces from damage until date of substantial completion. Repair work or replace damaged work, which cannot be repaired to Architect's satisfaction.

END OF SECTION 06 06 60

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SECTION 06 10 00

ROUGH CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies wood blocking, framing, sheathing, furring, nailers, sub-flooring, rough hardware, and light wood construction.

1.2 RELATED WORK:

A. Sustainable design requirements: Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS./

B. Gypsum sheathing: Section 09 29 00, GYPSUM BOARD.

1.3 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Sustainable Design Submittals, as described below:
   1. Postconsumer and preconsumer recycled content as specified in PART 2 - PRODUCTS.
   2. Volatile organic compounds per volume as specified in PART 2 - PRODUCTS.
   3. For composite wood products, submit documentation indicating that product contains no added urea formaldehyde.

C. Shop Drawings showing framing connection details, fasteners, connections and dimensions.

D. Manufacturer's Literature and Data:
   1. Submit data for lumber, panels, hardware and adhesives.
   2. Submit data for wood-preservative treatment from chemical treatment manufacturer and certification from treating plants that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
   3. Submit data for fire retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
   4. For products receiving a waterborne treatment, submit statement that moisture content of treated materials was reduced to levels specified before shipment to project site.

E. Manufacturer's certificate for unmarked lumber.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Protect lumber and other products from dampness both during and after delivery at site.

B. Pile lumber in stacks in such manner as to provide air circulation around surfaces of each piece.

C. Stack plywood and other board products so as to prevent warping.

D. Locate stacks on well drained areas, supported at least 152 mm (6 inches) above grade and cover with well-ventilated sheds having firmly constructed over hanging roof with sufficient end wall to protect lumber from driving rain.

1.5 QUALITY ASSURANCE:

A. Installer: A firm with a minimum of three (3) years' experience in the type of work required by this section.

1.6 GRADING AND MARKINGS:

A. Any unmarked lumber or plywood panel for its grade and species will not be allowed on VA Construction sites for lumber and material not normally grade marked, provide manufacturer's certificates (approved by an American Lumber Standards approved agency) attesting that lumber and material meet the specified the specified requirements.

1.7 APPLICABLE PUBLICATIONS:

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.

B. American Forest and Paper Association (AFPA):
NDS-15.....National Design Specification for Wood Construction

WCD1-01.....Details for Conventional Wood Frame Construction

C. American Institute of Timber Construction (AITC):
A190.1-07.....Structural Glued Laminated Timber

D. American Society of Mechanical Engineers (ASME):
B18.2.1-12(R2013).....Square and Hex Bolts and Screws

B18.2.2-10.....Square and Hex Nuts

B18.6.1-81(R2008).....Wood Screws

E. American Plywood Association (APA):
E30-11.....Engineered Wood Construction Guide

F. ASTM International (ASTM):
A653/A653M-13 .....Steel Sheet Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot Dip Process

C954-11.....Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Studs from 0.033 inch (2.24 mm) to 0.112-inch (2.84 mm) in thickness

C1002-14.....Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Metal Studs

D198-14.....Test Methods of Static Tests of Lumber in Structural Sizes

D2344/D2344M-13.....Test Method for Short-Beam Strength of Polymer Matrix Composite Materials and Their Laminates

D2559-12a.....Adhesives for Structural Laminated Wood Products for Use Under Exterior (Wet Use) Exposure Conditions

D3498-03(R2011) .....Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems

D6108-13.....Test Method for Compressive Properties of Plastic Lumber and Shapes

D6109-13.....Test Methods for Flexural Properties of Unreinforced and Reinforced Plastic Lumber and Related Products

D6111-13a.....Test Method for Bulk Density and Specific Gravity of Plastic Lumber and Shapes by Displacement

D6112-13.....Test Methods for Compressive and Flexural Creep and Creep-Rupture of Plastic Lumber and Shapes

F844-07a(R2013).....Washers, Steel, Plan (Flat) Unhardened for General Use

F1667-13 ..... Nails, Spikes, and Staples

G. American Wood Protection Association (AWPA):
AWPA Book of Standards

H. Commercial Item Description (CID):
A-A-55615 ..... Shield, Expansion (Wood Screw and Lag Bolt Self Threading Anchors)

I. Forest Stewardship Council (FSC):
FSC-STD-01-001(Ver. 4-0)FSC Principles and Criteria for Forest Stewardship

J. Military Specification (Mil. Spec.):
MIL-L-19140E..... Lumber and Plywood, Fire-Retardant Treated

K. Environmental Protection Agency (EPA):
40 CFR 59(2014) ..... National Volatile Organic Compound Emission Standards for Consumer and Commercial Products

L. Truss Plate Institute (TPI):
TPI-85..... Metal Plate Connected Wood Trusses

M. U.S. Department of Commerce Product Standard (PS)
PS 1-95 ..... Construction and Industrial Plywood

PS 20-10 ..... American Softwood Lumber Standard

N. ICC Evaluation Service (ICC ES):
AC09 ..... Quality Control of Wood Shakes and Shingles

AC174 ..... Deck Board Span Ratings and Guardrail Systems (Guards and Handrails)

PART 2 - PRODUCTS

2.1 LUMBER:

A. Unless otherwise specified, each piece of lumber must bear grade mark, stamp, or other identifying marks indicating grades of material, and rules or standards under which produced.
1. Identifying marks are to be in accordance with rule or standard under which material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification.
2. Inspection agency for lumber approved by the Board of Review, American Lumber Standards Committee, to grade species used.

B. Structural Members: Species and grade as listed in the AFPA NDS having design stresses as shown.

C. Lumber Other Than Structural:
1. Unless otherwise specified, species graded under the grading rules of an inspection agency approved by Board of Review, American Lumber Standards Committee.
2. Framing lumber: Minimum extreme fiber stress in bending of 7584 kPa (1100 PSI).
3. Furring, blocking, nailers and similar items 101 mm (4 inches) and narrower Standard Grade; and, members 152 mm (6 inches) and wider, Number 2 Grade.
4. Board Sub-flooring: Shiplap edge, 25 mm (1 inch) thick, not less than 203 mm (8 inches) wide.

D. Sizes:
1. Conforming to PS 20.
2. Size references are nominal sizes, unless otherwise specified, actual sizes within manufacturing tolerances allowed by standard under which produced.

E. Moisture Content:
   1. Maximum moisture content of wood products is to be as follows at the time of delivery to site.
      a. Boards and lumber 50 mm (2 inches) and less in thickness: 19 percent or less.
      b. Lumber over 50 mm (2 inches) thick: 25 percent or less.

F. Fire Retardant Treatment:
   1. Comply with Mil Spec. MIL-L-19140.
   2. Treatment and performance inspection, by an independent and qualified testing agency that establishes performance ratings.

G. Preservative Treatment:
   1. Do not treat Heart Redwood and Western Red Cedar.
   2. Treat wood members and plywood exposed to weather or in contact with plaster, masonry or concrete, including framing of open roofed structures; sills, sole plates, furring, and sleepers that are less than 610 mm (24 inches) from ground; nailers, edge strips, blocking, crickets, curbs, cant, vent strips and other members provided in connection with roofing and flashing materials.
   3. Treat other members specified as preservative treated (PT).
   4. Preservative treat by the pressure method complying with AWPA Book use category system standards U1 and T1, except any process involving the use of Chromated Copper Arsenate (CCA) or other agents classified as carcinogenic for pressure treating wood is not permitted.

2.2 PLYWOOD:

A. Comply with PS 1.

B. Bear the mark of a recognized association or independent inspection agency that maintains continuing control over quality of plywood which identifies compliance by veneer grade, group number, span rating where applicable, and glue type.

C. Sheathing:
   1. APA rated Exposure 1 or Exterior; panel grade CD or better.
   2. Wall sheathing:
      a. Minimum 9 mm (11/32 inch) thick with supports 406 mm (16 inches) on center and 12 mm (15/32 inch) thick with supports 610 mm (24 inches) on center unless specified otherwise.
      b. Minimum 1200 mm (48 inches) wide at corners without corner bracing of framing.
   3. Roof sheathing:
      a. Minimum 9 mm (11/32 inch) thick with span rating 24/0 or 12 mm (15/32 inch) thick with span rating for supports 406 mm (16 inches) on center unless specified otherwise.
      b. Minimum 15 mm (19/32 inch) thick or span rating of 40/20 or 18 mm (23/32 inch) thick or span rating of 48/24 for supports 610 mm (24 inches) on center.

2.3 STRUCTURAL-USE PANELS:

A. Comply with APA E30.

B. Bearing the mark of a recognized association or independent agency that maintains continuing control over quality of panel which identifies compliance by end use, Span Rating, and exposure durability classification.

C. Wall and Roof Sheathing:
   1. APA Rated sheathing panels, durability classification of Exposure 1 or Exterior Span Rating of 16/0 or greater for supports 406 mm (16 inches) on center and 24/0 or greater for supports 610 mm (24 inches) on center.

D. Underlayment:
   1. APA rated Exposure I.

2. Minimum 6 mm (1/4 inch) thick or greater over subfloor.

E. Wood "I" Beam Members:
1. Size and Shape as indicated in contract documents.
2. Cambered and marked "TOP UP".
3. Plywood webs: PS-1, minimum 9 mm (3/8 inch) thick, unless shown otherwise.
4. Flanges: Kiln dried stress rated dense lumber minimum 38 mm (1-1/2 inch) thick, width as indicated on contract documents.
5. Plywood web fitted into flanges and joined with ASTM D2559 adhesive to form "I" beam section unless shown otherwise.

F. Laminated Veneer Lumber (LVL):
1. Bonded jointed wood veneers with ASTM D2559 adhesive.
2. Scarf jointed wood veneers with grain of wood parallel.
3. Size as indicated on contract documents.

2.4 ROUGH HARDWARE AND ADHESIVES:

A. Anchor Bolts:
1. ASME B18.2.1 and ASME B18.2.2 galvanized, 13 mm (1/2 inch) unless shown otherwise.
2. Extend at least 203 mm (8 inches) into masonry or concrete with ends bent 50 mm (2 inches).

B. Miscellaneous Bolts: Expansion Bolts: C1D A-A-55615; lag bolt, long enough to extend at least 65 mm (2-1/2 inches) into masonry or concrete. Provide 13 mm (1/2 inch) bolt unless shown otherwise.

C. Washers
1. ASTM F844.
2. Provide zinc or cadmium coated steel or cast iron for washers exposed to weather.

D. Screws:
1. Wood to Wood: ASME B18.6.1 or ASTM C1002.
2. Wood to Steel: ASTM C954, or ASTM C1002.

E. Nails:
1. Size and type best suited for purpose unless noted otherwise. Provide aluminum-alloy nails, plated nails, or zinc-coated nails, for nailing wood work exposed to weather and on roof blocking.
2. ASTM F1667:
   a. Common: Type I, Style 10.
   b. Concrete: Type I, Style 11.
   c. Barbed: Type I, Style 26.
   d. Underlayment: Type I, Style 25.
   e. Masonry: Type I, Style 27.
   f. Provide special nails designed for use with ties, strap anchors, framing connectors, joists hangers, and similar items. Nails not less than 32 mm (1-1/4 inches) long, 8d and deformed or annular ring shank.

F. Framing and Timber Connectors:
1. Fabricate of ASTM A653/A653M, Grade A; steel sheet not less than 1.3 mm (0.052 inch) thick unless specified otherwise. Apply standard plating to steel timber connectors after punching, forming and assembly of parts.
2. Framing Angles: Angle designed with bendable legs to provide three (3) way anchors.
3. Straps:
   a. Designed to provide wind and seismic ties with sizes as shown or specified.
   b. Strap ties not less than 32 mm (1-1/4 inches) wide.
   c. Punched for fastener.
4. Joist Hangers:

a. Fabricated of 1.6 mm (0.063 inch) minimum thick sheet, U design unless shown otherwise.
b. Heavy duty hangers fabricated of minimum 2.7 mm (0.108 inch) thick sheet, U design with bent top flange to lap over beam.

5. Timber Connectors: Fabricated of steel to shapes indicated on contract drawings.
6. Joist Ties: Mild steel flats, 5 mm by 32 mm (3/16 inch by 1-1/4 inch) size with ends bent about 30 degrees from horizontal, and extending at least 406 mm (16 inches) onto framing. Punch each end for three (3) spikes.
7. Wall Anchors for Joists and Rafters:
   a. Mild steel strap, 5 mm by 32 mm (3/16 inch by 1-1/4 inch) with wall ends bent 50 mm (2 inches), or provide 9 mm by 130 mm (3/8 inch by 5 inch) pin through strap end built into masonry.
   b. Strap long enough to extend onto three joists or rafters, and punched for spiking at each bearing.
   c. Strap not less than 101 mm (4 inches) embedded end.
8. Joint Plates:
   a. Steel plate punched for nails.
   b. Steel plates formed with teeth or prongs for mechanically clamping plates to wood.
   c. Size for axial eccentricity, and fastener loads.

G. Adhesives:
1. For field-gluing plywood to lumber framing floor or roof systems: ASTM D3498.
2. For structural laminated Wood: ASTM D2559.
3. Adhesives to have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, (EPA Method 24).

PART 3 - EXECUTION

3.1 INSTALLATION OF FRAMING AND MISCELLANEOUS WOOD MEMBERS:

A. Conform to applicable requirements of the following:
1. AFPA NDS for timber connectors.
2. AITC A190.1 Timber Construction Manual for heavy timber construction.
3. AFPA WCD1 for nailing and framing unless specified otherwise.
4. APA for installation of plywood or structural use panels.
5. TPI for metal plate connected wood trusses.

B. Fasteners:
1. Nails.
   a. Nail in accordance with the Recommended Nailing Schedule as specified in AFPA WCD1 where detailed nailing requirements are not specified in nailing schedule. Select nail size and nail spacing sufficient to develop adequate strength for the connection without splitting the members.
   b. Use special nails with framing connectors.
   c. For sheathing and subflooring, select length of nails sufficient to extend 25 mm (1 inch) into supports.
   d. Use 8d or larger nails for nailing through 25 mm (1 inch) thick lumber and for toe nailing 50 mm (2 inch) thick lumber.
   e. Use 16d or larger nails for nailing through 50 mm (2 inch) thick lumber.
   f. Select the size and number of nails in accordance with the Nailing Schedule except for special nails with framing anchors.
   g. Nailing Schedule; Using Common Nails:
      1) Joist bearing on sill or girder, toe nail three (3) 8d nails or framing anchor.
      2) Bridging to joist, toe nail each end two (2) 8d nails.
      3) Ledger strip to beam or girder three (3) 16d nails under each joint.
      4) Subflooring or Sheathing:
         a) 152 mm (6 inch) wide or less to each joist face nail two (2) 8d nails.

b) Subflooring, more than 152 mm (6 inches) wide, to each stud or joint, face nail three (3) 8d nails.
c) Plywood or structural use panel to each stud or joist face nail 8d, at supported edges 152 mm (6 inches) on center and at intermediate supports 254 mm (10 inches) on center. When gluing plywood to joint framing increase nail spacing to 305 mm (12 inches) at supported edges and 508 mm (20 inches) o.c. at intermediate supports.

5) Sole plate to joist or blocking, through sub floor face nail 20d nails, 406 mm (16 inches) on center.
6) Top plate to stud, end nail two (2) 16d nails.
7) Stud to sole plate, toe nail or framing anchor. Four (4) 8d nails.
8) Doubled studs, face nail 16d at 610 mm (24 inches) on center.
9) Built-up corner studs 16d at 610 mm (24 inches) (24 inches) on center.
10) Doubled top plates, face nails 16d at 406 mm (16 inches) on center.
11) Top plates, laps, and intersections, face nail two (2) 16d.
12) Continuous header, two pieces 16d at 406 mm (16 inches) on center along each edge.
13) Ceiling joists to plate, toenail three (3) 8d or framing anchor.
14) Continuous header to stud, four (4) 16d.
15) Ceiling joists, laps over partitions, face nail three (3) 16d or framing anchor.
16) Ceiling joists, to parallel rafters, face nail three (3) 16d.
17) Rafter to plate, toe nail three (3) 8d or framing anchor. Brace 25 mm (1 inch) thick board to each stud and plate, face nail three (3) 8d.
18) Built-up girders and beams 20d at 812 mm (32 inches) on center along each edge.

2. Bolts:
   a. Fit bolt heads and nuts bearing on wood with washers.
   b. Countersink bolt heads flush with the surface of nailers.
   c. Embed in concrete and solid masonry or provide expansion bolts. Special bolts or screws designed for anchor to solid masonry or concrete in drilled holes may be used.
   d. Provide toggle bolts to hollow masonry or sheet metal.
   e. Provide bolts to steel over 2.84 mm (0.112 inch, 11 gage) in thickness. Secure wood nailers to vertical structural steel members with bolts, placed one at ends of nailer and 610 mm (24 inch) intervals between end bolts. Provide clips to beam flanges.
3. Drill Screws to steel less than 2.84 mm (0.112 inch) thick.
   a. ASTM C1002 for steel less than 0.84 mm (0.033 inch) thick.
   b. ASTM C954 for steel over 0.84 mm (0.033 inch) thick.
4. Power actuated drive pins may be provided where practical to anchor to solid masonry, concrete, or steel.
5. Do not anchor to wood plugs or nailing blocks in masonry or concrete. Provide metal plugs, inserts or similar fastening.
6. Screws to Join Wood:
   a. Where shown or option to nails.
   b. ASTM C1002, sized to provide not less than 25 mm (1 inch) penetration into anchorage member.
   c. Spaced same as nails.
7. Installation of Timber Connectors:
   a. Conform to applicable requirements of the AFPA NDS.
   b. Fit wood to connectors and drill holes for fasteners so wood is not split.

C. Set sills or plates level in full bed of mortar on masonry or concrete walls.
   1. Space anchor bolts 1219 mm (4 feet) on centers between ends and within 152 mm (6 inches) of end. Stagger bolts from side to side on plates over 178 mm (7 inches) in width.

2. Provide shims of slate, tile or similar approved material to level wood members resting on concrete or masonry. Do not use wood shims or wedges.
3. Closely fit, and set to required lines.

D. Cut notch, or bore in accordance with AFPA WCD1 passage of ducts wires, bolts, pipes, conduits and to accommodate other work. Repair or replace miscut, misfit or damaged work.

E. Blocking Nailers, and Furring:
1. Install furring, blocking, nailers, and grounds where shown.
2. Provide longest lengths practicable.
3. Provide fire retardant treated wood blocking where shown at openings and where shown or specified.
4. Layers of Blocking or Plates:
   a. Stagger end joints between upper and lower pieces.
   b. Nail at ends and not over 610 mm (24 inches) between ends.
   c. Stagger nails from side to side of wood member over 127 mm (5 inches) in width.
5. Fabricate roof edge vent strips with 6 mm by 6 mm (1/4 inch by 1/4 inch) notches, 101 mm (4 inches) on center, aligned to allow for venting of venting base sheet. / Option: Texture 1-11 plywood with parallel grooves 101 mm (4 inches) o.c. may be used.

F. Bridging:
1. Provide 25 mm by 75 mm (1 inch by 3 inch) lumber with ends beveled for slope. Option: Metal bridging may be provided in lieu of wood bridging.
2. Install one (1) row of bridging for joist spans over 2438 mm (8 feet), but less than 4877 mm (16 feet) long; install two (2) rows for spans over 4877 mm (16 feet) long.
3. Install an extra row of bridging between trimmer and next two (2) joists if header is more than 610 mm (2 feet) from end of trimmer or from regular row of bridging.
4. Secure with two (2) nails at ends.
5. Leave bottom ends loose until after subflooring or roof sheathing is installed.
6. Install single row of bridging at centerline of span and two (2) rows at the third points of span unless otherwise shown.

G. Roof Framing:
1. Set rafters with crown edge up.
2. Form a true plane at tops of rafters.
3. Valley, Ridge, and Hip Members:
   a. Size for depth of cut on rafters.
   b. Straight and true intersections of roof planes.
   c. Secure hip and valley rafters to wall plates by using framing connectors.
   d. Double valley rafters longer than the available lumber, with pieces lapped not less than 1219 mm (4 feet) and spiked together.
   e. Butt joint and scab hip rafters longer than the available lumber.
4. Spike to wall plate and to ceiling joists except when secured with framing connectors.
5. Frame openings in roof with headers and trimmer rafters. Double headers carrying more than one (1) rafter unless shown otherwise.
6. Install 50 mm by 101 mm (2 inch by 4 inch) strut between roof rafters and ceiling joists at 1219 mm (4 feet) on center unless shown otherwise.

H. Framing of Dormers:
1. Frame as indicated in contract documents, with top edge of ridge beveled to pitch of roof header.
2. Set studs on doubled trimmer rafters.
3. Double studs at corners of dormers.
4. Double plate on studs and notch rafters over plate and bear at least 75 mm (3 inches) on plates.
5. Frame opening to receive window frame or louver frame.

I. Partition and Wall Framing:

1. Provide 50 mm by 101 mm (2 inch by 4 inch) studs spaced 406 mm (16 inches) on centers; unless otherwise indicated on contract documents.
2. Install double studs at openings and triple studs at corners.
3. Installation of sole plate:
   a. Anchor plates of walls or partitions resting on concrete floors in place with expansion bolts, one (1) near ends of piece and at intermediate intervals of not more than 1219 mm (4 feet) or with power actuated drive pins with threaded ends of suitable type and size, spaced 610 mm (2 feet) on center unless shown otherwise.
   b. Nail plates to wood framing through subfloor as specified in nailing schedule.
4. Headers or Lintels:
   a. Make headers for openings of two (2) pieces of 50 mm (2 inch) thick lumber of size shown with plywood filler to finish flush with face of studs or solid lumber of equivalent size.
   b. Support ends of headers on top of stud cut for height of opening. Spike cut stud to adjacent stud. Spike adjacent stud to header.
5. Provide double top plates, with members lapped at least 610 mm (2-feet) spiked together.
6. Install intermediate cut studs over headers and under sills to maintain uniformity of stud spacing.
7. Provide single sill plates at bottom of opening unless otherwise indicated in contract documents. Toe nail to end stud, face nail to intermediate studs.
8. Install 50 mm (2 inch) blocking for firestopping so that maximum dimension of any concealed space is not over 2438 mm (8 feet) in accordance with AFPA WCD1.
9. Install corner bracing when plywood or structured use panel sheathing is not used.
   a. Let corner bracing into exterior surfaces of studs at an angle of approximately 45 degrees, extended completely over walls plates, and secured at bearing with two (2) nails.
   b. Provide 25 mm by 101 mm (1 inch by 4 inch) corner bracing.

J. Rough Bucks:
1. Install rough wood bucks at opening in masonry or concrete where wood frames or trim occur.
2. Brace and maintain bucks plumb and true until masonry has been built around them or concrete cast in place.
3. Cut rough bucks from 50 mm (2 inch) thick stock, of same width as partitions in which they occur and of width shown in exterior walls.
4. Extend bucks full height of openings and across head of openings; fasten securely with anchors specified.

K. Sheathing:
1. Provide plywood or structural-use panels for sheathing.
2. Lay panels with joints staggered, with edge and ends 3 mm (1/8 inch) apart and nailed over bearings as specified.
3. Set nails not less than 9 mm (3/8 inch) from edges.
4. Install 50 mm by 101 mm (2 inch by 4 inch) blocking spiked between joists, rafters and studs to support edge or end joints of panels.
5. Match and align sheathing which is an extension of work in place to existing.

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SECTION 07 19 00

WATER REPELLENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This specification describes the grouting of cracks/sealing of concrete by topical treatment with a 100% solids

1.2 RELATED WORK

A. Section 01 45 29, TESTING LABORATORY SERVICES: Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.

B. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS

C. Section 03 30 00, CAST IN PLACE CONCRETE

1.3 QUALITY ASSURANCE

A. Manufacturing qualifications: The manufacturer of the specified product shall be ISO 9001 certified and have in existence a recognized ongoing quality assurance program independently audited on a regular basis.

B. Contractor qualifications: Contractor shall be qualified in the field of concrete repair and protection with a successful track record of 5 years or more. Contractor shall maintain qualified personnel who have received product training by a manufacturer's representative.

C. Install materials in accordance with all safety and weather conditions required by manufacturer, or as modified by applicable rules and regulations of local, state and federal authorities having jurisdiction. Consult Material Safety Data Sheets for complete handling recommendations.

1.4 TOLERANCES

1.5 REGULATORY REQUIREMENTS

A. ACI SP-66 – ACI Detailing Manual.

B. ACI 318 - Building Code Requirements for Reinforced Concrete.

C. ACI 301 – Standard Specifications for Structural Concrete.

1.6 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES. All items indicated below are required submittals requiring Contracting Officer’s Representative (COR) review and approval

B. Submit manufacturer's literature, to include: Product Data Sheets and appropriate Material Safety Data Sheets (MSDS).

C. Provide a written warranty from the manufacturer against defects of materials for a period of one (1) year, beginning with date of substantial completion of the project.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver packaged materials in original sealed containers, plainly marked with manufacturer's name and brand, and protect from damage until used.

B. Store all materials off the ground and protect from rain, freezing or excessive heat until ready for use.

C. Condition the specified product as recommended by the manufacturer.

1.8 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

B. American Concrete Institute (ACI):

117-10	Specifications for Tolerances for Concrete Construction and Materials and Commentary
211.1-91(R2009)	Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
211.2-98(R2004)	Standard Practice for Selecting Proportions for Structural Lightweight Concrete
318/318-19	Building Code Requirements for Structural Concrete and Commentary
347R-14	Guide to Formwork for Concrete
SP-66-04	ACI Detailing Manual

C. ASTM International (ASTM):

C881/C881M-20	Standard Specification for Epoxy Resin Base Bonding Systems for Concrete
C1315-19	Standard Specification for Liquid Membrane Forming Compounds Having Special Properties for Curing and Sealing Concrete
D4263-83(2018)	Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
E1155-20	Standard Test Method for Determining F_F Floor Flatness and F_L Floor Levelness Numbers
F1249-20	Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor
F1869-16a	Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

D. U. S. Army Corps of Engineers Handbook for Concrete and Cement:

CRD C513	Rubber Waterstops
CRD C572	Polyvinyl Chloride Waterstops

PART 2 - PRODUCTS

2.1 BASIS OF DESIGN:

A. Epoxy resin adhesive Sikadur 55 SLV:, as manufactured by sika corporation, 1682 Marion Williamsport Road, Marion, Ohio 43302 is considered to conform to the requirements of this specification**.**

1. Component “A” shall be a modified epoxy resin of the epichlorohydrin bisphenol A type containing suitable viscosity control agents. It shall not contain butyl glycidyl ether.
2. Component “B” shall be an aliphatic diamine containing suitable viscosity control agents and accelerators.
3. The ratio of component “A”: Component “B” shall be 2 : 1 by Volume.

B. Equal Product from other Manufacturers must meet specification requirements.

2.2 MATERIALS

A. Component "A" shall be a modified epoxy resin of the epichlorohydrin bisphenol A type containing suitable viscosity control agents. It shall not contain butyl glycidyl ether.

B. Component "B" shall be an aliphatic diamine containing suitable viscosity control agents and accelerators.

C. The ratio of component "A": Component "B" shall be 2 : 1 by Volume.

2.3 PERFORMANCE CRITERIA

A. Properties of the mixed epoxy resin adhesive:
1. Pot Life: min. 25 minutes (60 gram mass) @ 73° F F
2. Tack-Free Time: 20 mils

40F (4C)	60F(15C)	73F(23C)	90F(32C)
> 11 hrs.	11 hrs.	6 hrs.	2.5 hrs.

3. Color: Clear, Amber
4. Viscosity: 105 cps.

B. Properties of the cured epoxy resin adhesive:
1. Compressive Strength (ASTM D-695)min
   a. 1 day: 1,100 psi (7.6 MPa)
   b. 7 day: 10,900 psi (75.1 MPa)
   c. 28 day: 12,000 psi (82.7 MPa)
2. Compressive Modulus, psi : .min.
   a. 7 day 300,000 psi (2068 Mpa)
3. Shear Strength (ASTM D-732)
   a. 7 day: 5,800psi (40 MPa)
4. Flexural Strength (ASTM D-790)
   a. 7 day: 8,500 psi (58.6 MPa))
5. Tangent Modulus of Elasticity in Bending min
   a. 7 days: 320,000 psi
6. Bond Strength (ASTM C-882), 14 day (moist cure)min
   a. Hardened Concrete to Hardened Concrete 2,500 psi (17.2 Mpa)
   b. Hardened Concrete to Steel 1,600 psi (1 1 Mpa)
7. Water Absorption (ASTM D-570), max
   a. 24 hour immersion .06%
8. Tensile properties (ASTM D-638)
   a. 7 day Tensile Strength 7,100 psi (48.9 Mpa)
   b. Elongation at Break 10%

Note: Tests above were performed with material & curing conditions at 73F &45-55% relative humidity.

PART 3 - EXECUTION

3.1 JOB CONDITIONS

A. Environmental Conditions: Do not apply material if it is raining or snowing or if such conditions appear to be imminent. Minimum application temperature 40ºF (5ºC) and rising.

B. Protection: Precautions should be taken to avoid damage to any surface near the work zone due to mixing and handling of the specified product.

3.2 MIXING AND APPLICATION

A. Mixing the epoxy adhesive dbinder: Proportion 1 (one) part Component 'B' to 2 (two) parts Component 'A' by volume into a clean pail. Mix throroughly for 3 minutes with a low-speed drill

400-600 rpm) drill with Jiffy mixer until uniformly blended. Mix only that quantity which can be used within its pot life.

B. Placement procedure:
   1. Large cracks can be prefilled with oven dry sand and must be filled prior to the application. Pour mixed epoxy resin over all visible cracks for 5 – 10 minutes. Repeat the ponding procedure until the cracks are sealed. Care must be taken not to allow the epoxy resin to stiffen in these ponded areas. Spread material out over the substrate before it sets. Fill the cracks when widest (during the coolest part of the day) to maximize flow and material fill. If needed, seal cracks from underside, when accessible, to prevent leakage.
   2. After the visible cracks have been sealed, if needed commence sealing the entire prepared surface. Pour the mixed epoxy resin onto the substrate. Spread material using rubber squeegee and rollers. Allow material to penetratethe pores of the substrates. Continue to apply until the substrate is sealed. The finished appearance of the substrate should be wet looking with no visible surface film. After 30 minutes and within 2 hours cover treated area with a light broadcast of a 8/20 or similar oven dry sand. Distribute evenly over surface at a rate of 15 to 20 lbs./ per 100 sq. ft.. Allow material to cure before removal of any loose sand and then open to traffic. If penetration of any cracks is impossible, consult the Engineer before discontinuing the injection procedure. If modification of the proposed procedure is required to fill the cracks, submit said modification in writing to the Engineer for acceptance prior to proceeding.

C. Adhere to all limitations and cautions for the epoxy resin adhesive in the manufacturers current printed literature.

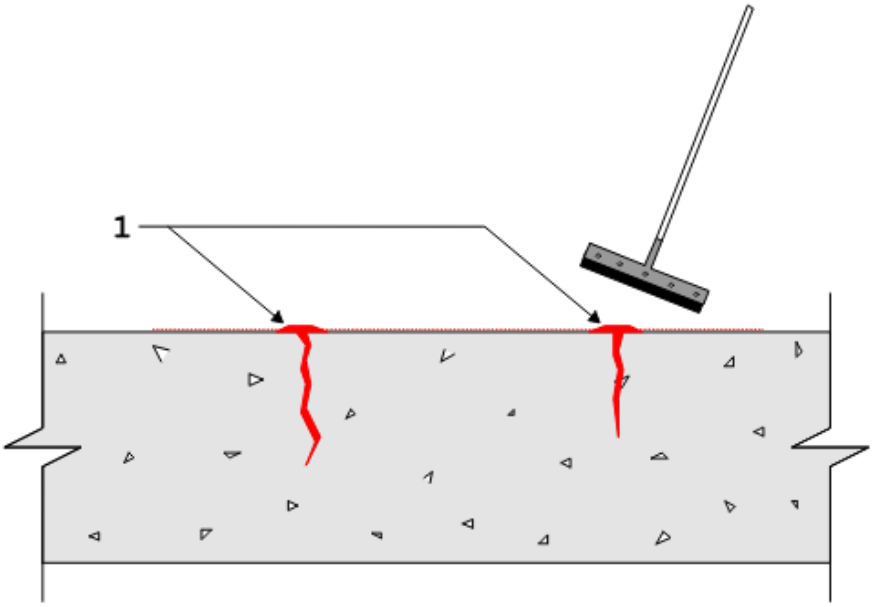
3.3 CLEANING

A. After the epoxy resin adhesive for grouting has cured, the epoxy resin adhesive for sealing cracks and porting devices shall be removed as required by the Engineer. Clean the substrate in a manner to produce a finish appearance acceptable to the Owner.

B. The uncured epoxy resin adhesive can be cleaned from tools with approved solvent. The cured epoxy resin adhesive can only be removed mechanically.

C. Leave finished work and work area in a neat, clean condition without evidence of spillovers onto adjacent areas.

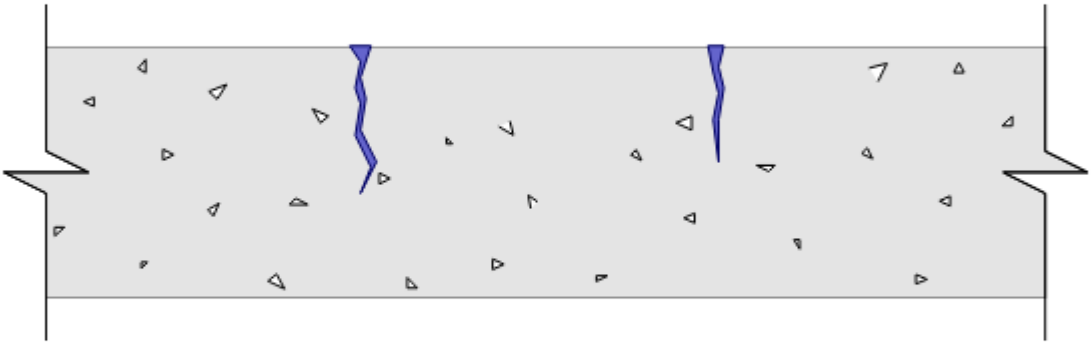
SC-006 Sikadur 55 SLV
Crack Healer/Surface Sealer



1. Spread neat Sikadur 55 SLV with flat squeegee or roller allowing to pond over cracked areas.
2. Let material penetrate into cracks and surrounding substrate.
3. Remove excess leaving no visible surface film.

Note: For cracks greater than 1/8" wide, fill crack with oven-dried sand before applying Sikadur 55 SLV. Prior to filling seal underside of slab, when accessible, to prevent leakage.

SC-006 Sikadur® 55 SLV Crack Filler



1. Pour neat Sikadur 55 SLV epoxy resin adhesive into vee notched crack.
2. Continue placement until cracks are completely filled.

Note: Prior to filling, seal underside of slab if cracks reflect through.

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SECTION 07 46 46

FIBER-CEMENT SIDING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fiber cement lap siding, panels, trim, fascia, and accessories

B. Factory-finished fiber cement lap siding, panels, trim, fascia, and accessories.

1.2 RELATED SECTIONS

A. Section 06 10 00 - Rough Carpentry.

1.3 REFERENCES

A. ASTM

C1186-08(2016) ..... Standard Specification for Flat Fiber-Cement Sheets

E136 ..... Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 degrees C.

D3359 ..... Standard Test Method for Measuring Adhesion by Tape Test, Tool and Tape.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 33 23 – Shop Drawings, Product Data, and Samples.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Shop Drawings: Provide detailed drawings of atypical non-standard applications of cementitious siding materials which are outside the scope of the standard details and specifications provided by the manufacturer.

D. Selection Samples:
1. For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples:
1. For each finish product specified, two samples, minimum size 4 by 6 inches (100 by 150 mm), representing actual product, color, and patterns.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Minimum of 2 years experience with installation of similar products.

B. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
1. Finish areas designated by COR.
2. Do not proceed with remaining work until workmanship, color, and sheen are approved by COR.
3. Remodel mock-up area as required to produce acceptable work.

DELIVERY, STORAGE, AND HANDLING

C. Store products in manufacturer's unopened packaging until ready for installation.

D. Store siding on edge or lay flat on a smooth level surface. Protect edges and corners from chipping. Store sheets under cover and keep dry prior to installing.

E. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.6 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.7 WARRANTY

A. Product Warranty: Limited, non-pro-rated product warranty.
   1. Lap siding for 30 years.

B. Panels for 30 years.Siding for 30 years.Finish Warranty: Limited product warranty against manufacturing finish defects.
   1. When used for its intended purpose, properly installed and maintained according to published installation instructions, factory finish, for a period of 15 years from the date of purchase: will not peel; will not crack; and will not chip. Finish warranty includes the coverage for labor and material.

C. Workmanship Warranty: Application limited warranty for 2 years.

PART 2 - PRODUCTS

2.1 SIDING AND TRIM

A. Basis of Design: James Hardie Building Products, Inc.
   1. Or Equal product approved prior to bid.

B. Lap siding, , Soffit panels and Shingle siding requirement for materials:
   1. Fiber-cement siding - complies with ASTM C 1186 Type A Grade II.
   2. Fiber-cement siding - complies with ASTM E 136 as a noncombustible material.
   3. Fiber-cement siding - complies with ASTM E 84 Flame Spread Index = 0, Smoke Developed Index = 5.
   4. CAL-FIRE, Fire Engineering Division Building Materials Listing - Wildland Urban Interface (WUI) Listed Product.
   5. ICC-ES evaluation reports ESR-2290, ESR-1844, and ESR-2273 (IBC, IRC, CBC, CRC)
   6. City of Los Angeles, Research Report No. 24862.
   7. Miami Dade County, -Notice of Acceptance -15-0122.04.
   8. US Department of Housing and Urban Development Materials Release -1263f.
   9. California DSA PA-019.
   10. City of New York M EA 223-93-M.
   11. Florida State Product Approval -FL13192, FL13223, and FL13265
   12. Texas Department of Insurance Product Evaluation EC-23.

C. Lap Siding: HardiePlank HZ10 Lap as manufactured by James Hardie Building Products, Inc.
   1. Type: Smooth 7-1/4 inches (184 mm) with 6 inches (152 mm) exposure.

D. Shingle Siding: HardieShingle HZ10 siding as manufactured by James Hardie Building Products, Inc.
   1. Type: HardiShingle Individual Shingles 6 inches (152 mm) wide by 18 inches (457 mm) high with 8 inches (203 mm) exposure.

E. Soffit Panels: Non-Vented Soffit Panel, as manufactured by James Hardie Building Products, Inc.
   1. Factory sealed on 5 sides.

2. Thickness: 1/4 inch (6 mm).
3. Type: Smooth, 12 inches (305 mm) by 12 feet (3658 mm).
4. Type: Smooth, 16 inches (406 mm) by 12 feet (3658 mm.
5. Type: Smooth, 24 inches (610 mm) by 8 feet (2438 mm).

F. 2X Smooth Trim:
1. 2X Smooth Trim
2. Overall Thickness: 1-1/2 in (38 mm).
3. Width: 5-1/2 inch (140 mm).
4. Width: 9-1/4 inch (235 mm).
5. Width: 11-1/4 inch (286 mm).
6. Texture: Smooth.

2.2 FASTENERS

A. Metal Framing:
1. Metal Framing: 1-1/4 inches (32 mm) No. 8-18 by 0.375 inch (9.5 mm) head self-drilling, corrosion resistant S-12 ribbed buglehead screws.
2. Metal Framing: 1-5/8 inches (41 mm) No. 8-18 by 0.323 inch (8.2 mm) head self-drilling, corrosion resistant S-12 ribbed buglehead screws.
3. Metal Framing: 1 inch (25 mm) No. 8-18 by 0.323 inch (8.2 mm) head self-drilling, corrosion resistant ribbed buglehead screws.
4. Metal Framing: 1 inch (25 mm) No. 8-18 by 0.311 inch (7.9 mm) head self-drilling, corrosion resistant S-12 ribbed buglehead screws.
5. Metal Framing: 1.5 inch (38mm) AGS-100 .100 inches by 25 inches (2540 mm by 635 mm) ET&F Pin or equivalent pneumatic fastener.

2.3 FINISHES

A. Factory Primer: Provide factory applied universal primer.
1. Primer: Recommend Factory primed by Fiber Cement Siding Manufacture.
2. Topcoat: Refer to Section 09 91 00 - Painting and Coating and Exterior Finish Schedule.

B. Factory Finish: Refer to Exterior Finish Schedule.
1. Definition: Factory applied finish; defined as a finish applied in the same facility and company that manufactures the siding substrate.
2. Process:
   a. Factory applied finish by fiber cement manufacturer in a controlled environment within the fiber cement manufacturer's own facility utilizing a multi-coat, heat cured finish within one manufacturing process.
   b. Each finish color must have documented color match to delta E of 0.5 or better between product lines, manufacturing lots or production runs as measured by photospectrometer and verified by third party.
3. Protection: Factory applied finish protection such as plastic laminate that is removed once siding is installed
4. Accessories: Complete finishing system includes pre-packaged touch-up kit provided by fiber cement manufacturer. Provide quantities as recommended by manufacturer.

C. Factory Finish Color for Trim, Soffit and Siding Colors:
1. Color Names and Number Basis of Design:
   a. ColorPlus Technology by James Hardie
2. Arctic White JH10-20.
3. Crisp White
4. Summer White
5. White Picket Fence

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If framing preparation is the responsibility of another installer, notify COR of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION - LAP SIDING, ARTISAN LAP SIDING, AND ARTISAN LAP SIDING WITH LOCK JOINT SYSTEM

A. Install materials in strict accordance with manufacturer's installation instructions.

B. Starting: Install a minimum 1/4 inch (6 mm) thick lath starter strip at the bottom course of the wall. Apply planks horizontally with minimum 1-1/4 inches (32 mm) wide laps at the top. The bottom edge of the first plank overlaps the starter strip.

C. Allow minimum vertical clearance between the edge of siding and any other material in strict accordance with the manufacturer's installation instructions.

D. Align vertical joints of the planks over framing members.

E. Butt joints must not fall within 4 inches (102 mm) of a stud. Do not nail within 2 inches (51 mm) of the end of planks.

F. Maintain clearance between siding and adjacent finished grade.

G. Locate splices at least one stud cavity away from window and door openings.

H. For proper fastener selection and fastening schedules for various wind load requirements and framing options, refer to the Technical Data Sheet at www.aspyredesign.com.

I. Face nail to CFS system.

J. Locate splices at least 12 inches (305 mm) away from window and door openings.

3.4 INSTALLATION - SOFFIT PANELS

A. Install materials in strict accordance with manufacturer's installation instructions.
   1. Panels may be installed as soffit or ceiling over wood or steel framing; 20 gauge (33 mils) minimum to 16 gauge (54 mils), complying with local building code. Install soffits to nominal 2 x 4 framing members spaced a maximum of 24 inches (610 mm) on center with the long dimension perpendicular to the rafter or joist framing.
   2. Support edges by framing.
   3. Install kickout flashing at roof-wall junctions per manufacturer's instructions.
   4. Additional framing may be needed to ensure proper fastening.
   5. Fastener Positioning: Position fasteners 3/8 inches (9.5 mm) from panel edges and no closer than 2 inches (51 mm) away from corners when using soffit greater than 12 inch (305 mm) wide and no closer than 1 inch (25 mm) away from corners when using soffit that is less than or equal to 12 inch (305 mm) wide.
   6. Jointing Methods: Install panels in moderate contact at ends, provide PVC or metal jointers, battens or leave appropriate gap and caulk.
   7. Drive fasteners perpendicular to siding and framing.
   8. Fastener heads should fit snug against siding; no air space.

3.5 INSTALLATION — HARDIE HZ10 SHINGLE SIDE CLADDING

A. Install materials in strict accordance with manufacturer's installation instructions.

1. Substrate: Install a minimum 7/16 inch (11 mm) thick OSB wall sheathing or equivalent braced walls complying with applicable building codes.
2. Starting: Install a minimum 1/4 inch (6 mm) thick lath starter strip at the bottom course of the wall.
3. Maintain clearance between siding and adjacent finished grade.
4. Apply starter course of 10 inches (254 mm) shingles or 9-1/2 inches (241 mm) lap siding overlapping the starter strip.
5. Apply subsequent courses horizontally with a minimum 10 inch overlap at the top and a minimum 2 inch (51 mm) side lap. The bottom edge of the first two courses overlaps the starter strip.
6. Fasten between 1/2 inch (13 mm) and 1 inch (25 mm) in from the side edge and between 8-1/2 inches (216 mm) and 9 inches (229 mm) up from the shingle bottom edge.
7. Allow minimum vertical clearance between the edge of siding and any other material in strict accordance with the manufacturer's installation instructions.
8. Ensure vertical joints of overlapping shingle course do not align.
9. Wind Resistance: Where a specified level of wind resistance is required, Hardie Shingle siding is installed to substrate and secured with a minimum two fasteners described in Table No. 6, 7 and 8 in National Evaluation Service Report No. NER-405.

3.6 INSTALLATION - TRIM BOARDS

A. Install materials in strict accordance with manufacturer's installation instructions. Install flashing around all wall openings.

B. Fasten through trim into structural framing or code complying sheathing. Fasteners must penetrate minimum 3/4 inch (19 mm) or full thickness of sheathing. Additional fasteners may be required to ensure adequate security.

C. Place fasteners no closer than 3/4 inch (19 mm) and no further than 2 inches (51 mm) from side edge of trim board and no closer than 1 inch (25 mm) from end. Fasten maximum 16 inches (406 mm) on center.

D. Maintain clearance between trim and adjacent finished grade.

E. Trim inside corner with a single board trim both side of corner.

F. Outside Corner Board Attach Trim on both sides of corner with 16 gage corrosion resistant finish nail 1/2 inch (13 mm) from edge spaced 16 inches (406 mm) apart, weather cut each end spaced minimum 12 inches (305 mm) apart.

G. Allow 1/8 inch gap between trim and siding.

H. Seal gap with high quality, paint-able caulk.

I. Shim frieze board as required to align with corner trim.

J. Fasten through overlapping boards. Do not nail between lap joints.

K. Overlay siding with single board of outside corner board then align second corner board to outside edge of first corner board. Do not fasten Trim boards to Trim boards.

L. Shim frieze board as required to align with corner trim.

M. Install Trim Fascia boards to rafter tails or to sub fascia.

3.7 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

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SECTION 07 54 23

THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Flashing tie-ins for equipment and vents in Thermoplastic Polyolefin (TPO) sheet roofing adhered to roof deck.

1.2 RELATED WORK

A. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS: Non-Flooring Adhesives and Sealants VOC Limits.

B. Comply with references to extent specified in this section.

C. American National Standards Institute/Single-Ply Roofing Institute (ANSI/SPRI):
1. FX-1-16 Standard Field Test Procedure for Determining the Withdrawal Resistance of Roofing Fasteners.

D. American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI):
1. 7-16 Minimum Design Loads for Buildings and Other Structures.

E. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE):
1. 90.1-13 Energy Standard for Buildings Except Low-Rise Residential Buildings.

F. ASTM International (ASTM):
1. C67-20 Sampling and Testing Brick and Structural Clay Tile.
2. C140/C140M-20a Sampling and Testing Concrete Masonry Units and Related Units.
3. C1371-15 Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.
4. C1549-16 Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.
5. D1876-08(2015)e1 Peel Resistance of Adhesives (T-Peel Test).
6. D4263-83(2018) Indicating Moisture in Concrete by the Plastic Sheet Method.
7. D4434/D4434M-15 Poly(Vinyl Chloride) Sheet Roofing.
8. D6878/D6878M-13 Thermoplastic Polyolefin Based Sheet Roofing.
9. E408-13 Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.
10. E1918-16 Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field.
11. E1980-11(2019) Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.

G. Cool Roof Rating Council (CRRC):
1. 1-20 Product Rating Program.

H. National Roofing Contractors Association (NRCA):
1. Manual-19 The NRCA Roofing Manual: Membrane Roofing Systems.

I. U.S. Department of Agriculture (USDA):
1. BioPreferred® Program Catalog.

J. UL LLC (UL):
1. 580-06 Tests for Uplift Resistance of Roof Assemblies.
2. 1897-20 Uplift Tests for Roof Covering Systems.

K. U.S. Department of Commerce National Institute of Standards and Technology (NIST):
   1. DOC PS 1-19 Structural Plywood.
   2. DOC PS 2-18 Performance Standard for Wood-Based Structural-Use Panels.

L. U.S. Environmental Protection Agency (EPA):
   1. Energy Star ENERGY STAR Program Requirements for Roof Products Version 3.0.

1.3 PREINSTALLATION MEETINGS

A. Conduct pre-installation meeting at project site minimum 30 days before beginning Work of this section.
   1. Required Participants:
      a. Contracting Officer's Representative.
      b. Architect/Engineer.
      c. Inspection and Testing Agency.
      d. Contractor.
      e. Installer.
      f. Manufacturer's field representative.
      g. Other installers responsible for adjacent and intersecting work, including roof deck, flashings, roof penetrations, roof accessories, utility penetrations, rooftop curbs and equipment
   2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.
      a. Installation schedule.
      b. Installation sequence.
      c. Preparatory work.
      d. Protection before, during, and after installation.
      e. Installation.
      f. Terminations.
      g. Transitions and connections to other work.
      h. Inspecting and testing.
      i. Other items affecting successful completion.
      j. Pullout test of fasteners.
      k. Material storage, including roof deck load limitations.
   3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:
   1. Roof membrane layout.
   2. Roofing membrane seaming and joint details.
   3. Roof membrane penetration details.
   4. Base flashing and termination details.
   5. Paver layout.
   6. Paver anchoring locations and details.

C. Manufacturer's Literature and Data:
   1. Description of each product.
   2. Minimum fastener pullout resistance.
   3. Installation instructions.
   4. Warranty.

D. Samples:
   1. Roofing Membrane: 150 mm (6 inch) square.
   2. Base Flashing: 150 mm (6 inch) square.
   3. Fasteners: Each type.
   4. Roofing Membrane Seam: 300 mm (12 inches) square.

E. Sustainable Construction Submittals:
   1. Solar Reflectance Index (SRI) for roofing membrane.
   2. Biobased Content:
      a. Show type and quantity for each product.
   3. Low Pollutant-Emitting Materials:
      a. Show volatile organic compound types and quantities.
   4. Energy Star label for roofing membrane.

F. Certificates: Certify products comply with specifications.
   1. Fire and windstorm classification.
   2. High wind zone design requirements.
   3. Energy performance requirements.

G. Qualifications: Substantiate qualifications comply with specifications.
   1. Installer, including supervisors with project experience list.
   2. Manufacturer's field representative with project experience list.

H. Field quality control reports.

I. Temporary protection plan. Include list of proposed temporary materials.

J. Operation and Maintenance Data:
   1. Maintenance instructions.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Approved by roofing system manufacturer as installer for roofing system with specified warranty.
   2. Regularly installs specified products.
   3. Installed specified products with satisfactory service on five similar installations for minimum five years.
      a. Project Experience List: Provide contact names and addresses for completed projects.
   4. Employs full-time supervisors experienced installing specified system and able to communicate with Contracting Officer's Representative and installer's personnel.

B. Manufacturer's Field Representative:
   1. Manufacturer's full-time technical employee or independent roofing inspector.
   2. Individual certified by Roof Consultants Institute as Registered Roof Observer.

1.6 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.

B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, and manufacture date.

C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

A. Comply with NRCA Manual storage and handling requirements.

B. Store products indoors in dry, weathertight facility.

C. Store adhesives according to manufacturer's instructions.

D. Protect products from damage during handling and construction operations.

E. Products stored on the roof deck must not cause permanent deck deflection.

1.8 FIELD CONDITIONS

A. Environment:
   1. Product Temperature: Minimum 4 degrees C (40 degrees F) for minimum 48 hours before installation.
   2. Weather Limitations: Install roofing only during dry current and forecasted weather conditions.

1.9 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

B. Manufacturer's Warranty: Warrant roofing system against material and manufacturing defects and agree to repair any leak caused by a defect in the roofing system materials or workmanship of the installer.
   1. Warranty Period: 10 years.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Roofing System: Thermoplastic Polyolefin (TPO) sheet roofing adhered fastened to roof deck.

2.2 SYSTEM PERFORMANCE

A. Design roofing system complying with specified performance:
   1. Load Resistance: ASCE/SEI 7; Design criteria: as indicated on Drawings.
      a. Uplift Pressures:
         1) Corner Uplift Pressure: -2.28 kPa/square meter (-47.67 lbs per square foot).
         2) Perimeter Uplift Pressure: -1.52 kPa/square meter (-31.71 lbs per square foot).
         3) Field-of-Roof Uplift Pressure: .91 kPa/square meter (-18.90 lbs per square foot).
   2. Energy Performance:
      a. EPA Energy Star Listed for low-slope roof products.

2.3 PRODUCTS - GENERAL

A. Provide roof system components from one manufacturer.

B. Sustainable Construction Requirements:
   1. Solar Reflectance Index: 78 minimum.
   2. Biobased Content: Where applicable, provide products designated by USDA and meeting or exceeding USDA recommendations for bio-based content, and products meeting Rapidly Renewable Materials and certified sustainable wood content definitions; refer to www.biopreferred.gov.
   3. Low Pollutant-Emitting Materials: Comply with VOC limits specified in Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for the following products:
      a. Non-flooring adhesives and sealants.

2.4 TPO ROOFING MEMBRANE

   1. TPO Sheet: ASTM D6878/D6878M, internally fabric or scrim reinforced, 1.5 mm (60 mils) thick, with fabric backing.

2.5 MEMBRANE ACCESSORY MATERIALS

A. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as TPO sheet membrane.

B. Factory Formed Flashings: Inside and outside corners, pipe boots, and other special flashing shapes to minimize field fabrication.

C. Bonding Adhesive: Manufacturer's standard, water based.

D. Metal Termination Bars: Manufacturer's standard, stainless-steel or aluminum, 25 mm wide by 3 mm thick (1-inch wide by 1/8 inch thick) factory drilled for fasteners.

E. Battens: Manufacturer's standard, galvannealed or galvanized steel sheet, 25 mm wide by 1.3 mm thick (1-inch wide by 0.05 inch thick), factory punched for fasteners.

F. Fasteners: Manufacturer's standard coated steel with metal or plastic plates, to suit application.

G. Primers, Sealers, T-Joint Covers, Lap Sealants, and Termination Reglets: As specified by roof membrane manufacturer.

H. Adhesive and sealant materials recommended by roofing system manufacturer for intended use, identical to materials utilized in approved listed roofing system, and compatible with roofing membrane.

2.6 ACCESSORIES

A. Temporary Protection Materials:
1. Expanded Polystyrene (EPS) Insulation: ASTM C578.
2. Plywood: NIST DOC PS 1, Grade CD Exposure 1.
3. Oriented Strand Board (OSB): NIST DOC PS 2, Exposure 1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine and verify substrate suitability with roofing Installer and roofing inspector present.
1. Verify roof penetrations are complete, secured against movement, and firestopped.
2. Verify roof deck is adequately secured to resist wind uplift.
3. Verify roof deck is clean, dry, and in-plane ready to receive roofing system.

B. Correct unsatisfactory conditions before beginning roofing work.

3.2 PREPARATION

A. Complete roof deck construction before beginning roofing work:
1. Curbs, blocking, edge strips, nailers, cants, and other components to which insulation, roofing, and base flashing is attached in place ready to receive insulation and roofing.
2. Coordinate roofing membrane installation with flashing work and roof insulation work so insulation and flashing are installed concurrently to permit continuous roofing operations.
3. Complete installation of flashing, insulation, and roofing in same day except for the area where temporary protection is required when work is stopped for inclement weather or end of work day.

B. Dry out surfaces including roof deck flutes, that become wet from any cause during progress of the work before roofing work is resumed. Apply materials to dry substrates, only.

C. Broom clean roof decks. Remove dust, dirt and debris.

D. Remove projections capable of damaging roofing materials.

E. Concrete Decks, except Insulating Concrete:
1. Test concrete decks for moisture according to ASTM D4263 before installing roofing materials.
2. Prime concrete decks. Keep primer back 100 mm (4 inches) from precast concrete deck joints.
3. Allow primer to dry before application of bitumen.

3.3 TEMPORARY PROTECTION

A. Install temporary protection consisting of a temporary seal and water cut-offs at the end of each day's work and when work is halted for an indefinite period or work is stopped when precipitation is imminent.

B. Install temporary cap flashing over top of base flashings where permanent flashings are not in place to protect against water intrusion into roofing system. Securely anchor in place to prevent blow off and damage by construction activities.

C. Temporarily seal exposed insulation surfaces within roofing membrane.
   1. Apply temporary seal and water cut off by extending roofing membrane beyond insulation and securely embedding edge of the roofing membrane in 6 mm (1/4 inch) thick by 50 mm (2 inches) wide strip of temporary closure sealant. Weight roofing membrane edge with sandbags, to prevent displacement; space sandbags maximum 2400 mm (8 feet) on center.
   2. Direct water away from work. Provide drainage, preventing water accumulation.
   3. Check daily to ensure temporary seal remains watertight. Reseal open areas and weight down.

D. Before the work resumes, cut off and discard portions of roof membrane in contact with temporary seal.
   1. Cut minimum 150 mm (6 inches) back from sealed edges and surfaces.

E. Remove sandbags and store for reuse.

3.4 INSTALLATION - GENERAL

A. Install products according to manufacturer's instructions and approved submittal drawings.
   1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

B. Comply with NRCA Manual installation requirements.

C. Comply with UL 580 or UL 1897 for uplift resistance.

D. Do not allow membrane and flashing to contact surfaces contaminated with asphalt, coal tar, oil, grease, or other substances incompatible with TPO.

3.5 ROOFING INSTALLATION

A. Install the membrane so the sheets run perpendicular to the long dimension of the insulation boards.

B. Begin installation at the low point of the roof and work towards the high point. Lap membrane shingled in water flow direction.

C. Position the membrane free of buckles and wrinkles.

D. Roll membrane out; inspect for defects as membrane is unrolled. Remove defective areas:
   1. Lap edges and ends of sheets 50 mm (2 inches) or more as recommended by the manufacturer.
   2. Heat weld laps. Apply pressure as required. Seam strength of laps as required by ASTM D4434/D4434M.
   3. Check seams to ensure continuous adhesion and correct defects.
   4. Finish seam edges with beveled bead of lap sealant.
   5. Finish seams same day as membrane is installed.
   6. Anchor membrane perimeter to roof deck or parapet wall as indicated on drawings.
   7. Repair areas of welded seams where samples have been taken or marginal welds, bond voids, or skips occurs.
   8. Repair fishmouths and wrinkles by cutting to lay flat and installing patch over cut area extending 100 mm (4 inches) beyond cut.

E. Membrane Perimeter Anchorage:

1. Install batten at perimeter of each roof area, curb flashing, expansion joints and similar penetrations on top of roof membrane as indicated on drawings.
2. Mechanically Fastening:
   a. Space fasteners maximum 300 mm (12 inches) on center, starting 25 mm (1 inch) from ends.
   b. When battens are cut, round edges and corners before installing.
   c. After mechanically fastening strip cover and seal strip with a 150 mm (6 inch) wide roof membrane strip; heat weld to roof membrane and seal edges.
   d. At gravel stops or fascia-cants, turn roofing membrane down over front edge of the blocking, cant, or nailer. Secure roofing membrane to vertical portion of nailer; or, if required by the membrane manufacturer, with fasteners spaced maximum 150 mm (6 inches) on centers.
   e. At parapet walls intersecting building walls and curbs, secure roofing membrane to structural deck with fasteners 150 mm (6 inches) on centers or as shown in NRCA manual.

F. Adhered System:
1. Apply bonding adhesive in quantities required by roof membrane manufacturer.
2. Fold sheet back on itself, clean and coat the bottom side of the membrane and the top of substrate with adhesive. Do not coat the lap joint area.
3. After adhesive has set according to adhesive manufacturer's instruction, roll roofing membrane into adhesive minimizing voids and wrinkles.
4. Repeat for other half of sheet.

3.6 FLASHING INSTALLATION

A. Install flashings same day as roofing membrane is installed. When flashing cannot be completely installed in one day, complete installation until flashing is watertight and provide temporary covers or seals.

B. Flashing Roof Drains:
1. Install roof drain flashing as recommended by roofing membrane manufacturer.
   a. Coordinate to set the metal drain flashing in asphalt roof cement, holding cement back from the edge of the metal flange.
   b. Do not allow the roof cement to come in contact with TPO roofing membrane.
   c. Adhere roofing membrane to metal flashing with bonding adhesive.
2. Turn down the metal drain flashing and roofing membrane into drain body. Install clamping ring and strainer.

C. Installing Base Flashing and Pipe Flashing:
1. Install flashing sheet to pipes, wall or curbs to minimum200 mm (8 inches) above roof surfaces and extending roofing manufacturer's standard lap dimension onto roofing membranes.
   a. Adhere flashing with bonding adhesive.
   b. Form inside and outside corners of flashing sheet according to NRCA manual. Form pipe flashing according to NRCA manual.
   c. Lap ends roofing manufacturer's standard dimension.
   d. Heat weld flashing membranes together and flashing membranes to roofing membranes. Finish exposed edges with lap sealant.
   e. Install flashing membranes according to NRCA manual.
2. Anchor top of flashing to walls and curbs with fasteners spaced maximum150 mm (6 inches) on center. Use surface mounted fastening strip with sealant on ducts. Use pipe clamps on pipes or other round penetrations.
3. Apply sealant to top edge of flashing.

D. Installing Building Expansion Joints:
1. Install base flashing on curbs as specified.
2. Coordinate installation with roof expansion joint system.

3. Install flexible tubing 1-1/2 times the width of joint centered over joint. Cover tubing with flashing sheet adhered to base flashing and lapping base flashing roofing manufacturer's standard dimension. Finish edges of laps with sealant.

E. Repairs to Membrane and Flashings:
1. Remove sections of roofing membrane or flashing that are creased, wrinkled, or fish-mouthed.
2. Cover removed areas, cuts and damaged areas with a patch extending 100 mm (4 inches) beyond damaged, cut, or removed area. Heat weld to roofing membrane or flashing sheet. Finish edge of lap with lap sealant.

3.7 WALKWAY PAD INSTALLATION

A. Heat weld walkway sheet to roofing membrane at edges. Weld area 50 mm (2 inches) wide by the entire length of the walkway sheet.

B. Finish edges of laps with lap sealant.

3.8 FIELD QUALITY CONTROL

A. Field Tests: Performed by testing laboratory specified in Section 01 45 29, TESTING LABORATORY SERVICES.
1. Fastener Pull Out Tests: ANSI/SPRI FX-1; one test for every 230 square meter (2,500 square feet) of deck. Perform tests for each combination of fastener type and roof deck type before installing roof insulation.
   a. Test at locations selected by Contracting Officer's Representative.
   b. Do not proceed with roofing work when pull out resistance is less than manufacturer's required resistance.
   c. Test Results:
      1) Repeat tests using different fastener type or use additional fasteners achieve pull out resistance required to meet specified wind uplift performance.
      2) Patch cementitious deck to repair areas of fastener tests holes.
2. Examine and probe roofing membrane and flashing seams in presence of Contracting Officer's Representative and Manufacturer's field representative.
3. Probe seams to detect marginal bonds, voids, skips, and fishmouths.
4. Cut 100 mm (4 inch) wide by 300 mm (12 inch) long samples through seams where directed by Contracting Officer's Representative.
5. Cut one sample for every 450 m (1500 feet) of seams.
6. Cut samples perpendicular to seams.
7. Failure of samples to pass ASTM D1876 test will be cause for rejection of work.
8. Repair areas where samples are taken and where marginal bond, voids, and skips occur.
9. Repair fishmouths and wrinkles by cutting to lay flat. Install patch over cut area extending 100 mm (4 inches) beyond cut.

B. Manufacturer Services:
1. Inspect initial installation, installation in progress, and completed work.
2. Issue supplemental installation instructions necessitated by field conditions.
3. Prepare and submit inspection reports.
4. Certify completed installation complies with manufacturer's instructions and warranty requirements.

3.9 CLEANING

A. Remove excess adhesive before adhesive sets.

B. Clean exposed roofing surfaces. Remove contaminants and stains to comply with specified solar reflectance performance.

3.10 PROTECTION

A. Protect roofing system from traffic and construction operations.

1. Protect roofing system when used for subsequent work platform, materials storage, or staging.
2. Distribute scaffolding loads to exert maximum 50 percent roofing system materials compressive strength.

B. Loose lay temporary insulation board overlaid with plywood or OSB.
   1. Weight boards to secure against wind uplift.

C. Remove protective materials immediately before acceptance.

D. Repair damage.

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SECTION 07 81 00

APPLIED FIREPROOFING

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies spray-applied mineral fiber and cementitious coverings to provide fire resistance to interior structural steel members shown.

1.2 RELATED WORK:

A. Sustainable Design Requirements: Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

1.3 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Sustainable Design Submittals, as described below:
   1. Volatile organic compounds per volume as specified in PART 2 - PRODUCTS.

C. Installer qualifications.

D. Testing laboratory accreditations.

E. Manufacturer's Literature and Data:
   1. Manufacturer's complete and detailed application instructions and specifications.
   2. Manufacturer's repair and patching instructions.

F. Certificates:
   1. Certificate from testing laboratory attesting fireproofing material and application method meet the specified fire ratings.
      a. List thickness and density of material required to meet fire ratings.
      b. Accompanied by complete test report and test record.
   2. Manufacturer's certificate indicating sprayed-on fireproofing material supplied under the Contract is same within manufacturing tolerance as fireproofing material tested.

G. Miscellaneous:
   1. Manufacturer's written approval of surfaces to receive sprayed-on fireproofing.
   2. Manufacturer's written approval of completed installation.
   3. Manufacturer's written approval of the applicators of fireproofing material.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Deliver to job-site in sealed containers marked and labeled to show manufacturer's name and brand and UL certification markings of compliance with the specified requirements.

B. Remove damaged or opened containers from the site.

C. Store the materials off the ground, under cover, away from damp surfaces.

D. Keep dry until ready for use.

E. Remove materials that have been exposed to water before installation from the site.

1.5 FIELD CONDITIONS:

A. Temperature: Do not apply fireproofing when substrate or ambient temperature is below 4 degrees C (40 degrees F) unless temporary protection and heat are provided to maintain temperature at or above stated value during application and for 24 hours before and after application.

B. Humidity: Maintain relative humidity levels within limits recommended by fireproofing manufacturer.

C. Ventilation: Provide ventilation to properly dry the fireproofing after application. Provide a minimum of four (4) air exchanges per hour by forced air circulation. When permitted by Contracting Officer Representative (COR), ventilate by natural circulation.

1.6 QUALITY ASSURANCE:

A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements. Submit manufacturer's certification that each installer is trained and qualified to install the specified fireproofing. Submit evidence that each installer has a minimum of three (3) years' experience and a minimum of four (4) installations using the specified fireproofing.

B. Testing Laboratory Accreditation Requirements: Construction materials testing laboratories must be accredited by a laboratory accreditation authority. Submit a copy of the Certificate of Accreditation and Scope of Accreditation.

C. Test for fire endurance in accordance with ASTM E119, for fire rating specified, in a nationally recognized laboratory.

D. Manufacturer's inspection and approval of surfaces to receive fireproofing.

E. Manufacturer's approval of fireproofing applications.

F. Manufacturer's approval of completed installation.

G. Manufacturer's representative is to observe and advise at the commencement of application, and is required to visit the site as required thereafter for the purpose of ascertaining proper application.

H. Pre-Application Test Area.
   1. Apply a test area consisting of a typical overhead fireproofing installation, including not less than 4.5 m (15 feet) of beam and deck.
      a. Apply to one (1) column.
      b. Apply for the hourly ratings required in the construction documents.
   2. Install in location selected by the COR, for approval by the representative of the fireproofing material manufacturer and the COR.
   3. Perform Bond test for cohesive and adhesive strength in accordance with ASTM E736 for each applied fireproofing design used.
   4. Perform density test in accordance with ASTM E736 for each applied fireproofing design used.
   5. Do not proceed in other areas until installation of test area has been completed and approved.
   6. Keep approved installation area open for observation as criteria for sprayed-on fireproofing.

1.7 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. ASTM International (ASTM):

C841-03(R2013) ..... Installation of Interior Lathing and Furring

C847-14..... Metal Lath

E84-14..... Surface Burning Characteristics of Building Materials

E119-12a..... Fire Tests of Building Construction and Materials

E605-93(R2011).....Thickness and Density of Sprayed Fire-Resistive Materials Applied to Structural Members

E736-00(R2011).....Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members

E759-92(R2011).....The Effect of Deflection on Sprayed Fire-Resistive Material Applied to Structural Members

E760-92(R2011).....Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members

E761-92(R2011).....Compressive Strength of Fire-Resistive Material Applied to Structural Members

E859-93(R2011).....Air Erosion of Sprayed Fire-Resistive Materials Applied to Structural Members

E937-93(R2011).....Corrosion of Steel by Sprayed Fire-Resistive Material Applied to Structural Members

E1042-02(R2014).....Acoustically, Absorptive Materials Applied by Trowel or Spray.

G21-13 .....Determining Resistance of Synthetic Polymeric Materials to Fungi

C. Underwriters Laboratories, Inc. (UL):
Fire Resistance Directory...Latest Edition including Supplements

D. Warnock Hersey (WH):
Certification Listings .....Latest Edition

E. Factory Mutual System (FM):
Approval Guide.....Latest Edition including Supplements

F. Environmental Protection Agency (EPA):
40 CFR 59(2014) .....National Volatile Organic Compound Emission Standards for Consumer and Commercial Products

PART 2 - PRODUCTS

2.1 SPRAYED-ON FIREPROOFING:

A. ASTM E1042, Class (a), Category A.
1. Factory mixed cementitious materials with approved aggregate.
.

B. Materials containing asbestos are not permitted.

C. Fireproofing characteristics when applied in the thickness and density required to achieve the fire-rating specified.

	Characteristic	Test	Results
1.	Deflection	ASTM E759	No cracking, spalling, or delamination when backing to which it is applied has a deflection up to 1/120 in 3 m (10 ft.)
2.	Corrosion-Resistance	ASTM E937	No promotion of corrosion of steel.
3.	Bond Impact	ASTM E760	No cracking, spalling, or delamination.
4.	Cohesion/Adhesion (Bond Strength)	ASTM E736	Minimum cohesive/adhesive strength of 9.57 kPa (200 lbf per sq. ft.) for protected areas. 19.15 kPa (400 lbf per sq. ft.) for exposed

	Characteristic	Test	Results
			areas.
5.	Air Erosion	ASTM E859	Maximum gain weight of the collecting filter 0.27 gm per sq. meter (0.025 gm per sq. ft.).
6.	Compressive Strength	ASTM E761	Minimum compressive strength 48 kPa (1000 psf).
7.	Surface Burning Characteristics with adhesive and sealer to be used	ASTM E84	Flame spread 25 or less smoke developed 50 or less
8.	Fungi Resistance	ASTM G21	Resistance to mold growth when inoculated with aspergillus niger (28 days for general application)

2.2 ADHESIVE:

A. Adhesive may be an integral part of the material or applied separately to surface receiving fireproofing material.

2.3 SEALER:

A. Surface burning characteristics as specified for fireproofing material.

B. Fungus resistant.

C. Sealer may be an integral part of the material or applied separately to the exposed surface. When applied separately use contrasting color pigmented sealer, white preferred.

D. VOC content: Product to comply with VOC content limits of authorities having jurisdiction and the following VOC limits when calculated according to 40 CFR 59, (EPA Method 24):
   1. Flat Paints and Coatings: 50 g/L.
   2. Nonflat Paints and Coatings: 150 g/L.
   3. Primers, Sealers, and Undercoaters: 200 g/L.

2.4 WATER:

A. Clean, fresh, and free from organic and mineral impurities.

B. pH of 6.9 to 7.1.

2.5 MECHANICAL BOND MATERIAL:

A. Expanded Metal Lath: ASTM C847, minimum weight of 0.92 kg per square meter (1.7 pounds per square yard) or as required, according to fire-resistance designs indicated and fire proofing manufacturer's written instructions.

   Fasteners: ASTM C841.

B. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by fireproofing manufacturer.

C. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by fireproofing manufacturer. Include pins and attachments.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Verify surfaces to receive fireproofing are clean and free of dust, soot, oil, grease, water soluble materials or any foreign substance which would prevent adhesion of the fireproofing material.

B. Verify hangers, inserts and clips are installed before the application of fireproofing material.

C. Verify ductwork, piping, and other obstructing material and equipment is not installed that will interfere with fireproofing installation.

D. Verify concrete work on steel decking and concrete encased steel is completed.

E. When applied in conjunction with roof structures or roof decks, verify that roofing, installation of rooftop HVAC equipment, and other related work are complete.

F. Verify temperature and enclosure conditions required by fire-proofing material manufacturer.

G. Conduct tests according to fireproofing manufacturer's written instructions to verify that substrates are free of substances capable of interfering with bond. Submit test report.

3.2 APPLICATION:

A. Do not start application until written approval has been obtained from manufacturer of fireproofing materials that surfaces have been inspected by the manufacturer or his representative, and are suitable to receive sprayed-on fireproofing.

B. Coordinate application of fireproofing material with other trades.

C. Cover other work and exterior openings subject to damage from fallout or overspray of fireproofing materials during application.

D. Application of Metal Lath:
   1. Apply to beam and columns having painted surfaces which fail ASTM E736 Bond Test requirements in pre-application test area.
   2. Apply to beam flanges 305 mm (12-inches) or more in width.
   3. Apply to column flanges 406 mm (16-inches) or more in width.
   4. Apply to beam or column web 406 mm (16-inches) or more in depth.
   5. Tack weld or mechanically fasten on maximum of 305 mm (12-inch) center.
   6. Lap and tie lath member in accordance with ASTM C841.

E. Mix and apply in accordance with manufacturer's instructions.
   1. Mechanically control material and water ratios.
   2. Apply adhesive and sealer, when not an integral part of the materials, in accordance with the manufacturer's instructions.
   3. Apply to density and thickness indicated in UL Fire Resistance Directory, FM Approval Guide, or WH Certification Listings unless specified otherwise. Test in accordance with ASTM E119.
   4. Minimum ASTM E605 applied dry density per cubic meter (cubic foot) for the underside of the walk on deck (interstitial) hung purlin or beam and steel deck, columns in interstitial spaces and mechanical equipment rooms to be as follows:
      a. Type I - 350 kg per cubic meter (22 lb. per cubic ft.).

F. Complete application is to be completed in one area. Inspection and approval by COR is required before removal of application equipment and proceeding with further work.

3.3 FIELD TESTS:

A. The applied fireproofing to be tested by a COR approved independent testing laboratory and paid for by the Contractor. Submit test reports documenting results of tests on the applied material in the project.

B. COR will select area to be tested in specific bays on each floor using a geometric grid pattern. Apply test sample every 929 square meters (10,000 square feet) of floor area or two (2) for each floor, whichever produces the greatest number of test areas.

C. Test for thickness and density in accordance with ASTM E605. Areas showing thickness less than that required as a result of fire endurance test are not acceptable.

D. Areas showing less than required fireproofing characteristics are not suitable for the following field tests.
   1. Test for cohesion/adhesion: ASTM E736.
   2. Test for bond impact strength: ASTM E760.

3.4 PATCHING AND REPAIRING:

A. Inspect after mechanical, electrical and other trades have completed work in contact with fireproofing material, but before sprayed material is covered by subsequent construction.

B. Perform corrective measures in accordance with fireproofing material manufacturer's recommendations.
   1. Respray areas requiring additional fireproofing material to provide the required thickness, and replace dislodged or removed material.
   2. Spray material for patching by machine directly on point to be patched, or into a container and then hand apply.
   3. Do not hand mix material.

C. Repair:
   1. Respray test and rejected areas.
   2. Patch fireproofing material which is removed or disturbed after approval.

D. Perform final inspection of sprayed areas after patching and repair.

3.5 SCHEDULE:

A. Apply fireproofing material to new interior structural steel members supporting new Equipment in the attic, except on following surfaces:
   1. Existing steel to remain in exiting condition.
   2. Structural steel and underside of steel decks in elevator or dumbwaiter machine rooms.
   3. Steel members in elevator hoist ways.
   4. Areas used as air handling plenums.
   5. Steel to be encased in concrete or designated to receive other type of fireproofing.

Fire Rating Schedule			
Type	Element	Hourly Rating	UL Design Reference
II	Columns supporting more than one floor	2	X701
II	Columns supporting roof	1	X701
II	Floor decks	2	N735
II	Floor supports Floor Decks @ existing Pan Joists	2 2	N735 J701
II	Roof decks	1	N735 S740
II	Roof supports	1	N735 S740

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SECTION 07 84 00

FIRESTOPPING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide UL or equivalent approved firestopping system for the closures of openings in walls, floors, and roof decks against penetration of flame, heat, and smoke or gases in fire resistant rated construction.

B. Provide UL or equivalent approved firestopping system for the closure of openings in walls against penetration of gases or smoke in smoke partitions.

1.2 RELATED WORK

A. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS: Sustainable Design Requirements.

B. Section 07 81 00, APPLIED FIREPROOFING: Spray applied fireproofing.

C. Section 07 92 00, JOINT SEALANTS: Sealants and application.

D. Section 23 31 00, HVAC DUCTS AND CASINGS: Fire and smoke damper assemblies in ductwork.

E. Section 23 37 00, AIR OUTLETS AND INLETS: Fire and smoke damper assemblies in ductwork.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Sustainable Design Submittals, as described below:
   1. Volatile organic compounds per volume as specified in PART 2 - PRODUCTS.

C. Installer qualifications.

D. Inspector qualifications.

E. Manufacturers literature, data, and installation instructions for types of firestopping and smoke stopping used.

F. List of FM, UL, or WH classification number of systems installed.

G. Certified laboratory test reports for ASTM E814 tests for systems not listed by FM, UL, or WH proposed for use.

H. Submit certificates from manufacturer attesting that firestopping materials comply with the specified requirements.

1.4 DELIVERY AND STORAGE

A. Deliver materials in their original unopened containers with manufacturer’s name and product identification.

B. Store in a location providing protection from damage and exposure to the elements.

1.5 QUALITY ASSURANCE

A. FM, UL, or WH or other approved laboratory tested products will be acceptable.

B. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991 or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements." Submit qualification data.

C. Inspector Qualifications: Contractor to engage a qualified inspector to perform inspections and final reports. The inspector to meet the criteria contained in ASTM E699 for agencies involved in quality assurance and to have a minimum of two years' experience in construction field inspections of firestopping systems, products, and assemblies. The inspector to be completely independent of, and divested from, the Contractor, the installer, the manufacturer, and the supplier of material or item being inspected. Submit inspector qualifications.

1.6 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. ASTM International (ASTM):
E84-20 ..... Surface Burning Characteristics of Building Materials
E699-16 ..... Standard Specification for Agencies Involved in Testing, Quality Assurance, and Evaluating of Manufactured Building Components
E814-13a(2017) ..... Fire Tests of Penetration Firestop Systems
E2174-20a ..... Standard Practice for On-Site Inspection of Installed Firestop Systems
E2393-20 ..... Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers

C. FM Global (FM):
1. Annual Issue Approval Guide Building Materials
4991-13 ..... Approval of Firestop Contractors

D. Underwriters Laboratories, Inc. (UL):
1. Annual Issue Building Materials Directory
2. Annual Issue Fire Resistance Directory
723-Edition 11(2018)..... Standard for Test for Surface Burning Characteristics of Building Materials
1479-04(2015)..... Fire Tests of Penetration Firestops

E. Intertek Testing Services - Warnock Hersey (ITS-WH):
1. Annual Issue Certification Listings

F. Environmental Protection Agency (EPA):
40 CFR 59(2014) ..... National Volatile Organic Compound Emission Standards for Consumer and Commercial Products

PART 2 - PRODUCTS

2.1 FIRESTOP SYSTEMS

A. Provide either factory built (Firestop Devices) or field erected (through-Penetration Firestop Systems) to form a specific building system maintaining required integrity of the fire barrier and stop the passage of gases or smoke. Firestop systems to accommodate building movements without impairing their integrity.

B. Through-penetration firestop systems and firestop devices tested in accordance with ASTM E814 or UL 1479 using the "F" or "T" rating to maintain the same rating and integrity as the fire barrier being sealed. "T" ratings are not required for penetrations smaller than or equal to 101

mm (4 inches) nominal pipe or 0.01 square meter (16 square inches) in overall cross sectional area.

C. Firestop sealants used for firestopping or smoke sealing to have the following properties:
   1. Contain no flammable or toxic solvents.
   2. Release no dangerous or flammable out gassing during the drying or curing of products.
   3. Water-resistant after drying or curing and unaffected by high humidity, condensation or transient water exposure.
   4. When installed in exposed areas, capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.
   5. VOC Content: Firestopping sealants and sealant primers to comply with the following limits for VOC content when calculated according to 40 CFR 59, (EPA Method 24):
      a. Sealants: 250 g/L.
      b. Sealant Primers for Nonporous Substrates: 250 g/L.
      c. Sealant Primers for Porous Substrates: 775 g/L.

D. Firestopping system or devices used for penetrations by glass pipe, plastic pipe or conduits, unenclosed cables, or other non-metallic materials to have following properties:
   1. Classified for use with the particular type of penetrating material used.
   2. Penetrations containing loose electrical cables, computer data cables, and communications cables protected using firestopping systems that allow unrestricted cable changes without damage to the seal.

E. Maximum flame spread of 25 and smoke development of 50 when tested in accordance with ASTM E84 or UL 723. Material to be an approved firestopping material as listed in UL Fire Resistance Directory or by a nationally recognized testing laboratory.

F. FM, UL, or WH rated or tested by an approved laboratory in accordance with ASTM E814.

G. Materials to be nontoxic and noncarcinogen at all stages of application or during fire conditions and to not contain hazardous chemicals. Provide firestop material that is free from Ethylene Glycol, PCB, MEK, and asbestos.

H. For firestopping exposed to view, traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions.
   1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
   2. For floor penetrations with annular spaces exceeding 101 mm (4 inches) or more in width and exposed to possible loading and traffic, provide firestop systems capable of supporting the floor loads involved either by installing floor plates or by other means acceptable to the firestop manufacturer.
   3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

2.2 SMOKE STOPPING IN SMOKE PARTITIONS

A. Provide silicone sealant in smoke partitions as specified in Section 07 92 00, JOINT SEALANTS.

B. Provide mineral fiber filler and bond breaker behind sealant.

C. Sealants to have a maximum flame spread of 25 and smoke developed of 50 when tested in accordance with ASTM E84.

D. When used in exposed areas capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Submit product data and installation instructions, as required by article, submittals, after an on-site examination of areas to receive firestopping.

B. Examine substrates and conditions with installer present for compliance with requirements for opening configuration, penetrating items, substrates, and other conditions affecting performance of firestopping. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove dirt, grease, oil, laitance and form-release agents from concrete, loose materials, or other substances that prevent adherence and bonding or application of the firestopping or smoke stopping materials.

B. Remove insulation on insulated pipe for a distance of 150 mm (6 inches) on each side of the fire rated assembly prior to applying the firestopping materials unless the firestopping materials are tested and approved for use on insulated pipes.

C. Prime substrates where required by joint firestopping system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

D. Masking Tape: Apply masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials. Remove tape as soon as it is possible to do so without disturbing seal of firestopping with substrates.

3.3 INSTALLATION

A. Do not begin firestopping work until the specified material data and installation instructions of the proposed firestopping systems have been submitted and approved.

B. Install firestopping systems with smoke stopping in accordance with FM, UL, WH, or other approved system details and installation instructions.

C. Install smoke stopping seals in smoke partitions.

3.4 CLEAN-UP

A. As work on each floor is completed, remove materials, litter, and debris.

B. Clean up spills of liquid type materials.

C. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping products and of products in which opening and joints occur.

D. Protect firestopping during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping immediately and install new materials to provide firestopping complying with specified requirements.

3.5 INSPECTIONS AND ACCEPTANCE OF WORK

A. Do not conceal or enclose firestop assemblies until inspection is complete and approved by the Contracting Officer Representative (COR).

B. Furnish service of approved inspector to inspect firestopping in accordance with ASTM E2393 and ASTM E2174 for firestop inspection, and document inspection results. Submit written

reports indicating locations of and types of penetrations and type of firestopping used at each location; type is to be recorded by UL listed printed numbers.

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SECTION 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section covers interior and exterior sealant and their application, wherever required for complete installation of building materials or systems.

1.2 RELATED WORK (INCLUDING BUT NOT LIMITED TO THE FOLLOWING):

A. Sustainable Design Requirements: Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

B. Sealing of Site Work Concrete Paving: Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS.

C. Firestopping Penetrations: Section 07 84 00, FIRESTOPPING.

D. Glazing: Section 08 80 00, GLAZING.

E. Sound Rated Gypsum Partitions/Sound Sealants: Section 09 29 00, GYPSUM BOARD.

F. Mechanical Work: Section 21 13 13, WET-PIPE SPRINKLER SYSTEMS Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

1.3 QUALITY ASSURANCE:

A. Installer Qualifications: An experienced installer with a minimum of three (3) years' experience and who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance. Submit qualification.

B. Source Limitations: Obtain each type of joint sealant through one (1) source from a single manufacturer.

C. Product Testing: Obtain test results from a qualified testing agency based on testing current sealant formulations within a 12-month period.
   1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021.
   2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C920, and where applicable, to other standard test methods.
   3. Test elastomeric joint sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C920 for adhesion and cohesion under cyclic movement, adhesion-in peel, and indentation hardness.
   4. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.

D. Lab Tests: Submit samples of materials that will be in contact or affect joint sealants to joint sealant manufacturers for tests as follows:
   1. Adhesion Testing: Before installing elastomeric sealants, test their adhesion to protect joint substrates according to the method in ASTM C794 to determine if primer or other specific joint preparation techniques are required.
   2. Compatibility Testing: Before installing elastomeric sealants, determine compatibility when in contact with glazing and gasket materials.
   3. Stain Testing: Perform testing per ASTM C1248 on interior and exterior sealants to determine if sealants or primers will stain adjacent surfaces. No sealant work is to start until results of these tests have been submitted to the Contracting Officer Representative (COR) and the COR has given written approval to proceed with the work.

E. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to joint substrates according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
   1. Locate test joints where indicated in construction documents or, if not indicated, as directed by COR.
   2. Conduct field tests for each application indicated below:
      a. Each type of elastomeric sealant and joint substrate indicated.
      b. Each type of non-elastomeric sealant and joint substrate indicated.
   3. Notify COR seven (7) days in advance of dates and times when test joints will be erected.
   4. Arrange for tests to take place with joint sealant manufacturer's technical representative present.

1.4 CERTIFICATION:

A. Contractor is to submit to the COR written certification that joints are of the proper size and design, that the materials supplied are compatible with adjacent materials and backing, that the materials will properly perform to provide permanent watertight, airtight or vapor tight seals (as applicable), and that materials supplied meet specified performance requirements.

1.5 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Sustainable Design Submittals, as described below:
   1. Volatile organic compounds per volume as specified in PART 2 - PRODUCTS.

C. C. Installer qualifications.

D. Contractor certification.

E. Manufacturer's installation instructions for each product used.

F. Cured samples of exposed sealants for each color.

G. Manufacturer's Literature and Data:
   1. Primers
   2. Sealing compound, each type, including compatibility when different sealants are in contact with each other.

H. Manufacturer warranty.

1.6 PROJECT CONDITIONS:

A. Environmental Limitations:
   1. Do not proceed with installation of joint sealants under following conditions:
      a. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 degrees C (40 degrees F).
      b. When joint substrates are wet.

B. Joint-Width Conditions:
   1. Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

C. Joint-Substrate Conditions:
   1. Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.7 DELIVERY, HANDLING, AND STORAGE:

A. Deliver materials in manufacturers' original unopened containers, with brand names, date of manufacture, shelf life, and material designation clearly marked thereon.

B. Carefully handle and store to prevent inclusion of foreign materials.

C. Do not subject to sustained temperatures exceeding 32 degrees C (90 degrees F) or less than 5 degrees C (40 degrees F).

1.8 DEFINITIONS:

A. Definitions of terms in accordance with ASTM C717 and as specified.

B. Backing Rod: A type of sealant backing.

C. Bond Breakers: A type of sealant backing.

D. Filler: A sealant backing used behind a back-up rod.

1.9 WARRANTY:

A. Construction Warranty: Comply with FAR clause 52.246-21 "Warranty of Construction".

B. Manufacturer Warranty: Manufacturer shall warranty their sealant for a minimum of five (5) years from the date of installation and final acceptance by the Government. Submit manufacturer warranty.

1.10 APPLICABLE PUBLICATIONS:

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

B. ASTM International (ASTM):

C509-06.....Elastomeric Cellular Preformed Gasket and Sealing Material

C612-14.....Mineral Fiber Block and Board Thermal Insulation

C717-14a.....Standard Terminology of Building Seals and Sealants

C734-06(R2012) .....Test Method for Low-Temperature Flexibility of Latex Sealants after Artificial Weathering

C794-10.....Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants

C919-12.....Use of Sealants in Acoustical Applications.

C920-14a.....Elastomeric Joint Sealants.

C1021-08(R2014) .....Laboratories Engaged in Testing of Building Sealants

C1193-13.....Standard Guide for Use of Joint Sealants.

C1248-08(R2012) .....Test Method for Staining of Porous Substrate by Joint Sealants

C1330-02(R2013) .....Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants

C1521-13.....Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints

D217-10.....Test Methods for Cone Penetration of Lubricating Grease

D1056-14.....Specification for Flexible Cellular Materials—Sponge or Expanded Rubber

E84-09.....Surface Burning Characteristics of Building Materials

C. Sealant, Waterproofing and Restoration Institute (SWRI).

D. The Professionals' Guide

E. Environmental Protection Agency (EPA):

40 CFR 59(2014) .....National Volatile Organic Compound Emission Standards for Consumer and Commercial Products

PART 2 - PRODUCTS

2.1 SEALANTS:

A. Exterior Sealants:
   1. Vertical surfaces, provide non-staining ASTM C920, Type S or M, Grade NS, Class 25, Use NT.
   2. Horizontal surfaces, provide ASTM C920, Type S or M, Grade P, Class 25, Use T.
   3. Provide location(s) of exterior sealant as follows:
      a. Joints formed where frames and subsills of windows, doors, louvers, and vents adjoin masonry, concrete, or metal frames. Provide sealant at exterior surfaces of exterior wall penetrations.
      b. Metal to metal.
      c. Masonry to masonry or stone.
      d. Stone to stone.
      e. Cast stone to cast stone.
      f. Masonry expansion and control joints.
      g. Wood to masonry.
      h. Masonry joints where shelf angles occur.
      i. Voids where items penetrate exterior walls.
      j. Metal reglets, where flashing is inserted into masonry joints, and where flashing is penetrated by coping dowels.

B. B. Floor Joint Sealant:
   1. ASTM C920, Type S or M, Grade P, Class 25, Use T.
   2. Provide location(s) of floor joint sealant as follows.
      a. Seats of metal thresholds exterior doors.
      b. Control and expansion joints in floors, slabs, ceramic tile, and walkways.

C. Interior Sealants:
   1. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system are to comply with the following limits for VOC content when calculated according to 40 CFR 59, (EPA Method 24):
      a. Architectural Sealants: 250 g/L.
      b. Sealant Primers for Nonporous Substrates: 250 g/L.
      c. Sealant Primers for Porous Substrates: 775 g/L.
   2. Vertical and Horizontal Surfaces: ASTM C920, Type S or M, Grade NS, Class 25, Use NT.
   3. Food Service: Use a Vinyl Acetate Homopolymer, or other low VOC, non-toxic sealant approved for use in food preparation areas.
   4. 4. Provide location(s) of interior sealant as follows:
      a. Typical narrow joint 6 mm, (1/4 inch) or less at walls and adjacent components.
      b. Perimeter of doors, windows, access panels which adjoin concrete or masonry surfaces.
      c. Interior surfaces of exterior wall penetrations.
      d. Joints at masonry walls and columns, piers, concrete walls or exterior walls.
      e. Perimeter of lead faced control windows and plaster or gypsum wallboard walls.
      f. Exposed isolation joints at top of full height walls.
      g. Joints between shower receptors and ceramic tile; joints formed where nonplanar tile surfaces meet.
      h. Joints formed between tile floors and tile base cove; joints between tile and dissimilar materials; joints occurring where substrates change.
      i. Behind escutcheon plates at valve pipe penetrations and showerheads in showers.

D. Acoustical Sealant:
   1. Conforming to ASTM C919; flame spread of 25 or less; and a smoke developed rating of 50 or less when tested in accordance with ASTM E84. Acoustical sealant have a consistency of 250 to 310 when tested in accordance with ASTM D217; remain flexible

and adhesive after 500 hours of accelerated weathering as specified in ASTM C734; and be non-staining.

2. Provide location(s) of acoustical sealant as follows:
   a. Exposed acoustical joint at sound rated partitions.
   b. Concealed acoustic joints at sound rated partitions.
   c. Joints where item pass-through sound rated partitions.

2.2 COLOR:

A. Sealants used with exposed masonry are to match color of mortar joints.

B. Sealants used with unpainted concrete are to match color of adjacent concrete.

C. Color of sealants for other locations to be light gray or aluminum, unless otherwise indicated in construction documents.

2.3 JOINT SEALANT BACKING:

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
   1. Type C: Closed-cell material with a surface skin.

C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056 or synthetic rubber (ASTM C509), nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 32 degrees C (minus 26 degrees F). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.

D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.4 WEEPS:

A. Weep/Vent Products: Provide the following unless otherwise indicated or approved.
   1. Round Plastic Tubing: Medium-density polyethylene, 10 mm (3/8-inch) OD by thickness of stone or masonry veneer.

2.5 FILLER:

A. Mineral fiberboard: ASTM C612, Class 1.

B. Thickness same as joint width.

C. Depth to fill void completely behind back-up rod.

2.6 PRIMER:

A. As recommended by manufacturer of caulking or sealant material.

B. Stain free type.

2.7 CLEANERS-NON POROUS SURFACES:

A. Chemical cleaners compatible with sealant and acceptable to manufacturer of sealants and sealant backing material. Cleaners to be free of oily residues and other substances capable of staining or harming joint substrates and adjacent non-porous surfaces and formulated to promote adhesion of sealant and substrates.

PART 3 - EXECUTION

3.1 INSPECTION:

A. Inspect substrate surface for bond breaker contamination and unsound materials at adherent faces of sealant.

B. Coordinate for repair and resolution of unsound substrate materials.

C. Inspect for uniform joint widths and that dimensions are within tolerance established by sealant manufacturer.

3.2 PREPARATIONS:

A. Prepare joints in accordance with manufacturer's instructions and SWRI (The Professionals' Guide).

B. Clean surfaces of joint to receive caulking or sealants leaving joint dry to the touch, free from frost, moisture, grease, oil, wax, lacquer paint, or other foreign matter that would tend to destroy or impair adhesion.
   1. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants.
   2. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include but are not limited to the following:
      a. Concrete.
      b. Masonry.
      c. Unglazed surfaces of ceramic tile.
   3. Remove laitance and form-release agents from concrete.
   4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous surfaces include but are not limited to the following:
      a. Metal.
      b. Glass.
      c. Porcelain enamel.
      d. Glazed surfaces of ceramic tile.

C. Do not cut or damage joint edges.

D. Apply non-staining masking tape to face of surfaces adjacent to joints before applying primers, caulking, or sealing compounds.
   1. Do not leave gaps between ends of sealant backings.
   2. Do not stretch, twist, puncture, or tear sealant backings.
   3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

E. Apply primer to sides of joints wherever required by compound manufacturer's printed instructions or as indicated by pre-construction joint sealant substrate test.
   1. Apply primer prior to installation of back-up rod or bond breaker tape.
   2. Use brush or other approved means that will reach all parts of joints. Avoid application to or spillage onto adjacent substrate surfaces.

3.3 BACKING INSTALLATION:

A. Install backing material, to form joints enclosed on three sides as required for specified depth of sealant.

B. Where deep joints occur, install filler to fill space behind the backing rod and position the rod at proper depth.

C. Cut fillers installed by others to proper depth for installation of backing rod and sealants.

D. Install backing rod, without puncturing the material, to a uniform depth, within plus or minus 3 mm (1/8 inch) for sealant depths specified.

E. Where space for backing rod does not exist, install bond breaker tape strip at bottom (or back) of joint so sealant bonds only to two opposing surfaces.

3.4 SEALANT DEPTHS AND GEOMETRY:

A. At widths up to 6 mm (1/4 inch), sealant depth equal to width.

B. At widths over 6 mm (1/4 inch), sealant depth 1/2 of width up to 13 mm (1/2 inch) maximum depth at center of joint with sealant thickness at center of joint approximately 1/2 of depth at adhesion surface.

3.5 INSTALLATION:

A. General:
1. Apply sealants and caulking only when ambient temperature is between 5 degrees C and 38 degrees C (40 degrees and 100 degrees F).
2. Do not install polysulfide base sealants where sealant may be exposed to fumes from bituminous materials, or where water vapor in continuous contact with cementitious materials may be present.
3. Do not install sealant type listed by manufacture as not suitable for use in locations specified.
4. Apply caulking and sealing compound in accordance with manufacturer's printed instructions.
5. Avoid dropping or smearing compound on adjacent surfaces.
6. Fill joints solidly with compound and finish compound smooth.
7. Tool exposed joints to form smooth and uniform beds, with slightly concave surface conforming to joint configuration per Figure 5A in ASTM C1193 unless shown or specified otherwise in construction documents. Remove masking tape immediately after tooling of sealant and before sealant face starts to “skin” over. Remove any excess sealant from adjacent surfaces of joint, leaving the working in a clean finished condition.
8. Finish paving or floor joints flush unless joint is otherwise detailed.
9. Apply compounds with nozzle size to fit joint width.
10. Test sealants for compatibility with each other and substrate. Use only compatible sealant. Submit test reports.
11. Replace sealant which is damaged during construction process.

B. Weeps: Place weep holes and vents in joints where moisture may accumulate, including at base of cavity walls, above shelf angles, at all flashing, and as indicated on construction documents.
1. Use round plastic tubing to form weep holes.
2. Space weep holes formed from plastic tubing not more than 406 mm (16 inches) o.c.
3. Trim tubing material used in weep holes flush with exterior wall face after sealant has set.

C. For application of sealants, follow requirements of ASTM C1193 unless specified otherwise. Take all necessary steps to prevent three-sided adhesion of sealants.

D. Interior Sealants: Where gypsum board partitions are of sound rated, fire rated, or smoke barrier construction, follow requirements of ASTM C919 only to seal all cut-outs and intersections with the adjoining construction unless specified otherwise.
1. Apply a 6 mm (1/4 inch) minimum bead of sealant each side of runners (tracks), including those used at partition intersections with dissimilar wall construction.
2. Coordinate with application of gypsum board to install sealant immediately prior to application of gypsum board.
3. Partition intersections: Seal edges of face layer of gypsum board abutting intersecting partitions, before taping and finishing or application of veneer plaster-joint reinforcing.

4. Openings: Apply a 6 mm (1/4 inch) bead of sealant around all cutouts to seal openings of electrical boxes, ducts, pipes and similar penetrations. To seal electrical boxes, seal sides and backs.
5. Control Joints: Before control joints are installed, apply sealant in back of control joint to reduce flanking path for sound through control joint.

3.6 FIELD QUALITY CONTROL:

A. Field-Adhesion Testing: Field-test joint-sealant adhesion to joint substrates according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
   1. Extent of Testing: Test completed elastomeric sealant joints as follows:
      a. Perform 10 tests for first 305 m (1000 feet) of joint length for each type of elastomeric sealant and joint substrate.
      b. Perform one test for each 305 m (1000 feet) of joint length thereafter or one test per each floor per elevation.

B. Inspect tested joints and report on following:
   1. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate.
   2. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
   3. Whether sealants filled joint cavities and are free from voids.
   4. Whether sealant dimensions and configurations comply with specified requirements.

C. Record test results in a field adhesion test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.

D. Repair sealants pulled from test area by applying new sealants following same procedures used to originally seal joints. Ensure that original sealant surfaces are clean and new sealant contacts original sealant.

E. Evaluation of Field-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements, will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.7 CLEANING:

A. Fresh compound accidentally smeared on adjoining surfaces: Scrape off immediately and rub clean with a solvent as recommended by manufacturer of the adjacent material or if not otherwise indicated by the caulking or sealant manufacturer.

B. Leave adjacent surfaces in a clean and unstained condition.

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SECTION 08 11 13

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Hollow metal doors hung in hollow metal frames atinterior and exterior locations.
2. Hollow metal door frames for wood doors and borrowed lights at interior locations.
3. Glazed openings in hollow metal doors.

1.2 RELATED WORK

A. Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS: Aluminum frames entrance work.

B. Section 08 71 00, DOOR HARDWARE: Door Hardware:

C. Section 08 80 00, GLAZING: Glazing.

D. Card Readers and Biometric Devices: Section 28 13 00, PHYSICAL ACCESS CONTROL SYSTEM.

E. Security Monitors: Section 28 23 00, VIDEO SURVEILLANCE.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. American National Standard Institute (ANSI):
1. A250.8-2014 Standard Steel Doors and Frames

C. ASTM International (ASTM):
1. A240/A240M-15b Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
2. A653/A653M-15 Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip
3. A1008/A1008M-15 Steel, Sheet, Cold-Rolled, Carbon, Structural, High Strength Low Alloy and High Strength Low Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
4. B209-14 Aluminum and Aluminum-Alloy Sheet and Plate
5. B209M-14 Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
6. B221-14 Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
7. B221M-13 Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
8. D3656/D3656M-13 Insect Screening and Louver Cloth Woven from Vinyl Coated Glass Yarns
9. E90-09 Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

D. Federal Specifications (Fed. Spec.):
1. L-S-125B Screening, Insect, Nonmetallic

E. Master Painters Institute (MPI):
1. No. 18 Primer, Zinc Rich, Organic

F. National Association of Architectural Metal Manufacturers (NAAMM):
1. AMP 500-06 Metal Finishes Manual

G. National Fire Protection Association (NFPA):
   1. 80-16 Fire Doors and Other Opening Protectives

H. UL LLC (UL):
   1. 10C-09 Positive Pressure Fire Tests of Door Assemblies
   2. 1784-15 Air Leakage Tests of Door Assemblies and Other Opening Protectives

I. Department of Veterans Affairs
   1. VA Physical Security and Resiliency Design Manual January 1, 2021

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:
   1. Show size, configuration, and fabrication and installation details.

C. Manufacturer's Literature and Data:
   1. Description of each product.
   2. Include schedule showing each door and frame requirements fire label and smoke control label for openings.
   3. Installation instructions.

D. Sustainable Construction Submittals:
   1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.

E. Test reports: Certify each product complies with specifications.
   1. Sound rated door.

F. Qualifications: Substantiate qualifications comply with specifications.
   1. Manufacturer with project experience list.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Regularly manufactures specified products.
   2. Manufactured specified products with satisfactory service on five similar installations for minimum five years.
      a. Project Experience List: Provide contact names and addresses for completed projects.

1.6 DELIVERY

A. Fasten temporary steel spreaders across the bottom of each door frame before shipment.

B. Deliver products in manufacturer's original sealed packaging.

C. Mark packaging, legibly. Indicate manufacturer's name or brand, type, production run number, and manufacture date.

D. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

A. Store products indoors in dry, weathertight conditioned facility.

B. Protect products from damage during handling and construction operations.

1.8 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

A. Design hollow metal doors and frames complying with specified performance:
   1. Fire Doors and Frames: UL 10C; NFPA 80 labeled.
      a. Where continuous hinges are specified in section 08 71 00, provide one additional label on top of door panel and on head of frame.
      b. Fire Ratings: See drawings.
   2. Stair Doors: Temperature rise rated fire doors.
   3. Smoke Control Doors and Frames: UL 1784; NFPA 80 labeled, maximum 0.15424 cubic meter/second/square meter (3.0 cubic feet/minute/square foot) at 24.9 Pa (0.10 inches water gauge) pressure differential.
   4. Sound Rated Doors and Frames: Minimum 35 sound transmission class (STC) when tested according to ASTM E90.
   5. Thermal Transmittance: .37 U-value maximum at exterior doors .

2.2 MATERIALS

A. Stainless Steel: ASTM A240/A240M; Type 304 .

B. Sheet Steel: ASTM A1008/A1008M, cold-rolled.

C. Galvanized Sheet Steel: ASTM A653.

D. Insect Screening: ASTM D3656/D3656M, 18 by 18 aluminum wire mesh.

E. Aluminum Sheet: ASTM B209M (ASTM B209).

F. Aluminum Extrusions: ASTM B221M (ASTM B221).

2.3 PRODUCTS - GENERAL

A. Provide hollow metal doors and frames from one manufacturer.

B. Sustainable Construction Requirements:
   1. Steel Recycled Content: 30 percent total recycled content, minimum.
   2. Stainless Steel Recycled Content: 70 percent total recycled content, minimum.
   3. Aluminum Recycled Content: 50percent total recycled content, minimum.

2.4 HOLLOW METAL DOORS

A. Hollow Metal Doors: ANSI A250.8; 44 mm (1-3/4 inches) thick.
   1. Interior Doors: Level 3 and Physical Performance Level A, extra-heavy duty; Model 2, seamless at stair locations.
   2. Exterior Doors: Level 4 and Physical Performance Level A, maximum heavy duty; Model 2, seamless.

B. Door Faces:
   1. Interior Doors: Galvanized sheet steel minimum Z120 or ZF120 (G40 or A40coating.
   2. Exterior Doors: Galvanized sheet steel minimum Z275 (G90) oating.

C. Door Cores:
   1. Interior Doors: Kraft paper honeycomb or vertical steel stiffeners .
   2. Exterior Doors: Polystyrene or polyurethane.
   3. Fire Doors: Manufacturer's standard complying with specified fire rating performance.
      a. Where continuous hinges are specified in section 08 71 00, provide one additional label on top of door panel

2.5 HOLLOW METAL FRAMES

A. Hollow Metal Frames: ANSI A250.8; face welded. See drawings for sizes and designs.
   1. Interior Frames:
      a. Level 1 Hollow Metal Doors: 1.0 mm (0.042 inch) thick.

b. Wood Doors and Borrowed Lights :1.3 mm (0.053 inch) thick.
2. Interior Borrowed Light Frames: 1.3 mm (0.051 inch) thick.

B. Frame Materials:
1. Interior Frames: Galvanized sheet steel minimum Z120 or ZF120 (G40 or A40) coating.
2. Exterior Frames: Galvanized sheet steel minimumZ275 (G90) coating.

2.6 FABRICATION

A. Hardware Preparation: ANSI A250.8; for hardware specified in Section 08 71 00, DOOR HARDWARE.

B. Hollow Metal Door Fabrication:
1. Close top edge of exterior doors flush and seal to prevent water intrusion.
2. Fill spaces between vertical steel stiffeners with insulation.

C. Fire and Smoke Control Doors:
1. Close top and vertical edges flush.
2. Apply steel astragal to active leaf at pair and double egress doors.
a. Exception: Where vertical rod exit devices are specified for both leaves swinging in same direction.
3. Fireand Smoke Control Door Clearances: NFPA 80.

D. Sound Rated Doors:
1. Seals: Integral spring type automatic door bottom seal.
2. Fabricate vision panel cutouts and frames to receive double glazing as shown on drawings.

E. Hollow Metal Frame Fabrication:
1. Fasten mortar guards to back of hardware reinforcements, except on lead-lined frames.
2. Concealed Closers in Head Frame: Provide 1 mm (0.042 inch) thick steel removable stop sections for access to concealed face plates and control valves, except when cover plates are furnished with closer.
3. Terminated Stops: ANSI A250.8.
4. Borrowed Light and Panel Opening Frames:
a. Provide integral stop on exterior, corridor, or secure side of door.
b. Design rabbet width and depth to receive glazing material or panel shown on drawings.
5. Two Piece Frames:
a. One piece unequal leg finished rough buck sub-frames as shown, drilled for anchor bolts.
b. Unequal leg finished frames formed to fit subframes and secured to subframe legs with countersunk, flat head screws, spaced 300 mm (12 inches) on center at head and jambs on both sides.
c. Preassemble at factory for alignment.
6. Frame Anchors:
a. Floor anchors:
1) Provide extension type floor anchors to compensate for depth of floor fills.
2) Provide 1.3 mm (0.053 inch) thick steel clip angles welded to jamb and drilled to receive floor fasteners.
3) Provide 50 mm by 50 mm by 9 mm (2 inch by 2 inch by 3/8 inch) clip angle for lead lined frames, drilled for floor fasteners.
4) Provide mullion 2.3 mm (0.093 inch) thick steel channel anchors, drilled for two floor fasteners and frame anchor screws.
5) Provide continuous 1 mm (0.042 inch) thick steel rough bucks drilled for floor fasteners and frame anchor screws for sill sections.
a) Space floor bolts50 mm (24 inches) on center.
b. Jamb anchors:
1) Place anchors on jambs:

a) Near top and bottom of each frame.
b) At intermediate points at maximum 600 mm (24 inches) spacing.

2) Form jamb anchors from steel minimum 1 mm (0.042 inch) thick.

3) Anchors set in masonry: Provide adjustable anchors designed for friction fit against frame and extended into masonry minimum 250 mm (10 inches). Provide one of following types:
   a) Wire Loop Type: 5 mm (3/16 inch) diameter wire.
   b) T-Shape type.
   c) Strap and stirrup type: Corrugated or perforated sheet steel.

4) Anchors for stud partitions: Provide tabs for securing anchor to sides of studs. Provide one of the following:
   a) Welded type.
   b) Lock-in snap-in type.

5) Anchors for frames set in prepared openings:
   a) Steel pipe spacers 6 mm (1/4 inch) inside diameter, welded to plate reinforcing at jamb stops, or hat shaped formed strap spacers 50 mm (2 inches) wide, welded to jamb near stop.
   b) Drill jamb stop and strap spacers for 6 mm (1/4 inch) flat head bolts to pass through frame and spacers.
   c) Two piece frames: Subframe or rough buck drilled for 6 mm (1/4 inch) bolts.

6) Anchors for observation windows and other continuous frames set in stud partitions.
   a) Weld clip anchors to sills and heads of continuous frames over 1200 mm (4 feet) long.
   b) Space maximum 600 mm (24 inches) on centers.

7) Modify frame anchors to fit special frame and wall construction.

8) Provide special anchors where shown on drawings and where required to suit application.

F. Sound Rated Door Frames:
   1. Seals: Integral continuous gaskets on frames.

G. Fire Rated Door Frame:
   1. Where continuous hinges are specified in section 08 71 00, provide one additional label on top of door frame.

2.7 FINISHES

A. Galvanized Steel : ANSI A250.8; shop primed.

B. Stainless Steel: NAAMM AMP 500; No. 4 polished finish.
   1. Blend welds to match adjacent finish.

C. Finish exposed surfaces after fabrication.

D. Aluminum Anodized Finish: NAAMM AMP 500.
   1. Clear Anodized Finish: AA-C22A41; Class I Architectural, 0.018 mm (0.7 mil) thick.

2.8 ACCESSORIES

A. Primers: ANSI A250.8.

B. Barrier Coating: ASTM D1187/D1187M.

C. Welding Materials: AWS D1.1/D1.1M, type to suit application.

D. Clips Connecting Members and Sleeves: Match door faces.

E. Fasteners: Galvanized steel.
   1. Metal Framing: Steel drill screws.
   2. Masonry and Concrete: Expansion bolts and power actuated drive pins.

F. Anchors: Galvanized steel.

G. Galvanizing Repair Paint: MPI No. 18.

H. Insulation: Unfaced mineral wool.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.

B. Protect existing construction and completed work from damage.

C. Apply barrier coating to metal surfaces in contact with cementitious materials to minimum 0.7 mm (30 mils) dry film thickness.

3.2 INSTALLATION - GENERAL

A. Install products according to manufacturer's instructions and approved submittal drawings.
   1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.
   2. Install fire doors and frames according to NFPA 80.
   3. Install smoke control doors and frames according to NFPA 105.

3.3 FRAME INSTALLATION

A. Apply barrier coating to concealed surfaces of frames built into masonry.

B. Plumb, align, and brace frames until permanent anchors are set.
   1. Use triangular bracing near each corner on both sides of frames with temporary wood spreaders at midpoint.
   2. Use wood spreaders at bottom of frame when shipping spreader is removed.
   3. Where construction permits concealment, leave shipping spreaders in place after installation, otherwise remove spreaders when frames are set and anchored.
   4. Remove wood spreaders and braces when walls are built and jamb anchors are secured.

C. Floor Anchors:
   1. Anchor frame jambs to floor with two expansion bolts.
      a. Lead Lined Frames: Use 9 mm (3/8 inch) diameter bolts.
      b. Other Frames: Use 6 mm (1/4 inch) diameter bolts.
   2. Power actuated drive pins are acceptable to secure frame anchors to concrete floors.

D. Jamb Anchors:
   1. Masonry Walls:
      a. Embed anchors in mortar.
      b. Fill space between frame and masonry with grout or mortar as walls are built.
   2. Metal Framed Walls: Secure anchors to sides of studs with two fasteners through anchor tabs.
   3. Prepared Masonry and Concrete Openings:
      a. Direct Securement: 6 mm (1/4 inch) diameter expansion bolts through spacers.
      b. Subframe or Rough Buck Securement:
         1) 6 mm (1/4 inch) diameter expansion bolts on 600 mm (24 inch) centers.
         2) Power activated drive pins on 600 mm (24 inches) centers.
      c. Secure two-piece frames to subframe or rough buck with machine screws on both faces.

E. Frames for Sound Rated Doors: Fill frames with insulation.

F. Touch up damaged factory finishes.
   1. Repair galvanized surfaces with galvanized repair paint.
   2. Repair painted surfaces with touch up primer.

3.4 DOOR INSTALLATION

A. Install doors plumb and level.

B. Adjust doors for smooth operation.

C. Touch up damaged factory finishes.
   1. Repair galvanized surfaces with galvanized repair paint.
   2. Repair painted surfaces with touch up primer.

3.5 CLEANING

A. Clean exposed door and frame surfaces. Remove contaminants and stains.

3.6 PROTECTION

A. Protect doors and frames from traffic and construction operations.

B. Remove protective materials immediately before acceptance.

C. Repair damage.

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SECTION 08 14 00

INTERIOR WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Interior flush wood doors transparent finish.
   a. Fire rated doors.
   b. Smoke rated doors.
   c. Acoustical doors.

1.2 RELATED WORK

A. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS: Paints and Coatings and Composite Wood and Agrifiber VOC Limits.

B. Section 08 71 00, DOOR HARDWARE: Door Hardware including hardware location (height).

C. Section 08 11 13, HOLLOW METAL DOORS AND FRAMES: Installation of Doors.

D. Section 08 71 00, DOOR HARDWARE: Installation of Door Hardware.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. American National Standards Institute/Window and Door Manufacturers Association (ANSI/WDMA):
1. I.S. 1A-13 - Architectural Wood Flush Doors.
2. I.S. 6A-13 - Interior Architectural Stile and Rails Doors.

C. ASTM International (ASTM):
1. E90-09(2016) - Laboratory Measurements of Airborne Sound Transmission Loss of Building Partitions and Elements.

D. National Fire Protection Association (NFPA):
1. 80-16 - Fire Doors and Other Opening Protectives.
2. 252-12 - Fire Tests of Door Assemblies.

E. UL LLC (UL):
1. 10C-09 - Positive Pressure Fire Tests of Door Assemblies.

F. Window and Door Manufacturers Association (WDMA):
1. TM 7-14 - Cycle-Slam Test.
2. TM 8-14 - Hinge Loading Test.
3. TM 10-14 - Screw Holding Capacity.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:
1. Show size, configuration, and fabrication and installation details.
2. Include details of glazing
3. Indicate project specific requirements not included in Manufacturer's Literature and Data submittal.

C. Manufacturer's Literature and Data:

1. Description of each product.
2. Fire rated doors showing conformance with NFPA 80.

D. Samples:
1. Corner section of flush veneered door 300 mm (12 inches) square, showing details of construction, labeled to show grade and type number and conformance to specified standard.
2. Veneer sample 200 mm by 275 mm (8 inch by 11 inch) showing specified wood species sanded to receive a transparent finish. Factory finish veneer sample where the prefinished option is accepted.

E. Sustainable Construction Submittals:
1. Low Pollutant-Emitting Materials:
a. Show volatile organic compound types and quantities.

F. Test Reports: Indicate each product complies with specifications.
1. Screw Holding Capacity Test.
2. Cycle-Slam Test.
3. Hinge-Loading Test.

G. Operation and Maintenance Data:
1. Care instructions for each exposed finish product.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications:
1. Regularly and presently manufactures specified products.
2. Manufactures specified products with satisfactory service on five similar installations for minimum five years.

1.6 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.
1. Minimum 0.15 mm (6 mil) polyethylene bags or cardboard packaging to remain unbroken during delivery and storage.

B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, and manufacture date.
1. Identify door opening corresponding to Door Schedule.

C. Before installation, return or dispose of products within distorted, damaged, or opened packaging. Retain packaging for door protection after installation.

1.7 STORAGE AND HANDLING

A. Store products indoors in dry, weathertight conditioned facility.
1. Store doors according to ANSI/WDMA I.S. 1A.

B. Protect products from damage during handling and construction operations.

1.8 FIELD CONDITIONS

A. Environment:
1. Product Temperature: Minimum 21 degrees C (70 degrees F) for minimum 48 hours before installation.
2. Work Area Ambient Temperature Range: 21 to 27 degrees C (70 to 80 degrees F) continuously, beginning 48 hours before installation.
3. Install products when building is permanently enclosed and when wet construction is completed, dried, and cured.
a. Comply with door manufacturer's instructions for relative humidity.

1.9 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

B. Manufacturer's Warranty: Warrant interior factory finished wood doors against material and manufacturing defects.
   1. Warranty Period: Lifetime of original installation.

PART 2 - PRODUCTS

2.1 PRODUCTS - GENERAL

A. Provide each product from one manufacturer.

B. Sustainable Construction Requirements:
   1. Low Pollutant-Emitting Materials: Comply with VOC limits specified in Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for the following products:
      a. Paints and coatings.
      b. Composite wood and agrifiber.

2.2 FLUSH WOOD DOORS

A. General:
   1. ANSI/WDMA I.S. 1A, Extra Heavy Duty.
   2. Adhesive: Type II.
   3. Core: Structural composite lumber, except when mineral core is required for fire rating.
   4. Thickness: 44 mm (1-3/4 inches) unless otherwise shown or specified.

B. Faces:
   1. ANSI/WDMA I.S. 1A.
   2. One species throughout project unless scheduled or otherwise shown.
   3. Transparent Finished Faces: Premium Grade. Plain Sliced red oak
      a. A Grade face veneer.
      b. Match face veneers for doors for uniform effect of color and grain at joints.
      c. Door Edges: Same species as door face veneer, except maple is acceptable for stile face veneer on birch doors.
      d. In existing buildings, where doors are required to have transparent finish, use wood species, grade, and assembly of face veneers to match adjacent existing doors.
   4. Painted Finishes: Custom Grade, mill option close grained hardwood, premium or medium density overlay.
   5. Factory sand doors for finishing.

C. Wood For Stops, Louvers, Muntins and Moldings For Flush Doors Required to Have Transparent Finish:
   1. Solid wood of same species as face veneer, except maple is acceptable on birch doors.
   2. Glazing:
      a. On non-fire-rated doors, use applied wood stops nailed tightly on room side and attached on opposite side with flathead, countersunk wood screws, spaced approximately 125 mm (5 inches) on center.
   3. Wood Louvers:
      a. Door manufacturer's standard product, fabricated of solid wood sections.
      b. Wood Slats: minimum 5 mm (3/16 inch) thick.
      c. Stiles routed out to receive slats.
      d. Secure louvers in prepared cutouts with wood stops.

D. Stiles and Rails:
   1. Composite material having screw withdrawal force greater than minimum performance level value when tested according to WDMA TM 10.
   2. Provide adequate blocking for bottom of doors having mechanically operated door bottom seal meeting or exceeding performance duty level per WDMA TM 10 for horizontal door edge screw holding.

3. Rabbeted transom meeting rail edges match face veneers of doors. Bottom rail of transom panel match face veneer on non-rabbeted meeting rail edge.

E. Fire-Rated Wood Doors:
1. Fire Resistance Rating:
   a. B Label: 1-1/2 hours.
   b. C Label: 3/4 hour.
2. Provide 20-minute smoke-rated doors in smoke-rated barriers.
3. Labels:
   a. Comply with NFPA 252, UL 10C, and labeled by qualified testing and inspection agency showing fire resistance rating.
   b. Metal labels with raised or incised markings.
   c. Where continuous hinges are specified in section 08 71 00, provide one additional label on top of door panel
4. Performance Criteria for Stiles of Doors Utilizing Standard Mortise Leaf Hinges:
   a. Hinge Loading: WDMA TM 8. Average of 10 test samples for Extra Heavy Duty doors.
   b. Direct Screw Withdrawal: WDMA TM 10 for Extra Heavy Duty doors. Average of 10 test samples using a steel, fully threaded #12 wood screw.
   c. Cycle-Slam: 1,000,000 cycles with no loose hinge screws or other visible signs of failure when tested according to WDMA TM 7.
5. Hardware Reinforcement:
   a. Provide fire and/or smoke rated doors with hardware reinforcement blocking.
   b. Size of lock blocks as required to secure hardware specified.
   c. Top, Bottom and Intermediate Rail Blocks: Minimum 125 mm (5 inches) by full core width.
   d. Reinforcement blocking in compliance with labeling requirements.
   e. Mineral material similar to core is not acceptable.
6. Other Core Components: Manufacturer's standard as allowed by labeling requirements.
7. Glazed Vision Panel Frame: Steel approved for use in labeled doors.
8. Astragal: Steel type for pairs of doors.

F. Smoke Barrier Doors:
1. Glazed Vision Panel Frame: Steel approved for use in labeled doors.
2. Astragal: Steel type for pairs of doors, including double egress doors.

G. Sound Rated Doors:
1. Fabricated as specified for flush wood doors with additional construction requirements to comply with specified sound transmission class (STC).
2. STC Rating of door assembly in place when tested according to ASTM E90 by independent acoustical testing laboratory minimum 35
3. Accessories:
   a. Frame Gaskets and Automatic Door Bottom Seal: As specified in Section 08 71 00, DOOR HARDWARE.

2.3 FABRICATION

A. Factory machine interior wood doors to receive hardware, bevels, undercuts, cutouts, accessories and fitting for frame.
1. Factory fit fire rated doors according to NFPA 80.

B. Rout doors for hardware using templates and location heights specified in Section 08 71 00, DOOR HARDWARE.

C. Factory fit doors to frame, bevel lock edge of doors 3 mm (1/8 inch) for each 50 mm (2 inches) of door thickness undercut where shown.

D. Clearances between Doors and Frames and Floors:
1. Fire Rated Doors: Comply with NFPA 80.

a. Doors with Automatic Bottom Seal: Maximum clearance 10 mm (3/8 inch) at threshold.
b. Other Door Bottoms: Maximum 3 mm (1/8 inch) clearance at the jambs, heads, and meeting stiles, and a 19 mm (3/4 inch) clearance at bottom, except as otherwise specified.

2. Door Jambs, Heads, and Meeting Stiles: Maximum 3 mm (1/8 inch).

E. Provide cutouts for glazed openings.

F. Finish surfaces, including both faces, top and bottom and edges of the doors smooth to touch.

G. Identify each door on top edge.
1. Mark with stamp, brand or other indelible mark, giving manufacturer's name, door's trade name, construction of door, date of manufacture and quality.
2. Mark door or provide separate certification including name of inspection organization.
3. Identify door manufacturing standard, including glue type.
4. Identify veneer and quality certification.
5. Identification of preservative treatment for stile and rail doors.

2.4 FINISHES

A. Field Finished Doors: Seal top and bottom edges of doors with two coats of catalyzed polyurethane or water resistant sealer.

B. Factory Transparent Finish:
1. Factory finish flush wood doors.
a. ANSI/WDMA I.S. 1A Section F-3 Finish System Descriptions for System 5, Conversion Varnish or System 7, Catalyzed Vinyl.
b. Use stain when required to produce finish specified
1) Stain: Cane From Masonite Architectural or equal.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.
1. Verify door frames are properly anchored.
2. Verify door frames are plumb, square, in plane, and within tolerances for door installation.

B. Protect existing construction and completed work from damage.

C. Install astragal on active leaf of pair of smoke doors and one leaf of double egress smoke doors.

3.2 INSTALLATION

A. Install products according to manufacturer's instructions and approved submittal drawings.
1. Install fire rated doors according to NFPA 80.
2. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

3.3 PROTECTION

A. After installation, place shipping container over door and tape in place.
1. Do not apply tape to door faces and edges.

B. Provide protective covering over exposed hardware in addition to covering door.

C. Maintain covering in good condition until removal is directed by Contracting Officer's Representative.

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SECTION 08 31 13

ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Access doors and panels installed in walls and ceilings.

1.2 RELATED WORK

A. Section 08 71 00, DOOR HARDWARE: Lock Cylinders.

B. Section 09 91 00, PAINTING: Field Painting.

C. Section 21 13 13, WET-PIPE SPRINKLER SYSTEMS: Access Doors for Control or Drain Valves.

D. Section 22 40 00, PLUMBING FIXTURES: Access Doors for Plumbing Valves.

E. Section 23 31 00, HVAC DUCTS AND CASINGS: Locations of Access Doors for Ductwork Cleanouts.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. American Welding Society (AWS):
1. D1.3/D1.3M-2018 Structural Welding Code - Sheet Steel (6th Edition.

C. ASTM International (ASTM):
1. A653/A653M-20 Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Sip Process.
2. A1008/A1008M-18 Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
3. A666-15 Annealed or Cold-Worked Austenitic Stainless Steel sheet, Strip, Plate, and Flat Bar.
4. E119-20 Fire Test of Building Construction and Materials.

D. National Fire Protection Association (NFPA):
1. 80-2019 Edition Fire Doors and Other Opening Protectives.
2. 252-2017 Edition Fire Tests of Door Assemblies.

E. National Association of Architectural Metal Manufacturers (NAAMM):
1. AMP 500-06 Metal Finishes Manual.

F. UL LLC (UL):
1. Listed Online Certifications Directory.
2. 10B-08 (Edition 10) Standard for Fire Tests of Door Assemblies.
3. 263-11 (Edition 14) Fire Tests of Building Construction and Materials.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:
1. Show size, configuration, and fabrication and installation details.

C. Manufacturer's Literature and Data:

1. Description of each product.
2. Installation instructions.

D. Sustainable Construction Submittals:
1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.

1.5 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.

B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.

C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.6 STORAGE AND HANDLING

A. Store products indoors in dry, weathertight facility.

B. Protect products from damage during handling and construction operations.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify field conditions affecting access door fabrication and installation. Show field measurements on Submittal Drawings.
1. Coordinate field measurement and fabrication schedule to avoid delay.

1.8 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel Sheet: ASTM A1008/A1008M.

B. Galvanized Steel: ASTM A653/A653M.

C. Stainless Steel: ASTM A666; Type 302 or Type 304.

2.2 PRODUCTS - GENERAL

A. Provide each product from one manufacturer.

B. Sustainable Construction Requirements:
1. Steel Access Doors Recycled Content: 30 percent total recycled content, minimum.
2. Stainless Steel Access Doors Recycled Content: 70 percent total recycled content, minimum.

2.3 ACCESS DOORS, FIRE-RATED

A. Door Construction:
1. Ceiling Access Door Construction: ASTM E119 or UL 263.
2. Wall Access Doors: NFPA 252 or UL 10B.

B. Label: Class B opening according to UL 10B or test by another nationally recognized laboratory. 1 hour fire-ratedwith maximum temperature rise of 120 degrees C (216 degrees F).

C. Door Panel: Minimum 0.9 mm (0.0359 inch) thick steel sheet, with mineral-fiber insulation core, insulated sandwich type construction.

D. Frame: Minimum 1.5 mm (0.0598 inch) thick steel sheet, depth and configuration to suit material and construction type where installed.
1. Frame Flange: Provide at units installed in concrete, masonry, or gypsum board.

2. Exposed Joints in Flange: Weld and grind smooth.

E. Provide automatic closing device.

F. Hinge: Continuous steel hinge with stainless steel pin.

G. Lock: Self-latching, mortise type with provision for fitting flush a standard screw-in type lock cylinder.
1. Lock cylinder specified in Section 08 71 00, DOOR HARDWARE.
2. Latch release device operable from inside of door.

H. Anchors for Fire-Rated Access Doors: Comply with requirements of applicable fire test.

2.4 ACCESS DOORS, FLUSH PANEL, NON-RATED

A. Door Panel:
1. 1.9 mm (0.07 inch) thick steel sheet.
2. Reinforce to maintain flat surface.

B. Frame:
1. 1.5 mm (0.06 inch) thick steel sheet, depth and configuration to suit material and construction type where installed.
2. Frame Flange: Provide at units installed in concrete, masonry, and gypsum board.
3. Exposed Joints in Flange: Weld and grind smooth.

C. Hinge:
1. Concealed spring hinge, 175 degrees of opening.
2. Removable hinge pin to allow removal of door panel from frame.

D. Lock:
1. Flush, screwdriver-operated cam lock.
2. Tamper proof screws (spanner head locks) for access panels in Behavioral Health Areas.

E. Gaskets:
1. Provide gasketing for an airtight installation.
2. Provide gasketing in accordance with manufacturers' written recommendations.
a.

2.5 ACCESS DOOR, RECESSED PANEL, NON-RATED

A. Door Panel:
1. 1.2 mm (0.05 inch) thick steel sheet to form a 25 mm (1 inch) deep recessed pan to accommodate installation of acoustical units and other materials where shown in walls and ceiling.
2. Reinforce to prevent sagging.

B. Frame:
1. 1.5 mm (0.06 inch) thick steel sheet of depth and configuration to suit installation in suspension system of ceiling or wall framing.
2. Extend sides of frame to protect edge of acoustical units when door panel is in open position.
3. Provide shims, bushings, clips and other devices necessary for installation.

C. Hinge: Continuous steel hinge with stainless steel pin, or concealed hinge.

D. Lock:
1. Flush screwdriver-operated cam lock.
2. Plastic sleeve or stainless steel grommet to protect hole made in acoustical unit for screwdriver access to lock.
3. Tamper proof screws (spanner head locks) for access panels in Behavioral Health Areas.

E. Gaskets:
1. Provide gasketing for an airtight installation.

2. Provide gasketing in accordance with manufacturers' written recommendations.

2.6 FABRICATION - GENERAL

A. Size: Minimum 600 mm (24 inches) square door unless otherwise shown or required to suit opening in suspension system of ceiling.

B. Component Fabrication: Straight, square, flat and in same plane where required.
   1. Exposed Edges: Slightly rounded, without burrs, snags and sharp edges.
   2. Exposed Welds: Continuous, ground smooth.
   3. Welding: AWS D1.3/D1.3M.

C. Locks and Non-Continuous Hinges: Provide in numbers required to maintain alignment of door panel with frame. For fire-rated doors, provide hinges and locks as required by fire test.

D. Anchoring: Make provisions in frame for anchoring to adjacent construction. Provide anchors in size, number and location on four sides to secure access door to substrate. Provide anchors as required by fire test.

2.7 FINISHES

A. Steel Paint Finish:
   1. Powder-Coat Finish: Manufacturer's standard two-coat finish system consisting of the following:
      a. One coat primer.
      b. One coat thermosetting topcoat.
      c. Dry-film Thickness: 0.05 mm (2 mils) minimum.

B. Stainless Steel Exposed Surfaces: NAAMM AMP 500; No.06 Metal Finishes.

2.8 ACCESSORIES

A. Fasteners: Type and size recommended by access door manufacturer, to suit application.
   1. Stainless Steel Access Doors: Stainless steel fasteners.
   2. Other Access Doors: Galvanized steel fasteners.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.
   1. Verify access door locations and sizes provide required maintenance access to installed building services components.

B. Protect existing construction and completed work from damage.

3.2 INSTALLATION - GENERAL

A. Install products according to manufacturer's instructions and approved submittal drawings
   1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

B. Install access doors and panels permitting access to service valves, traps, dampers, cleanouts, and other mechanical, electrical and conveyor control items concealed in walls and partitions, and concealed above gypsum board and plaster ceilings.

C. Install fire rated access door according to NFPA 80.

D. Install fire-rated doors in fire-rated partitions and ceilings.

E. Install flush access panels in partitions and in gypsum board and plaster ceilings.

3.3 ACCESS DOOR AND FRAME INSTALLATION

A. Wall Installations: Install access doors in openings with sides vertical.

B. Ceiling Installations: Install access doors parallel to ceiling suspension grid or room partitions.

C. Frames without Flanges: Install frame flush with surrounding finish surfaces.

D. Frames with Flanges: Overlap opening, with face uniformly spaced from finish surface.

E. Recessed Panel Access Doors: Install with face of surrounding materials flush with door panel installed finish.

F. Secure frames to adjacent construction with fasteners.

G. Install type, size and quantity of anchoring device suitable for material surrounding opening to maintain alignment, and resist displacement, during normal use of access door.

H. Field Painting Primed Access Doors: Comply with the requirements of Section 09 91 00, PAINTING.

3.4 ADJUSTMENT

A. Adjust hardware so door panel opens freely.

B. Adjust door when closed so door panel is centered in frame.

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SECTION 08 36 16.13
HIGH PERFORMANCE BARN (SLIDING) DOOR

PART 1 - GENERAL

1.1 SUMMARY

A. Sliding Barn Doors - flush wood and flush wood with glass, aluminum frames and related hardware.

1.2 RELATED SECTION

A. Section 08 14 00 – INTERIOR WOOD DOORS

B. Section 08 71 00 – DOOR HARDWARE

C. Section 08 80 00 – GLAZING

D. Section 09 22 16 – NON-STRUCTURAL METAL FRAMING

E. Section 10 14 00 - SIGNAGE

F. Division 26 – Electrical

G. Section 28 13 00 – Physical Access Control System

1.3 SUBMITTALS

A. Comply with Section 01 33 23 – SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

B. Product Data: Submit manufacturer’s product data, including installation instructions.

C. Shop Drawings: Submit manufacturer’s shop drawings, including plans, elevations, sections, and details, indicating dimensions, tolerances, materials, components, hardware, finish, options, and accessories. Shop Drawings to show required blocking by others.

D. Samples: Submit manufacturer’s samples of the following sliding door components:
   1. Door veneer or laminate sample
   2. Aluminum Frame finish sample

E. Manufacturer’s Certification: Submit manufacturer’s certification that materials comply with specified requirements and are suitable for intended application.

F. Warranty Documentation: Submit manufacturer’s standard warranty.

G. Test Reports: Submit acoustical reports or UL1784 as applicable.

1.4 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of interior aluminum frames and doors.

B. Source: Integrated assembly Obtain sliding aluminum framed doors, Door leaves and door hardware and seal systems from single source integrated assembly manufacturer.

C. Manufacturer's Qualifications: Manufacturer regularly engaged for past 5 years in manufacture of sliding doors similar to that specified.

1.5 REFERENCES

A. Architectural Barriers Act

B. Department of Veterans Affairs Barrier Free Design Standard PG-18-13

C. ANSI – American National Standards Institute
   1. ANSI 156.18 Materials and Finishes

2. ANSI A117.1 Specifications for making buildings and facilities usable by physically handicapped people.

D. BHMA – Builders Hardware Manufacturers Association

E. DHI – Door and Hardware Institute

F. NFPA – National Fire Protection Association
1. NFPA 80 – Fire Doors and Windows
2. NFPA 101 – Life Safety code
3. NFPA 105 – Smoke and Draft Control Door Assemblies
4. NFPA 252 – Fire Tests of Doors Assemblies

G. AWS – Architectural Woodwork Standards

1.6 PERFORMANCE

A. Aluminum perimeter frames with integral acoustic seals

B. Maximum Ambient Air Infiltration of 1.569CFM/ft2 @ 25Pa.

C. Maximum Elevated Temperature Air Infiltration 1.475 CFM/ft2 @ 25Pa and 400f.

D. Soft self-closing mechanism integrated with top track.

E. Concealed door guide.

1.7 DELIVERY: STORAGE AND PROTECTION

A. Delivery and Acceptance Requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Notify manufacturer immediately of any shipping damage.

C. Storage and Handling Requirements:
1. Store and handle materials in accordance with manufacturer's instructions.
2. Keep materials in manufacturer's original, unopened containers and packaging until installation.
3. Store materials in clean, dry area indoors.
4. Protect materials and finish during storage, handling, and installation to prevent damage.

PART 2 - PRODUCTS

2.1 INTERIOR SLIDING ALUMINUM-FRAMED DOORS AND PARTITIONS

1. ExamSlide High Performance Barn (Sliding) Door System by AD Systems. No Substitutions.

A. Interior Aluminum-Framed Integrated Assembly High Performance Top-Hung Sliding Doors with no visible bottom track.

B. Specified Wall Thickness: See Plans

C. Frame Profiles: Extruded aluminum frame "wrap" frame with integral vertical jamb (stile pocket).
1. Finish:
a. Standard: Painted Hardcoat (Kynar) Finish. Meets AAMA 2604 Standard Colors: Light Sequin 789G048.

D. Door Leafs. All Doors to be factory machined for hardware including pilot and function holes.
1. 1-3/4" Flush Wood Door: Reference Spec Section 08 14 00 Interior Wood Doors or other section as applicable.

E. Integrated Assembly Door Components:
1. Single Top Track: High Performance barn door track
2. Valances: Extruded aluminum with integral end caps
a. Sloped valance

3. Top Rollers: Tandem nylon roller sized to match door weight with integral soft close mechanism at both sides of door.
4. Concealed Floor Guide: Automatic Drop down acoustic and smoke seal with Integral concealed floor guide. (No bottom track in floor)
5. Soft-Closer: Soft and self-closing damper mechanism at one sides of door leaf
6. Handles:
   a. Standard Straight Pull: 12” long x 1” diameter. Finish: US32D Satin Stainless Steel

F. Accessories:
1. Door Locks:
   a. Mortise Latch and Lock Options:
      1) Standard AD-1 Thumbturn with Key Lock & 16-inch Ladder Pull
   b. Install, adjust, instruct all hardware per Part 3 of Division 8, 26, 28 to the satisfaction of COR

2. Automatic Door Bottom for improved acoustical performance

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine wall openings to receive sliding doors for plumb, level, and square. Note: Finish door operation will be affected by out of tolerance framing.

B. Verify dimensions of wall openings.

C. Examine surfaces to receive top and bottom guide.

D. Notify Architect of conditions that would adversely affect installation or subsequent use of sliding doors.

E. Do not begin installation until unacceptable conditions are corrected.

F. Base of door side to be flush or minimal. Rubber Base acceptable.

3.2 INSTALLATION

A. Install sliding doors in accordance with manufacturer’s instructions at locations indicated on the Drawings.

B. Install sliding doors plumb, level, square, and in proper alignment.

C. Install sliding doors to close against walls without gaps

D. Install sliding doors to open and close smoothly.

E. Anchor sliding doors securely in place to supports. Required: Fire treated 2 x 6 blocking required full length of track.

3.3 ADJUSTING

A. Adjust sliding doors for proper operation in accordance with manufacturer’s instructions.

B. Adjust sliding doors to operate smoothly without binding.

C. Repair minor damages to finish in accordance with manufacturer’s instructions and as approved by COR.

3.4 CLEANING

A. Clean sliding doors promptly after installation in accordance with manufacturer’s instructions.

B. Do not use harsh cleaning materials or methods that could damage materials or finish.

3.5 PROTECTION

A. Protect installed sliding doors from damage during construction.

END OF SECTION

SECTION 08 41 13

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Aluminum-framed entrances and storefronts.

1.2 RELATED REQUIREMENTS

A. Glass and Glazing: Section 08 80 00, GLAZING.

B. Hardware: Section 08 71 00, DOOR HARDWARE.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. American Architectural Manufacturers Associations (AAMA):
1. 2603-15 Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels
2. 2604-13 Performance Requirements and Test Procedures or High Performance Organic Coatings on Architectural Extrusions and Panels
3. 2605-13 Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels

C. American Welding Society (AWS):
1. D1.2/D1.2M-14 Structural Welding Code - Aluminum

D. ASTM International (ASTM):
1. A240/A240M-20 Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
2. B209-14 Aluminum and Aluminum-Alloy Sheet and Plate.
3. B209M-14 Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
4. B221-14 Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
5. B221M-13 Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
6. D1187/D1187M-97(2018) Asphalt-Base Emulsions for Use as Protective Coatings for Metal
7. E283/E283M-19 Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
8. E330/E330M-14 Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
9. E331-00(2016) Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
10. E1886-19 Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missiles and Exposes to Cyclic Pressure Differentials
11. E1996-17 Performance of Exterior Windows, Curtain Walls, Doors, and impact Protective Systems Impacted by Windborne Debris in Hurricanes
12. F468-16 Nonferrous Bolts, Hex Cap Screws, and Studs for General Use
13. F593-17 Stainless Steel Bolts, Hex Cap Screws, and Studs

E. National Association of Architectural Metal Manufacturers (NAAMM):
1. AMP 500-06 Metal Finishes Manual

F. National Fenestration Rating Council (NFRC):

1. 500-14(E1A0) Determining Fenestration Product Condensation Resistance Values

G. Department of Veterans Affairs(VA):
1. VA Physical Security and Resiliency Design Manual January 1, 2021

1.4 PREINSTALLATION MEETINGS

A. Conduct preinstallation meeting at project site minimum 30 days before beginning Work of this section.
1. Required Participants:
   a. Contracting Officer's Representative.
   b. Architect/Engineer.
   c. Contractor.
   d. Installer.
   e. Manufacturer's field representative.
   f. Other installers responsible for adjacent and intersecting work, including Glazing and Hardware.
2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.
   a. Installation schedule.
   b. Installation sequence.
   c. Preparatory work.
   d. Protection before, during, and after installation.
   e. Installation.
   f. Terminations.
   g. Transitions and connections to other work.
   h. Other items affecting successful completion.
3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.5 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings: Minimum 1 to 2 (half size) scale.
1. Show size, configuration, and fabrication and installation details.
2. Show anchorage and reinforcement.
3. Show interface and relationship to adjacent work, including thermal, air, and water barrier continuity.

C. Manufacturer's Literature and Data:
1. Description of each product.
2. Doors, each type.
3. Entrance and Storefront construction.
4. Installation instructions.
5. Warranty.

D. Samples:
1. Door Corner Section: Minimum 450 mm x 450 mm (18 x 18 inches) for each specified door type, showing head rail and hinge stile, door closer reinforcement, internal reinforcement
2. Aluminum Anodized Finish: wo sample extrusions minimum 150 mm (6 inches) long for each specified color in sets of three showing maximum color range.

E. Sustainable Construction Submittals:
1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.

F. Test reports: Certify each product complies with specifications.

G. Certificates: Certify each product complies with specifications.

1. Certify anodized finish thickness.

H. Qualifications: Substantiate qualifications comply with specifications.
1. Manufacturer with project experience list .
2. Installer with project experience list.
3. Welders and welding procedures.

I. Delegated Design Drawings and Calculations: Signed and sealed by responsible design professional.
1. Show location and magnitude of loads applied to building structural frame.
2. Identify deviations from details shown on drawings.

J. Operation and Maintenance Data:
1. Care instructions for each exposed finish product.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications:
1. Regularly manufactures specified products.
2. Manufactured specified products with satisfactory service on five similar installations for minimum five years.
a. Project Experience List: Provide contact names and addresses for completed projects.

B. Installer Qualifications: Product manufactureror Manufacturer authorized representative.
1. Regularly installs specified products.
2. Installed specified products with satisfactory service on five similar installations for minimum five years.
a. Project Experience List: Provide contact names and addresses for completed projects.

C. Welders and Welding Procedures Qualifications: AWS D1.2/D1.2M.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver products in manufacturer's original sealed packaging.

B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.

C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

D. Store products indoors in dry, weathertight conditioned facility.

E. Protect products from damage during handling and construction operations.

1.8 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

B. Manufacturer's Warranty: Warrant painted finish against material and manufacturing defects.
1. Warranty Period:20 years.

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

A. Delegated Design: Prepare submittal documents including design calculations and drawings signed and sealed by registered design professional, licensed in state where work is located.
1. Minor deviations to details shown on drawings to accommodate manufacturer’s standard products may be accepted by Contracting Officer's Representative when deviations do not affect design concept and specified performance.

2.2 MATERIALS

A. Aluminum:
   1. Sheet Metal: ASTM B209M (ASTM B209), minimum 1.6 mm (0.063 inch) thick.
   2. Extrusions: ASTM B221M (ASTM B221).
      a. Framing: Minimum 3 mm (0.125 inch) wall thickness.
      b. Glazing Beads, Moldings, and Trim: Minimum 1.25 mm (0.050 inch) thick.
   3. Alloy 6063 temper T5 for doors, door frames, fixed glass sidelights storefronts.
   4. Alloy 6061 temper T6 for guide tracks for sliding doors and other extruded structural members.
   5. Color Anodized Aluminum: Provide aluminum alloy required to produce specified color.

B. Stainless Steel: ASTM A240/A240M; Type 302 or Type 304.

2.3 PRODUCTS - GENERAL

A. Basis of Design: SCHEDULE FOR FINISHES.

B. Provide aluminum framed entrances and storefronts from one manufacturer and from one production run .

C. Provide aluminum entrances, storefront, windows, systems from same manufacturer.

D. Sustainable Construction Requirements:
   1. Aluminum Recycled Content: 80 percent total recycled content, minimum.

2.4 FRAMES

A. Framing Members: Extruded aluminum,

B. Stops: Provide integral fixed stops and glass rebates and snap-on removable stops.

C. Provide concealed screws, bolts and other fasteners.

D. Secure cover boxes to frames in back of lock strike cutouts.

2.5 STILE AND RAIL DOORS

A. Stiles and Rails: Extruded aluminum,
   1. Thickness: 45 mm (1-3/4 inch).
   2. Stiles and Head Rails: 90 mm (3-1/2 inches) wide.
   3. Bottom Rails: 250 mm (10 inches) wide.

B. Single-Acting Doors:
   1. Bevel: 3 mm (1/8 inch) at lock, hinge, and meeting stile edges.
   2. Clearances: 2 mm (1/16 inch) at hinge stiles, 3 mm (1/8 inch) at lock stiles and top rails, and 5 mm (3/16 inch) at floors and thresholds.

C. Glass Rebates: Integral with stiles and rails.

D. Glazing Beads: Extruded aluminum, 1.3 mm (0.050 inch) thick. Integral with stiles and rails or applied type, snap-fit secured.

E. Stile and Rail Joints: Welded or interlocking dovetail joints between stiles and rails.
   1. Clamp door together through top and bottom rails with 9 mm (3/8 inch) primed steel tie rod extending into stiles, and having self-locking nut and washer at both ends.
   2. Reinforce stiles and rails to prevent door distortion when tie rods are tightened.
   3. Provide compensating spring-type washer under each nut for stress relief.
   4. Construct joints to remain rigid and tight when door is operated.

F. Weather-stripping: Removable, woven pile type (silicone-treated) weather-stripping attached to aluminum or vinyl holder.
   1. Make slots for applying weather-stripping integral with doors and door frame stops.
   2. Apply continuous weather-stripping to heads, jambs, bottom, and meeting stiles of doors and frames so doors swing freely and close positively.

2.6 COLUMN COVERS AND TRIM

A. Column Covers and Trim: Sheet aluminum fabrications shown from sheet aluminum of longest available lengths.

B. Provide concealed fasteners.

C. Provide aluminum stiffeners and supporting members shown on drawings and as required to maintain component integrity and shape.

2.7 FABRICATION

A. Form metal parts and fit and assemble joints, except joints designed to accommodate movement. Seal joints to resist air infiltration and water penetration.

B. Welding:
   1. Make welds without distorting and discoloring exposed surfaces.
   2. Clean and dress welds. Remove welding flux and weld spatter.

C. Prepare and reinforce doors and frames for hardware and accessories.
   1. Coordinate preparation with specified hardware. See Section 08 71 00, DOOR HARDWARE.
   2. Fabricate reinforcement from stainless steel plates.
      a. Hinge and pivot reinforcing: Minimum 4.5 mm (0.179 inch) thick.
      b. Lock Face, Flush Bolts, Concealed Holders, Concealed and Surface Mounted Closers Reinforcing: Minimum 2.6 mm (0.104 inch) thick.
      c. Other Surface Mounted Hardware Reinforcing: Minimum 1.5 mm (0.059 inch) thick.
   3. Where concealed hardware is specified, provide space, cutouts, and reinforcement for installation and secure fastening.

D. Factory assembled doors.

2.8 FINISHES

A. Aluminum Anodized Finish: NAAMM AMP 500.
   1. Clear Anodized Finish: AA-C22A31; Class II Architectural, 0.01 mm (0.4 mil) thick.
   2. Color Anodized Finish: AA-C22A32 or AA-C22A34; Class II Architectural, 0.01 mm (0.4 mil) thick.

B. Aluminum Paint finish:
   1. Baked Enamel or Powder Coat: AAMA 2603; polyester resin, minimum 0.4 mm (1.5 mil) film thickness.
   2. Fluorocarbon Finish: AAMA 2604; 50 percent fluoropolymer resin, 2-coat mica

2.9 ACCESSORIES

A. Dielectric Tape: Plastic, non-absorptive, with pressure sensitive adhesive; 0.18 to 0.25 mm (7 to 10 mils) thick.

B. Barrier Coating: ASTM D1187/D1187M.

C. Welding Materials: AWS D1.2/D1.2M, type to suit application.

D. Fasteners:
   1. Aluminum: ASTM F468, Alloy 2024.
   2. Stainless Steel: ASTM F593, Alloy Groups 1, 2 and 3.

E. Anchors: Aluminum or stainless steel; type to suit application.

F. Galvanizing Repair Paint: MPI No. 18.

G. Touch-Up Paint: Match shop finish.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.
   1. Coordinate floor closer installation recessed into concrete slabs.
   2. Coordinate anchor installation built into masonry and concrete.

B. Protect existing construction and completed work from damage.

C. Clean substrates. Remove contaminants capable of affecting subsequently installed product's performance.

D. Apply dielectric tape or barrier coating to aluminum surfaces in contact with dissimilar metals and cementitious materials to minimum 0.7 mm (30 mils) dry film thickness.

3.2 INSTALLATION - GENERAL

A. Install products according to manufacturer's instructions and approved submittal drawings.
   1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

B. Install aluminum framed entrances and storefronts plumb and true, in alignment and to lines shown on drawings.

C. Anchor frames to adjoining construction at heads, jambs and sills.

D. Provide concealed aluminum clips to connect adjoining frame sections.

E. Install door hardware and hang doors. See Section 08 71 00, DOOR HARDWARE.

F. /Install door operators. See Section 08 71 13, AUTOMATIC DOOR OPERATORS.

G. Adjust doors and hardware uniform clearances and proper operation.

H. Touch up damaged factory finishes.
   1. Repair galvanized surfaces with galvanized repair paint.
   2. Repair painted surfaces with touch up primer.

I. Tolerances:
   1. Variation from Plumb, Level, Warp, and Bow: Maximum 3 mm in 3 meters (1/8 inch in 10 feet).
   2. Variation from Plane: Maximum3 mm in 3.65 meters (1/8 inch in 12 feet); 6 mm (1/4 inch) over total length.
   3. Variation from Alignment: Maximum 1.5 mm (1/16 inch) in-line offset and maximum3 mm (1/8 inch) corner offset.
   4. Variation from Square: Maximum 3 mm (1/8 inch) diagonal measurement differential.

3.3 PROTECTION, CLEANING AND REPAIRING

A. Clean exposed aluminum and glass surfaces. Remove contaminants and stains.

B. Protect aluminum-framed entrances and storefronts from construction operations.

C. Remove protective materials immediately before acceptance.

D. Repair damage.

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SECTION 08 51 13

ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Aluminum windows for new construction renovation work.

1.2 RELATED WORK

A. Section 07 92 00, JOINT SEALANTS: Sealing Joints.

B. Section 08 80 00, GLAZING: Glazing.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. American Architectural Manufacturers Associations (AAMA):
1. AAMA/WDMA/CSA 101/I.S.2/A440-17 Windows, Doors, and Skylights.
2. AAMA 505-17 Dry Shrinkage and Composite Performance Thermal Cycle Test Procedures.
3. AAMA 2605-20 Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
4. AAMA TIR A8-16 Structural Performance of Composite Thermal Barrier Framing System.

C. American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI):
1. 7-16 Minimum Design Loads for Buildings and Other Structures.

D. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
1. 90.1-19 Energy Standard for Buildings Except Low-Rise Residential Buildings.

E. ASTM International (ASTM):
1. B209-14 Aluminum and Aluminum-Alloy Sheet and Plate.
2. B209M-14 Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
3. B221-14 Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
4. B221M-13 Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
5. E283-19 Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
6. E331-00(2016) Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.

1.4 PREINSTALLATION MEETINGS

A. Conduct preinstallation meeting at project siteminimum 30 days before beginning Work of this section.
1. Required Participants:
   a. Contracting Officer's Representative.
   b. Architect/Engineer.
   c. Inspection and Testing Agency.
   d. Contractor.
   e. Installer.
   f. Manufacturer's field representative.
2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.
   a. Installation schedule.
   b. Installation sequence.

c. Preparatory work.
d. Protection before, during, and after installation.
e. Installation.
f. Transitions and connections to other work.
g. Other items affecting successful completion.

3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.5 SUBMITTAL

A. Submit according to Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:
1. Indicate window types required for project.
2. Identify window unit components by name and type of metal or material, show construction, locking systems, mechanical operators, trim, installation and anchorages.
3. Include glazing details and standards for factory glazed units.

C. Manufacturer's Literature and Data:
1. Description of each product.
2. Installation instructions.
3. Warranty.

D. Sustainable Construction Submittals:
1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.

E. Samples:
1. Window Frame: 150 mm (6 inch) long samples showing finishes, specified.

F. Test reports: Indicate each product complies with specifications.
1. Windows.
2. Operating hardware.

G. Certificates: Indicate each product complies with requirements (window characteristics may be on window schedule or other drawings).

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications:
1. Regularly manufactures specified products.
2. Manufactured specified products with satisfactory service on five similar installations for minimum five years.
a. Provide contact names and addresses for completed projects when requested by Contracting Officer's Representative.

B. Quality Certified Labels or Certificates:
1. AAMA Label affixed to each window indicating compliance with specification.
2. Certificates in lieu of label with copy of test report maximum 4 years old from independent testing laboratory and certificate signed by window manufacturer stating that windows provided comply with specified requirements and AAMA/WDMA/CSA 101/I.S.2/A440 for type of window specified.

1.7 STORAGE AND HANDLING

A. Protect windows from damage during handling and construction operations before, during and after installation.

B. Store windows under cover, setting upright.

C. Do not stack windows flat.

D. Do not lay building materials or equipment on windows.

1.8 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

B. Manufacturer's Warranty: Warrant windows against material and manufacturing defects.
   1. Warranty Period: 10 years.

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

A. Design windows complying with specified performance:
   1. Load Resistance: ASCE/SEI 7Design criteria as indicated on Drawings.
      a. Performance Grade: AAMA/WDMA/CSA 101/I.S.2/A440 required to resist maximum positive and negative wind load.

B. Provide the following operation types for locations indicated on the Drawings.
   1. Hung Windows: Single hung.
      a. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440, minimum AW-40 .
      b. Provide units with tilt-in feature permitting both sides of both sash to be cleaned from interior.
         1) Restrict sash tilting without use of maintenance release mechanism and removable locking handle.
         2) Finger operated tilt latches not acceptable.
      c. ..
   2. Fixed Windows:
      a. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440, minimum . AW-40.

2.2 MATERIALS

A. Aluminum Extrusions: ASTM B221M (ASTM B221); 6063 alloy, T5 temper.

B. Aluminum Sheet: ASTM B209M (ASTM B209); 5005 alloy, H15 or H34 temper.

2.3 PRODUCTS - GENERAL

A. .

B. Provide windows from one manufacturer.

C. Sustainable Construction Requirements:
   1. Aluminum Recycled Content: 80 total recycled content, minimum.

2.4 ALUMINUM WINDOWS

A. Frames and Sashes: Aluminum extrusions, AAMA/WDMA/CSA 101/I.S.2/A440.

B. Thermal-Break Window Construction:
   1. Manufacturer’s Standard.
   2. Low conductance thermal barrier.
   3. Capable of structurally holding sash in position and together.
   4. Thermal Break Assemblies: Tested according to AAMA TIR A8 and AAMA 505.
   5. Design location of thermal break so that, in closed position, outside air does not come in direct contact with interior frame of window.

C. Mullions: Match window units.

D. Provide anchors and other related accessories required for installation.

2.5 GLAZING

A. Glass and Glazing: As specified in Section 08 80 00, GLAZING.

1. Factory glaze windows.
2. Weep holes through glazed areas are not acceptable.

2.6 INSECT SCREENING

A. Screen Mesh: 18 by 18, AAMA/WDMA/CSA 101/I.S.2/A440.
   1. Screen Cloth: Vinyl clad aluminum .

B. Frame: Aluminum, match window unit finish type and color, unless otherwise indicated.

2.7 HARDWARE

A. Locks: Two position locking bolts or cam type tamperproof custodial locks with a single point control located not higher than 1500 mm (60 inches) from floor level. Locate locking devices in vent side rail. Provide concealed or non-removable fastenings for locks and keepers. Provide cam type locks on single hung and double windows to pull window sashes together in a locked and secured position.

B. Locking Device Strikes: Locate adjustable strikes in frame jamb. Fabricate strikes from Type 304 stainless steel or white bronze.

C. Counterbalancing: Primary window sash shall be equipped with counterbalancing mechanisms meeting the requirements of AAMA 902 or AAMA 908. Counterbalancing mechanism shall be of appropriate size and capacity to hold the sash stationary at any open position shall be used for the weights of sash to be counterbalanced.

D. Fabricate hinges of noncorrosive metal. Hinges may be either fully concealed when window is closed or semi-concealed with exposed knuckles and hospital tips. Surface mounted hinges are not acceptable.

E. Guide Blocks: Fabricate guide blocks of injection molded nylon. Install guide block fully concealed in vent/frame sill.

F. Hardware for Emergency Ventilation of Windows:
   1. Provide windows with hold open linkage.
   2. Provide hold open hardware for maximum 150 mm (6 inches) of window opening with adjustable friction shoe to provide resistance when closing window.
   3. Handles: Removable type.

G. Hardware for Maintenance Opening of Windows: Opening beyond limit stop position accomplished by maintenance key captured by release device when window is in open position.
   1. Design operating device to prevent opening with standard tools, coins or bent wire devices.

H. Pole Operators:
   1. Provide pole operator and pole hanger where operable windows have hardware more than 1500 mm (60 inches) above floor, but not over 3000 mm (10 feet) above floor.
   2. Fabricate pole of tubular anodized aluminum with rubber cap at lower end and standard push-pull hook at top end to match hardware design.
   3. Provide sufficient length for window operation without reaching more than 1500 mm (60 inches) above floor.
   4. Provide one operating pole and one pole hanger in each room or space where pole operation of windows is required.

I. Weather Stripping: AAMA/WDMA/CSA 101/I.S.2/A440; leaf type weather-stripping is not acceptable.

J. Provide wrenches, keys, or removable locking operating handles, as specified to operate windows.
   1. Provide one emergency ventilating operating handle for every four windows.
   2. Provide maintenance or window washer operating handles as required.

2.8 FABRICATION

A. Fabricate windows to comply specified performance class and grade.
   1. Assemble frame and sash so fasteners are concealed when window is closed.
   2. Attach locking and hold-open devices to windows with concealed fasteners.
   3. Where extrusion wall thickness is less than 3 mm (0.125 inch) thick, provide backup plates or similar reinforcements for fasteners.
   4. Use stainless steel fasteners to secure Venetian blind hanger clips, vent guide blocks, friction adjuster, and limit opening device.

B. Aluminum Trim:
   1. Trim includes casings, closures, and panning.
   2. Fabricate to shapes shown, minimum 1.6 mm (0.062 inch) thick.
   3. Extruded or formed sections, straight, true, and smooth on exposed surfaces. Curved sections true to line.
   4. Exposed external corners mitered and internal corners coped; fitted with hairline joints.
   5. Reinforce 1.6 mm (0.062 inch) thick members with minimum 3 mm (1/8 inch) thick aluminum.
   6. Except for strap anchors, provide reinforcing for fastening near ends and spaced maximum 300 mm (12 inches) on center.
   7. Design to allow unrestricted expansion and contraction of members and window frames.
   8. Secure to window frames with machine screws or expansion rivets.
   9. Exposed screws, fasteners or pop rivets are not acceptable on exterior of casing or trim cover system.

C. Aluminum Subsills and Stools:
   1. Fabricate to shapes shown, minimum 2 mm (0.080 inch) thick extrusion.
   2. One piece full length of opening with concealed anchors.
   3. Sills turned up back edge minimum 6 mm (1/4 inch). Front edge provide with drip.
   4. Sill back edge behind face of window frame. Do not extend to interior surface or bridge thermal breaks.
   5. Do not perforate for anchorage, clip screws, or other requirements.

2.9 FINISHES

A. Finish window units according to NAAMM AMP 500 series.

B. Anodized Aluminum:
   1. Clear Anodized Finish: AA-C22A41; Class I Architectural, 0.018 mm (0.7 mil) thick.
   2. Color Anodized Finish: AA-C22A42 or AA-C22A44; Class I Architectural, 0.018 mm (0.7 mil) thick.

C. Aluminum Paint finish:
   1. Fluorocarbon Finish: AAMA 2605; 70 percent fluoropolymer resin, 2-coat system.
   2. Color: To match existing.

D. Hardware: Finish hardware exposed when window is in closed position to match window.

2.10 ACCESSORIES

A. Fasteners: AAMA/WDMA/CSA 101/I.S.2/A440; non-magnetic stainless steel.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.
   1. Verify openings are within acceptable tolerances.

B. Protect existing construction and completed work from damage.

C. Remove existing windows to permit new installation when replacement window is available, and ready for immediate installation.
   1. Remove existing work carefully; avoid damage to existing work indicated to remain.
   2. Perform other operations as necessary to prepare openings for proper installation and operation of new windows.
   3. Do not leave openings uncovered at end of working day, during precipitation or temperatures below 16 degrees C (60 degrees F).

3.2 INSTALLATION, GENERAL

A. Install products according to manufacturer's instructionsand approved submittal drawings.
   1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

B. Where type, size or spacing of fastenings for securing window accessories or equipment to building construction is not shown or specified, provide expansion or toggle bolts or screws, as best suited to construction material.
   1. Provide bolts or screws minimum 6 mm (1/4 inch) in diameter.
   2. Sized and spaced to resist tensile and shear loads imposed.
   3. Do not install exposed fasteners on exterior, except when unavoidable for application of hardware.
   4. Provide non-magnetic stainless steel Phillips flat-head machine screws for exposed fasteners, where required, or special tamper-proof fasteners.
   5. Locate fasteners to avoid disturbing window thermal break.

C. Set windows plumb, level, true, and in alignment; without warp or rack of frames or sash.

D. Anchor windows on four sides with anchor clips or fin trim.
   1. Do not allow anchor clips to bridge thermal breaks.
   2. Use separate clips for both sides of thermal breaks.
   3. Make connections to allow for thermal and other movements.
   4. Do not allow building load to bear on windows.
   5. Use manufacturer's standard clips at corners and maximum 600 mm (24 inches) on center.
   6. Where fin trim anchorage is indicated build into adjacent construction, anchoring at corners and maximum 600 mm (24 inches) on center.

E. Sills and Stools:
   1. Set in bed of mortar or other compound to fully support, true to line shown.
   2. Do not extend sill to inside window surface or past thermal break.
   3. Leave space for sealants at ends and to window frame unless indicated otherwise.

3.3 MULLIONS CLOSURES, TRIM, AND PANNING

A. Cut mullion full height of opening and anchor directly to window frame on both sides.

B. Closures, Trim, and Panning: External corners mitered and internal corners coped, fitted with hairline, tightly closed joints.
   1. Secure to concrete and solid masonry with expansion bolts, expansion rivets, split shank drive bolts, or powder actuated drive pins.
   2. Toggle bolt to hollow masonry units.
   3. Screw to wood and metal.

C. Fasten except for strap anchors, near ends and corners and maximum 300 mm (12 inches) on center.

D. Seal units following installation to provide weathertight system.

3.4 ADJUSTING

A. Adjust ventilating sash and hardware to provide tight fit at contact points, and at weather-stripping for smooth operation and weathertight closure.

3.5 FIELD TESTING

A. Field Tests: Performed by testing laboratory specified in Section 01 45 29, TESTING LABORATORY SERVICES.

B. Test Method: AAMA 502.

C. Test Specimen:
   1. Include window assembly and construction. Affix test chamber to interior side of test specimen and the conduct testing using positive static air pressure (Test method A).
   2. Test specimens to be selected by the Contracting Officer's Representative after windows have been installed according to the drawings and specification.

3.6 CLEANING

A. Lubricate hardware and moving parts.

B. Remove excess glazing and sealant compounds.

C. Clean exposed aluminum and glass surfaces. Remove contaminants and stains.

D. Keep windows locked except while adjusting and testing.

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SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Door hardware and related items necessary for complete installation and operation of doors.

1.2 RELATED WORK

A. Caulking: Section 07 92 00 JOINT SEALANTS.

B. Application of Hardware:
   1. Section 08 11 13, HOLLOW METAL DOORS AND FRAMES
   2. Section 08 14 00, INTERIOR WOOD DOORS
   3. Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

C. Painting: Section 09 91 00, PAINTING.

D. Card Readers: Section 28 13 00, PHYSICAL ACCESS CONTROL SYSTEMS.

E. Electrical: Division 26, ELECTRICAL.

F. Fire Detection: Section 28 31 00, FIRE DETECTION AND ALARM.

1.3 GENERAL

A. All hardware shall comply with ABAAS, (Architectural Barriers Act Accessibility Standard) unless specified otherwise.

B. Provide rated door hardware assemblies where required by most current version of the International Building Code (IBC).

C. Hardware for Labeled Fire Doors and Exit Doors: Conform to requirements of NFPA 80 for labeled fire doors and to NFPA 101 for exit doors, as well as to other requirements specified. Provide hardware listed by UL, except where heavier materials, large size, or better grades are specified herein under paragraph HARDWARE SETS. In lieu of UL labeling and listing, test reports from a nationally recognized testing agency may be submitted showing that hardware has been tested in accordance with UL test methods and that it conforms to NFPA requirements.

D. Hardware for application on metal and wood doors and frames shall be made to standard templates. Furnish templates to the fabricator of these items in sufficient time so as not to delay the construction.

E. The following items shall be of the same manufacturer, except as otherwise specified:
   1. Mortise locksets.
   2. Hinges for hollow metal and wood doors.
   3. Surface applied overhead door closers.
   4. Exit devices.
   5. Floor closers.

1.4 WARRANTY

A. Automatic door operators shall be subject to the terms of FAR Clause 52.246-21, except that the Warranty period shall be two years in lieu of one year for all items except as noted below:
   1. Locks, latchsets, and panic hardware: 5 years.
   2. Door closers and continuous hinges: 10 years.

1.5 MAINTENANCE MANUALS

A. In accordance with Section 01 00 00, GENERAL REQUIREMENTS Article titled "INSTRUCTIONS", furnish maintenance manuals and instructions on all door hardware. Provide installation instructions with the submittal documentation.

1.6 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Submit 6 copies of the schedule per Section 01 33 23. Submit 2 final copies of the final approved schedules to VAMC Locksmith as record copies (VISN Locksmith if the VAMC does not have a locksmith).

B. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1) Function of building, purpose of each area and degree of security required.
2) Plans for existing and future key system expansion.
3) Requirements for key control storage and software.
4) Installation of permanent keys, cylinder cores and software.
5) Address and requirements for delivery of keys.

C. Hardware Schedule: AHC certified hardware consultant to prepare and submit hardware schedule in the following form:

Hardware Item	Quantity	Size	Reference Publication Type No.	Finish	Mfr. Name and Catalog No.	Key Control Symbols	UL Mark (if fire rated and listed)	ANSI/BHMA Finish Designation

D. Ligature Resistant Door Alarm Riser Diagram: Prepare and submit 6 copies of shop drawings of electric riser diagram complete with all required equipment components. Submission shall be in accordance with requirements per Section 01 33 23 for review and approval by project CO. Along with shop drawing submittal provide installation data. At completion of project provide CO with operation and maintenance manuals

E. Samples and Manufacturers' Literature:

1. Samples: All hardware items (proposed for the project) that have not been previously approved by Builders Hardware Manufacturers Association shall be submitted for approval. Tag and mark all items with manufacturer's name, catalog number and project number.
2. Samples are not required for hardware listed in the specifications by manufacturer's catalog number, if the contractor proposes to use the manufacturer's product specified.

F. Certificate of Compliance and Test Reports: Submit certificates that hardware conforms to the requirements specified herein. Certificates shall be accompanied by copies of reports as referenced. The testing shall have been conducted either in the manufacturer's plant and certified by an independent testing laboratory or conducted in an independent laboratory, within four years of submittal of reports for approval.

1.7 DELIVERY AND MARKING

A. Deliver items of hardware to job site in their original containers, complete with necessary appurtenances including screws, keys, and instructions. Tag one of each different item of

hardware and deliver to COR for reference purposes. Tag shall identify items by Project Specification number and manufacturer's catalog number. These items shall remain on file in COR's office until all other similar items have been installed in project, at which time the COR will deliver items on file to Contractor for installation in predetermined locations on the project.

1.8 PREINSTALLATION MEETING

A. Convene a preinstallation meeting not less than 30 days before start of installation of door hardware. Require attendance of parties directly affecting work of this section, including Contractor and Installer, Architect, Project Engineer and VA Locksmith, Hardware Consultant, and Hardware Manufacturer's Representative. Review the following:
1. Inspection of door hardware.
2. Job and surface readiness.
3. Coordination with other work.
4. Protection of hardware surfaces.
5. Substrate surface protection.
6. Installation.
7. Adjusting.
8. Repair.
9. Field quality control.
10. Cleaning.

1.9 INSTRUCTIONS

A. Hardware Set Symbols on Drawings: Except for protective plates, door stops, mutes, thresholds and the like specified herein, hardware requirements for each door are indicated on drawings by symbols. Symbols for hardware sets consist of letters (e.g., "HW") followed by a number. Each number designates a set of hardware items applicable to a door type.

B. Keying: All cylinders shall be keyed into existing Best Great Grand Master Key System. Provide removable core cylinders that are removable only with a special key or tool without disassembly of knob or lockset. Cylinders shall be 6 type. Keying information shall be furnished at a later date by the COR.

1.10 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. In text, hardware items are referred to by series, types, etc., listed in such specifications and standards, except as otherwise specified.

B. ASTM International(ASTM):
F883-13 ..... Padlocks

E2180-18..... Standard Test Method for Determining the Activity of Incorporated Antimicrobial Agent(s) In Polymeric or Hydrophobic Materials

C. American National Standards Institute/Builders Hardware Manufacturers Association (ANSI/BHMA):
A156.1-06 ..... Butts and Hinges

A156.2-03 ..... Bored and Pre-assembled Locks and Latches

A156.3-08 ..... Exit Devices, Coordinators, and Auto Flush Bolts

A156.4-08 ..... Door Controls (Closers)

A156.5-14 ..... Cylinders and Input Devices for Locks.

A156.6-05 ..... Architectural Door Trim

A156.8-05 ..... Door Controls-Overhead Stops and Holders

A156.11-14 ..... Cabinet Locks

A156.12-05 ..... Interconnected Locks and Latches

A156.13-05 ..... Mortise Locks and Latches Series 1000

A156.14-07 ..... Sliding and Folding Door Hardware

A156.15-06 ..... Release Devices-Closer Holder, Electromagnetic and Electromechanical

A156.16-08 ..... Auxiliary Hardware

A156.17-04 ..... Self-Closing Hinges and Pivots

A156.18-06 ..... Materials and Finishes

A156.20-06 ..... Strap and Tee Hinges, and Hasps

A156.21-09 ..... Thresholds

A156.22-05 ..... Door Gasketing and Edge Seal Systems

A156.23-04 ..... Electromagnetic Locks

A156.24-03 ..... Delayed Egress Locking Systems

A156.25-07 ..... Electrified Locking Devices

A156.26-06 ..... Continuous Hinges

A156.28-07 ..... Master Keying Systems

A156.29-07 ..... Exit Locks and Alarms

A156.30-03 ..... High Security Cylinders

A156.31-07 ..... Electric Strikes and Frame Mounted Actuators

A156.36-10 ..... Auxiliary Locks

A250.8-03 ..... Standard Steel Doors and Frames

D. National Fire Protection Association (NFPA):
   80-19 ..... Fire Doors and Other Opening Protectives

   101-21 ..... Life Safety Code

E. Underwriters Laboratories, Inc. (UL):
   1. Building Materials Directory

PART 2 - PRODUCTS

2.1 BUTT HINGES

A. ANSI A156.1. Provide only three-knuckle hinges, except five-knuckle where the required hinge type is not available in a three-knuckle version (e.g., some types of swing-clear hinges). The following types of butt hinges shall be used for the types of doors listed, except where otherwise specified:
   1. Exterior Doors: Type A2112/A5112 for doors 900 mm (3 feet) wide or less and Type A2111/A5111 for doors over 900 mm (3 feet) wide. Hinges for exterior outswing doors shall have non-removable pins. Hinges for exterior fire-rated doors shall be of stainless steel material.
   2. Interior Doors: Type A8112/A5112 for doors 900 mm (3 feet) wide or less and Type A8111/A5111 for doors over 900 mm (3 feet) wide. Hinges for doors exposed to high humidity areas (shower rooms, toilet rooms, kitchens, janitor rooms, etc. shall be of stainless steel material.

B. Provide quantity and size of hinges per door leaf as follows:

1. Doors up to 1210 mm (4 feet) high: 2 hinges.
2. Doors 1210 mm (4 feet) to 2260 mm (7 feet 5 inches) high: 3 hinges minimum.
3. Doors greater than 2260 mm (7 feet 5 inches) high: 4 hinges.
4. Doors up to 900 mm (3 feet) wide, standard weight: 114 mm x 114 mm (4-1/2 inches x 4-1/2 inches) hinges.
5. Doors over 900 mm (3 feet) to 1065 mm (3 feet 6 inches) wide, standard weight: 127 mm x 114 mm (5 inches x 4-1/2 inches).
6. Doors over 1065 mm (3 feet 6 inches) to 1210 mm (4 feet), heavy weight: 127 mm x 114 mm (5 inches x 4-1/2 inches).
7. Provide heavy-weight hinges where specified.
8. At doors weighing 330 kg (150 pounds) or more, furnish 127 mm (5 inch) high hinges.

C. See Articles "MISCELLANEOUS HARDWARE" and "HARDWARE SETS" for pivots and hinges other than butts specified above and continuous hinges specified below.

2.2 CONTINUOUS HINGES

A. ANSI/BHMA A156.26, Grade 1-600.
1. Listed under Category N in BHMA's "Certified Product Directory."

B. General: Minimum 0.120-inch- (3.0-mm-) thick, hinge leaves with minimum overall width of 4 inches (102 mm); fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete

C. Continuous, Barrel-Type Hinges: Hinge with knuckles formed around a Teflon-coated 6.35mm (0.25-inch) minimum diameter pin that extends entire length of hinge.
1. Base Metal for Exterior Hinges: Stainless steel.
2. Base Metal for Interior Hinges: Steel.
   a. Hinges for doors exposed to high humidity areas (shower rooms, toilet rooms, kitchens, janitor rooms, etc.) shall be of stainless steel material .
3. Base Metal for Hinges for Fire-Rated Assemblies: Stainless steel.
4. Provide with non-removable pin (hospital tip option) at lockable outswing doors.
5. Where required to clear adjacent casing, trim, and wall conditions and allow full door swing, provide wide throw hinges of minimum width required.
6. Provide with manufacturer’s cut-outs for separate mortised power transfers and/or mortised automatic door bottoms where they occur.
7. Where thru-wire power transfers are integral to the hinge, provide hinge with easily removable portion to allow easy access to wiring connections.
8. Where models are specified that provide an integral wrap-around edge guard for the hinge edge of the door, provide manufacturer’s adjustable threaded stud and machine screw mechanism to allow the door to be adjusted within the wrap-around edge guard.
9. Provide additional fire labels for both frame and door panel(s) on the top of door panel and head of frame.

2.3 DOOR CLOSING DEVICES

A. Closing devices shall be products of one manufacturer for each type specified.

2.4 OVERHEAD CLOSERS

A. Conform to ANSI A156.4, Grade 1.

B. Closers shall conform to the following:
1. The closer shall have minimum 50 percent adjustable closing force over minimum value for that closer and have adjustable hydraulic back check effective between 60 degrees and 85 degrees of door opening.
2. Where specified, closer shall have hold-open feature.
3. Size Requirements: Provide multi-size closers, sizes 1 through 6, except where multi-size closer is not available for the required application.
4. Material of closer body shall be forged or cast.

5. Arm and brackets for closers shall be steel, malleable iron or high strength ductile cast iron.
6. Where closers are exposed to the exterior or are mounted in rooms that experience high humidity, provide closer body and arm assembly of stainless steel material.
7. Closers shall have full size metal cover; plastic covers will not be accepted.
8. Closers shall have adjustable hydraulic back-check, separate valves for closing and latching speed, adjustable back-check positioning valve, and adjustable delayed action valve.
9. Provide closers with any accessories required for the mounting application, including (but not limited to) drop plates, special soffit plates, spacers for heavy-duty parallel arm fifth screws, bull-nose or other regular arm brackets, longer or shorter arm assemblies, and special factory templating. Provide special arms, drop plates, and templating as needed to allow mounting at doors with overhead stops and/or holders.
10. Closer arms or backcheck valve shall not be used to stop the door from overswing, except in applications where a separate wall, floor, or overhead stop cannot be used.
11. Provide parallel arm closers with heavy duty rigid arm.
12. Where closers are to be installed on the push side of the door, provide parallel arm type except where conditions require use of top jamb arm.
13. Provide all surface closers with the same body attachment screw pattern for ease of replacement and maintenance.
14. All closers shall have a 1 ½” (38mm) minimum piston diameter.

2.5 FLOOR CLOSERS AND FLOOR PIVOT SETS

A. Comply with ANSI A156.4. Provide stainless steel floor plates for floor closers and floor pivots, except where metal thresholds occur. Provide cement case for all floor closers. Floor closers specified for fire doors shall comply with Underwriters Laboratories, Inc., requirements for concealed type floor closers for classes of fire doors indicated on drawings. Hold-open mechanism, where required, shall engage when door is opened 105 degrees, except when door swing is limited by building construction or equipment, the hold-open feature shall engage when door is opened approximately 90 degrees. The hold-open mechanism shall be selectable on/off by turning a screw through the floor plate. Floor closers shall have adjustable hydraulic back-check, adjustable close speed, and adjustable latch speed. Provide closers with delayed action where a hold-open mechanism is not required. Floor closers shall be multi-sized. Single acting floor closers shall also have built in dead stop. Where required, provide closers with special cement cases appropriate for shallow deck installation or where concrete joint lines run through the floor blockout. At offset-hung doors installed in deep reveals, provide special closer arm and spindle to allow for installation. Where stone or terrazzo is applied over the floor closer case, provide closer without floor plate and with extended spindle (length as required) and special cover pan (depth as required) to allow closer to be accessed without damaging the material applied over the closer. Pivots for non-labeled doors shall be cast, forged or extruded brass or bronze.

B. Where floor closer appears in hardware set provide the following as applicable.
   1. Double Acting Floor Closers: Type C06012.
   2. Single Acting Floor Closer: Type C06021 (center pivoted). (Intermediate pivot is not required).
   3. Single Acting Floor Closers: Type C06041 (offset pivoted).
   4. Single Acting Floor Closer for Labeled Fire Doors: Type C06051 (offset pivoted).
   5. Single Acting Floor Closers For Lead Lined Doors: Type C06071 (offset pivoted).

2.6 DOOR STOPS

A. Conform to ANSI A156.16.

B. Provide door stops wherever an opened door or any item of hardware thereon would strike a wall, column, equipment or other parts of building construction. For concrete, masonry or quarry tile construction, use expansion shields for mounting door stops.

C. Where locks with turn pieces or pushbuttons occur, equip wall bumpers Type L02251 (rubber pads having concave face) to receive turn piece or button.

D. Provide floor stops (Type L02141 or L02161) in office areas; Type L02121 x 3 screws into floor elsewhere. Wall bumpers, where used, must be installed to impact the trim or the door within the leading half of its width. Floor stops, where used, must be installed within 4-inches of the wall face and impact the door within the leading half of its width.

E. Where drywall partitions occur, use floor stops, Type L02141 or L02161 in office areas, Type L02121 elsewhere.

F. Provide stop Type L02011, as applicable for exterior doors. At outswing doors where stop can be installed in concrete, provide stop mated to concrete anchor set in 76mm (3-inch) core-drilled hole and filled with quick-setting cement.

G. Omit stops where floor mounted door holders are required and where automatic operated doors occur.

H. Provide appropriate roller bumper for each set of doors (except where closet doors occur) where two doors would interfere with each other in swinging.

I. Provide appropriate door mounted stop on doors in individual toilets where floor or wall mounted stops cannot be used.

J. Provide overhead surface applied stop Type C02541, ANSI A156.8 on patient toilet doors in bedrooms where toilet door could come in contact with the bedroom door.

K. Provide door stops on doors where combination closer magnetic holders are specified, except where wall stops cannot be used or where floor stops cannot be installed within 4-inches of the wall.

L. Where the specified wall or floor stop cannot be used, provide concealed overhead stops (surface-mounted where concealed cannot be used).

2.7 OVERHEAD DOOR STOPS AND HOLDERS

A. Conform to ANSI Standard A156.8. Overhead holders shall be of sizes recommended by holder manufacturer for each width of door. Set overhead holders for 110 degree opening, unless limited by building construction or equipment. Provide Grade 1 overhead concealed slide type: stop-only at rated doors and security doors, hold-open type with exposed hold-open on/off control at all other doors requiring overhead door stops.

2.8 FLOOR DOOR HOLDERS

A. Conform to ANSI Standard A156.16. Provide extension strikes for Types L01301 and L01311 holders where necessary.

2.9 LOCKS AND LATCHES

A. Basis of Design; Corbin Russwin ML2000 Series Mortise Locksets. No substitutions permitted.

B. Conform to ANSI A156.2. Locks and latches for doors 45 mm (1-3/4 inch) thick or over shall have beveled fronts. Lock cylinders shall have not less than seven pins. Cylinders for all locksets shall be interchangeable core type, small format, "K" keyway cores. Cylinders shall be furnished with construction removable cores and construction master keys. Cylinder shall be removable by special key or tool. Construct all cores so that they will be interchangeable into the core housings of all mortise locks, rim locks, cylindrical locks, and any other type lock included in the Great Grand Master Key System. Disassembly of lever or lockset shall not be required to remove core from lockset. All locksets or latches on double doors with fire label shall have latch bolt with 19 mm (3/4 inch) throw, unless shorter throw allowed by the door manufacturer’s fire label. Provide temporary keying device or construction core to allow opening and closing during construction and prior to the installation of final cores.

C. In addition to above requirements, locks and latches shall comply with following requirements:

1. Mortise Lock and Latch Sets: Conform to ANSI/BHMA A156.13. Mortise locksets shall be series 1000, minimum Grade 1. All locksets and latchsets, except on designated doors in Psychiatric (Mental Health) areas, shall have lever handles fabricated from cast stainless steel. Provide sectional (lever x rose) lever design matching Corbin Russwin ML2000 Series. No substitute lever material shall be accepted. All locks and latchsets shall be furnished with 122.55 mm (4-7/8-inch) curved lip strike and wrought box. At outswing pairs with overlapping astragals, provide flat lip strip with 21mm (7/8-inch) lip-to-center dimension. All doors provided on this project shall include keyed cores for integration with our grand master system. Cores shall be small format interchangeable cores (SFIC). All lock cases installed on lead lined doors shall be lead lined before applying final hardware finish. Furnish armored fronts for all mortise locks. Where mortise locks are installed in high-humidity locations or where exposed to the exterior on both sides of the opening, provide non-ferrous mortise lock case.
2. Auxiliary locks shall be as specified under hardware sets and conform to ANSI A156.36.

2.10 ELECTROMAGNETIC LOCKS

A. ANSI/BHMA A156.23; electrically powered, of strength and configuration indicated; with electromagnet attached to frame and armature plate attached to door. Listed under Category E in BHMA's "Certified Product Directory."
1. Type: Full exterior or full interior, as required by application indicated.
2. Strength Ranking: 1500 pound force (6672 N)Inductive Kickback Peak Voltage: Not more than 3V.
3. Residual Magnetism: Not more than 4 pound force (18 N)to separate door from magnet.

B. Delayed-Egress Locks: BHMA A156.24. Listed under Category G in BHMA's "Certified Product Directory".
1. Means of Egress Doors: Lock releases within 15 seconds after applying a force not more than 15 pound force (67 N) for not more than 3 seconds, as required by NFPA 101.
2. Security Grade: Activated from secure side of door by initiating device.
3. Movement Grade: Activated by door movement as initiating device.
4. The lock housing shall not project more than 4-inches (101mm) from the underside of the frame head stop.

2.11 ELECTRIC STRIKES

A. ANSI/ BHMA A156.31 Grade 1.

B. General: Use fail-secure electric strikes at fire-rated doors.

2.12 KEYS

A. Stamp all keys with change number and key set symbol. Furnish keys in quantities as follows:

Locks/Keys	Quantity
Cylinder locks	2 keys each
Cylinder lock change key blanks	100 each different key way
Master-keyed sets	6 keys each
Grand Master sets	6 keys each
Great Grand Master set	5 keys
Control key	2 keys

2.13 ARMOR PLATES, KICK PLATES, MOP PLATES AND DOOR EDGING

A. Conform to ANSI Standard A156.6.

B. Provide protective plates and door edging as specified below:
1. Kick plates, mop plates and armor plates of metal, Type J100 series.

2. Provide kick plates and mop plates where specified. Kick plates shall be 16 inches high. Mop plates shall be 152 mm (6 inches) high. Both kick and mop plates shall be minimum 1.27 mm (0.050 inches) thick. Provide kick and mop plates beveled on all 4 edges (B4E). On push side of doors where jamb stop extends to floor, make kick plates 38 mm (1-1/2 inches) less than width of door, except pairs of metal doors which shall have plates 25 mm (1 inch) less than width of each door. Extend all other kick and mop plates to within 6 mm (1/4 inch) of each edge of doors. Kick and mop plates shall butt astragals. For jamb stop requirements, see specification sections pertaining to door frames.
3. Kick plates and/or mop plates are not required on following door sides:
   a. Armor plate side of doors;
   b. Exterior side of exterior doors;
   c. Closet side of closet doors;
   d. Both sides of aluminum entrance doors.
4. Armor plates for doors are listed under Article "Hardware Sets". Armor plates shall be thickness as noted in the hardware set, 875 mm (35 inches) high and 38 mm (1-1/2 inches) less than width of doors, except on pairs of metal doors. Provide armor plates beveled on all 4 edges (B4E). Plates on pairs of metal doors shall be 25 mm (1 inch) less than width of each door. Where top of intermediate rail of door is less than 875 mm (35 inches) from door bottom, extend armor plates to within 13 mm (1/2 inch) of top of intermediate rail. On doors equipped with panic devices, extend armor plates to within 13 mm (1/2 inch) of panic bolt push bar.
5. Where louver or grille occurs in lower portion of doors, substitute stretcher plate and kick plate in place of armor plate. Size of stretcher plate and kick plate shall be 254 mm (10 inches) high.
6. Provide stainless steel edge guards where so specified at wood doors. Provide mortised type instead of surface type except where door construction and/or ratings will not allow. Provide edge guards of bevel and thickness to match wood door. Provide edge guards with factory cut-outs for door hardware that must be installed through or extend through the edge guard. Provide full-height edge guards except where door rating does not allow; in such cases, provide edge guards to height of bottom of typical lockset armor front. Forward edge guards to wood door manufacturer for factory installation on doors.
7. Armor plates for doors shall be listed per NFPA 80; installed per door testing, and bear label from testing agency. Forward armor plates to wood door manufacturer for factory installation on doors.

2.14 EXIT DEVICES

A. Conform to ANSI Standard A156.3. Exit devices shall be Grade 1; type and function are specified in hardware sets. Provide flush with finished floor strikes for vertical rod exit devices in interior of building. Trim shall have cast satin stainless steel lever handles of design similar to locksets, unless otherwise specified. Provide key cylinders for keyed operating trim and, where specified, cylinder dogging.

B. Surface vertical rod panics shall only be provided less bottom rod; provide fire pins as required by exit device and door fire labels. Do not provide surface vertical rod panics at exterior doors.

C. Concealed vertical rod panics shall be provided less bottom rod at interior doors, unless lockable or otherwise specified; provide fire pins as required by exit device and door fire labels. Where concealed vertical rod panics are specified at exterior doors, provide with both top and bottom rods.

D. Where removable mullions are specified at pairs with rim panic devices, provide mullion with key-removable feature.

E. At non-rated openings with panic hardware, provide panic hardware with key cylinder dogging feature.

F. Exit devices for fire doors shall comply with Underwriters Laboratories, Inc., requirements for Fire Exit Hardware. Submit proof of compliance.

G. Electrified devices:
1. Include concealed Power Transfer devices where electrified Exit devices are scheduled.
   a. Select Power Transfer models having required number of conductors and conductors of the wire gauge recommended for the device served.
2. Include Power Supply as required.

H. Delayed Egress Devices
1. Meet the following Regulatory Requirements:
   a. National Fire Protection Association Life Safety Code 101
   b. International Building Code
   c. UL 294 Listing
2. Include concealed Power Transfer devices where delayed egress Exit devices are scheduled.
   a. Select Power Transfer models having required number of conductors and conductors of the wire gauge recommended for the device served.
3. Include Power Supply as required.
4. Control Panel:
   a. Fire Alarm contacts
   b. Secure Status contacts
   c. Card Readers
   d. Remote Alarms
   e. Door Position Switch.
5. Signage or decal to be applied to the door panels for each delayed egress exit device.
   a. Silk screen on device
   b. See Section 28 13 00, PHYSICAL ACCESS CONTROL SYSTEMS 2.14 D. 2. g.
6. Status Indicator at the device for the following statuses:
   a. Armed
   b. Off
   c. Rearm Delay
7. Key Switch to arm, disarm, and reset the device.
   a. Key to be removable in either position.
8. Selectable Delay to egress:
   a. 15 Seconds
   b. 30 Second where the AHJ approves
      1) For this project the AHJ approves the use of the 30 Second delay.
9. Selectable Nuisance Delay:
   a. Allow Push Pad to be actuated and released and alarm to not sound.
   b. Nuisance Delay selectable between:
      1) 0 Seconds, off
      2) 1 Second
      3) 3 Seconds.
10. Rearm Delay:
   a. Selectable between 0 and 30 seconds and device will rearm after the door is closed.
   b. Rearm Delay shall also use the door position switch.
11. Internal Alarm
   a. To sound continuously during and after a fire alarm or a Release Delay.
   b. Status indicator and Internal Alarm shall pulse fast during the nuisance delay or a tamper.
   c. Pulses slow during the disarmed powerup mode.
12. Fail Secure (FSE)
   a. Trim shall fail secure (FSE) unless noted otherwise.
13. Dogging
   a. No Dogging allowed unless noted otherwise
   b. Provide cylinder dogging with SFIC cores.
14. Cylinder

a. Provide cylinder to retract latch
b. Provide cylinder with SFIC cores.

2.15 FLUSH BOLTS (LEVER EXTENSION)

A. Conform to ANSI A156.16. Flush bolts shall be Type L24081 unless otherwise specified. Furnish proper dustproof strikes conforming to ANSI A156.16, for flush bolts required on lower part of doors.

B. Lever extension manual flush bolts shall only be used at non-fire-rated pairs for rooms only accessed by maintenance personnel.

C. Face plates for cylindrical strikes shall be rectangular and not less than 25 mm by 63 mm (1 inch by 2-1/2 inches).

D. Friction-fit cylindrical dustproof strikes with circular face plate may be used only where metal thresholds occur.

E. Provide extension rods for top bolt where door height exceeds 2184 mm (7 feet 2 inches).

2.16 FLUSH BOLTS (AUTOMATIC)

A. Conform to ANSI A156.3. Dimension of flush bolts shall conform to ANSI A115. Bolts shall conform to Underwriters Laboratories, Inc., requirements for fire door hardware. Flush bolts shall automatically latch and unlatch. Furnish dustproof strikes conforming to ANSI A156.16 for bottom flush bolt. Face plates for dustproof strike shall be rectangular and not less than 38 mm by 90 mm (1-1/2 by 3-1/2 inches).

B. At interior doors, provide auto flush bolts less bottom bolt, unless otherwise specified, except at wood pairs with fire-rating greater than 20 minutes; provide fire pins as required by auto flush bolt and door fire labels.

2.17 DOOR PULLS WITH PLATES

A. Conform to ANSI A156.6. Pull Type J401, 152 mm CTC (6 inches CTC) length by 19 mm (3/4 inches) diameter minimum with plate Type J302, 90 mm by 381 mm (3-1/2 inches by 15 inches), unless otherwise specified. Provide pull with projection of 57.2 mm (2 1/4 inches) minimum and a clearance of 38.1 mm (1 1/2 inches) minimum. Cut plates of door pull plate for cylinders, or turn pieces where required.

2.18 PUSH PLATES

A. Conform to ANSI A156.6. Metal, Type J302, 203 mm (8 inches) wide by 406.4 mm (16 inches) high. Provide metal Type J302 plates 102 mm (4 inches) wide by 406.4 mm (16 inches) high where push plates are specified for doors with stiles less than 203 mm (8 inches) wide. Cut plates for cylinders, and turn pieces where required.

2.19 COMBINATION PUSH AND PULL PLATES

A. Conform to ANSI 156.6. Type J303, stainless steel 3 mm (1/8 inch) thick, 80 mm (3-1/3 inches) wide by 800 mm (16 inches) high), top and bottom edges shall be rounded. Secure plates to wood doors with 38 mm (1-1/2 inch) long No. 12 wood screws. Cut plates for turn pieces, and cylinders where required. Pull shall be mounted down.

2.20 COORDINATORS

A. Conform to ANSI A156.16. Coordinators, when specified for fire doors, shall comply with Underwriters Laboratories, Inc., requirements for fire door hardware. Coordinator may be omitted on exterior pairs of doors where either door will close independently regardless of the position of the other door. Coordinator may be omitted on interior pairs of non-labeled open where open back strike is used. Open back strike shall not be used on labeled doors. Paint coordinators to match door frames, unless coordinators are plated. Provide bar type coordinators, except where gravity coordinators are required at acoustic pairs. For bar type

coordinators, provide filler bars for full width and, as required, brackets for push-side surface mounted closers, overhead stops, and vertical rod panic strikes.

2.21 THRESHOLDS

A. Conform to ANSI A156.21, mill finish extruded aluminum, except as otherwise specified. In existing construction, thresholds shall be installed in a bed of sealant with ¼-20 stainless steel machine screws and expansion shields. In new construction, embed aluminum anchors coated with epoxy in concrete to secure thresholds. Furnish thresholds for the full width of the openings.

B. For thresholds at elevators entrances see other sections of specifications.

C. At exterior doors and any interior doors exposed to moisture, provide threshold with non-slip abrasive finish.

D. Provide with miter returns where threshold extends more than 12 mm (0.5 inch) beyond face of frame.

2.22 AUTOMATIC DOOR BOTTOM SEAL AND RUBBER GASKET FOR LIGHT PROOF OR SOUND CONTROL DOORS AND SMOKE SEALS.

A. Conform to ANSI A156.22. Provide mortise or under-door type, except where not practical. For mortise automatic door bottoms, provide type specific for door construction (wood or metal).

B. Perimeter Gasketing:
   1. Perimeter Gasketing – Self-Adhesive Seals:
      a. Seal: Silicone.
      b. Fasteners: Self-adhesive strip.
      c. Color: Black
      d. Use R0E154.
   2. Perimeter Gasketing - Heavy Duty Type:
      a. Material: Extruded tempered aluminum 6063-T6.
      b. Finish (ANSI/BHMA 156.18): Clear anodized aluminum
      c. Seal: Silicone
      d. Fasteners: Stainless steel.
      e. Use R3G165
   3. 180 Degree Aluminum Retainer Brush Weatherstrip:
      a. Material: Extruded tempered aluminum 6063-T6.
      b. Finish (ANSI/BHMA A156.18): Clear anodized aluminum.
      c. Brush Construction: Densely compressed nylon filaments encased in galvanized retainer.
      d. Color: Aluminum color, black and gray nylon.
      e. Use R3A734

2.23 WEATHERSTRIPS (FOR EXTERIOR DOORS)

A. Conform to ANSI A156.22. Air leakage shall not to exceed 0.50 CFM per foot of crack length (0.000774m^3/s/m).

B. Perimeter Gasketing:
   1. Perimeter Gasketing - Heavy Duty Type:
      a. Material: Extruded tempered aluminum 6063-T6.
      b. Finish (ANSI/BHMA 156.18): Clear anodized aluminum
      c. Seal: Silicone
      d. Fasteners: Stainless steel.
      e. Use R3G165
   2. 90 Degree Aluminum Retainer Brush Weatherstrip:
      a. Material: Extruded tempered aluminum 6063-T6.
      b. Finish (ANSI/BHMA A156.18): Mill finish aluminum

c. Brush Construction: Densely compressed nylon filaments encased in galvanized retainer.
d. Color: Aluminum color, black and gray nylon
e. Use R3A414

2.24 MISCELLANEOUS HARDWARE

A. Access Doors (including Sheet Metal, Screen and Woven Wire Mesh Types): Except for fire-rated doors and doors to Temperature Control Cabinets, equip each single or double metal access door with Lock Type E07213, conforming to ANSI A156.11. Key locks as directed. Ship lock prepaid to the door manufacturer. Hinges shall be provided by door manufacturer.

B. Cylinders for Various Partitions and Doors: Key cylinders same as entrance doors of area in which partitions and door occur, except as otherwise specified. Provide cylinders to operate locking devices where specified for following partitions and doors:
1. Folding doors and partitions.
2. Slide-up doors.
3. Swing-up doors.
4. Fire-rated access doors-Engineer's key set.

C. Mutes: Conform to ANSI A156.16. Provide door mutes or door silencers Type L03011 or L03021, depending on frame material, of white or light gray color, on each steel or wood door frame, except at fire-rated frames, lead-lined frames and frames for sound-resistant, lightproof and electromagnetically shielded doors. Furnish 3 mutes for single doors and 2 mutes for each pair of doors, except double-acting doors. Provide 4 mutes or silencers for frames for each Dutch type door. Provide 2 mutes for each edge of sliding door which would contact door frame.

2.25 CONTROLLED ACCESS ACCESSORY ITEMS

A. Keyswitch (KS):
1. Wall mounted, single gang box activation device.
2. Maintained contacts unless otherwise noted; field-selectable to momentary action.
3. Red/green LED.
4. Include Cylinder.

B. Exit Button (EB):
1. Wall mounted, single gang box lock release button for emergency egress.
2. Momentary contacts.
3. Locate EB where indicated in Drawings.

C. Remote Lock Release (RLR) Button:
1. Wall mounted, single gang box activation device.
2. Convenience releasing device, located remotely from opening, to release an electrified locking mechanism.
   a. Where used with Automatic Doors: RLR shall also activate operator to open.
3. Momentary contacts.

D. Remote Lock Activation (RLA) Button:
1. Wall mounted, single gang box activation device.
2. Crisis lock Actuation Device located remotely from opening, to activate and hold an electrified locking mechanism in the event of threat to facility or occupants.
   a. Where used with Automatic Doors: RLA shall also disable other Actuation Devices on the unsecured side.
3. Alternate action/Maintained contacts.

E. Remote Lock Release (RLR) Button:
1. Surface mounted under countertop or under cabinets.
2. Convenience lock release device for staff use.
3. Where used with Automatic Doors: RLR shall also activate operator to open.
4. Momentary contacts.

F. Remote Lock Activation (RLA) Button:
   1. Surface mounted under countertop or under cabinets.
   2. Crisis lock Actuation Device to activate and hold an electrified locking mechanism in the event of threat to facility or occupants.
   3. Where used with Automatic Doors: RLA shall disable other Actuation Devices on the unsecured side.
   4. Maintained contacts.

G. Card Readers:
   1. Per Section 28 13 00, PHYSICAL ACCESS CONTROL SYSTEM.

H. Door Position Switches (DPS):
   1. Per Section 28 13 00, PHYSICAL ACCESS CONTROL SYSTEM.
      a. Exception: Where Hardware Sets specifically call for DPS to be provided by Section 08 71 00 (this section), refer to the following paragraph.

I. Div 08 Door Position Switches (DPS) specified herein:
   1. Description: Magnetic, concealed mounting, normally closed contacts.
   2. Provided and installed by Hardware supplier/installer.

J. Request-to-Exit (REX) motion sensors:
   1. Provide where necessary to shunt alarm.

K. Request-to-Exit (REX) motion sensors by Division 08:
   1. REX devices provided by Division 08 where used to momentarily drop a lock for free egress. (See Security System for REX Motion Sensors used to shunt alarm).
   2. Passive Infrared (PIR) technology, unaffected by Fire Alarm Strobes, camera flashes, ambulance lights etc.
   3. Adjustable latch time, up to 60 seconds.
   4. Tilt adjustable.
   5. Selectable Voltage: 12-24 VDC.
   6. Base Product:
   7. Optional Product: XMS by Securitron.

L. Touch Bars:
   1. Non-latching exit bar with no moving parts used to momentarily release Magnetic Lock when touched by user.
   2. Base Product: 692 SmartBar by Locknetics.
   3. Base Product: TSB-CL Touch Sense Exit Device by Securitron.

M. Fire Alarm Relays:
   1. Specified with Fire Alarm System in Section 28 31 00.

N. Low Voltage Power (centrally supplied by Security System):
   1. Unless otherwise noted, Section 28 13 00, PHYSICAL ACCESS CONTROL SYSTEM will provide low voltage power required to power items with current draw less than 2 AMP (24 VDC) including the following:
      a. Magnetic Locks.
      b. Electric Strikes.
      c. Electro-Mechanical Mortise Locksets.
      d. Electro-Mechanical Cylindrical Locksets.

O. Power Supplies (PS) – Division 08 devices installed local to opening:
   1. Provide filtered, regulated power.
   2. Include relay modules that interface with Fire Alarm System.
   3. Select power supply units that are:
      a. Same brand as primary devices being powered.
      b. Capable of receiving Fire Alarm Inputs.
      c. Capable of interfacing scheduled hardware with automatic operators.

d. Include time delay modules where required for described function.

4. Provide UL listed power supply units where ever Magnetic Locks, Electrified Locksets, Electric Strikes and similar items are scheduled.

2.26 THERMOSTATIC TEMPERATURE CONTROL VALVE CABINETS

A. Where lock is shown, equip each cabinet door (metal) with lock Type E06213, conforming to ANSI A156.36. Key locks in Key Sets approved by Contracting Officer. See mechanical drawings and specifications for location of cabinets.

B. Cabinet manufacturer shall supply the hinges, bolts and pulls. Ship locks to cabinet manufacturer for installation.

2.27 HINGED WIRE GUARDS (FOR WINDOWS, DOORS AND TRANSOMS) AND WIRE PARTITION DOORS

A. Butt hinges, type A8133 (special swaging) 100 mm by 90 mm (4 inches by 3-1/2 inches), Finish US2C.
1. 3 hinges for guards over 1060 mm (3-1/2 feet) high.
2. 2 hinges for guards less than 1060 mm (3-1/2 feet) high.

B. Conform to ANSI A156.36. Lock Type E06081 for guards and Type E06061 for partitions.
1. Keying: Except as noted otherwise, key locks like entrance door or space wherein guards and partitions are located except as otherwise specified.
2. Key locks for partitions enclosing mechanical and electrical equipment in Engineer's Set. (See detailed drawings for number of locks and butt hinges required for each guard).

2.28 FINISHES

A. Exposed surfaces of hardware shall have ANSI A156.18, finishes as specified below. Finishes on all hinges, pivots, closers, thresholds, etc., shall be as specified below under "Miscellaneous Finishes." For field painting (final coat) of ferrous hardware, see Section 09 91 00, PAINTING.

B. 626 or 630: All surfaces on exterior and interior of buildings, except where other finishes are specified.

C. Miscellaneous Finishes:
1. Hinges --exterior doors: 626 or 630.
2. Hinges --interior doors: 652 or 630.
3. Pivots: Match door trim.
4. Door Closers: Factory applied paint finish. Dull or Satin Aluminum color.
5. Thresholds: Mill finish aluminum.
6. Cover plates for floor hinges and pivots: 630.
7. Other primed steel hardware: 600.

D. Hardware Finishes for Existing Buildings: U.S. Standard finishes shall match finishes of hardware in (similar) existing spaces.

E. Anti-microbial Coating: All hand-operated hardware (levers, pulls, push bars, push plates, paddles, and panic bars) shall be provided with an anti-microbial/anti-fungal coating that has passed ASTM E2180 tests. Coating to consist of ionic silver (Ag+). Silver ions surround bacterial cells, inhibiting growth of bacteria, mold, and mildew by blockading food and respiration supplies.

2.29 BASE METALS

A. Apply specified U.S. Standard finishes on different base metals as following:

Finish	Base Metal
652	Steel
626	Brass or bronze

Finish	Base Metal
630	Stainless steel

PART 3 - EXECUTION

3.1 HARDWARE HEIGHTS

A. For existing buildings locate hardware on doors at heights to match existing hardware. The Contractor shall visit the site, verify location of existing hardware and submit locations to VA COR for approval.

B. Hardware Heights from Finished Floor:
1. Exit devices centerline of strike (where applicable) 1024 mm (40-5/16 inches).
2. Locksets and latch sets centerline of strike 1024 mm (40-5/16 inches).
3. Deadlocks centerline of strike 1219 mm (48 inches).
4. Hospital arm pull 1168 mm (46 inches) to centerline of bottom supporting bracket.
5. Centerline of door pulls to be 1016 mm (40 inches).
6. Push plates and push-pull shall be 1270 mm (50 inches) to top of plate.
7. Push-pull latch to be 1024 mm (40-5/16 inches) to centerline of strike.
8. Locate other hardware at standard commercial heights. Locate push and pull plates to prevent conflict with other hardware.

3.2 INSTALLATION

A. Closer devices, including those with hold-open features, shall be equipped and mounted to provide maximum door opening permitted by building construction or equipment. Closers shall be mounted on side of door inside rooms, inside stairs, and away from corridors, except security bedroom, bathroom and anteroom doors which shall have closer installed parallel arm on exterior side of doors. At exterior doors, closers shall be mounted on interior side. Where closers are mounted on doors they shall be mounted with hex nuts and bolts; foot shall be fastened to frame with machine screws.

B. Hinge Size Requirements:

Door Thickness	Door Width	Hinge Height
45 mm (1-3/4 inch)	900 mm (3 feet) and less	113 mm (4-1/2 inches)
45 mm (1-3/4 inch)	Over 900 mm (3 feet) but not more than 1200 mm (4 feet)	125 mm (5 inches)
35 mm (1-3/8 inch) (hollow core wood doors)	Not over 1200 mm (4 feet)	113 mm (4-1/2 inches)

C. Hinge leaves shall be sufficiently wide to allow doors to swing clear of door frame trim and surrounding conditions.

D. Where new hinges are specified for new doors in existing frames or existing doors in new frames, sizes of new hinges shall match sizes of existing hinges; or, contractor may reuse existing hinges provided hinges are restored to satisfactory operating condition as approved by COR. Existing hinges shall not be reused on door openings having new doors and new frames. Coordinate preparation for hinge cut-outs and screw-hole locations on doors and frames.

E. Hinges Required Per Door:

Door Description	Number butts
Doors 1500 mm (5 ft) or less in height	2 butts

Door Description	Number butts
Doors over 1500 mm (5 ft) high and not over 2280 mm (7 ft 6 in) high	3 butts
Doors over 2280 mm (7 feet 6 inches) high	4 butts
Dutch type doors	4 butts
Doors with spring hinges 1370 mm (4 feet 6 inches) high or less	2 butts
Doors with spring hinges over 1370 mm (4 feet 6 inches)	3 butts

F. Fastenings: Suitable size and type and shall harmonize with hardware as to material and finish. Provide machine screws and lead expansion shields to secure hardware to concrete, ceramic or quarry floor tile, or solid masonry. Fiber or rawl plugs and adhesives are not permitted. All fastenings exposed to weather shall be of nonferrous metal.

G. After locks have been installed; show in presence of COR that keys operate their respective locks in accordance with keying requirements. (All keys, Master Key level and above shall be sent Registered Mail to the Medical Center Director along with the bitting list. Also a copy of the invoice shall be sent to the COR for his records.) Installation of locks which do not meet specified keying requirements shall be considered sufficient justification for rejection and replacement of all locks installed on project.

3.3 FINAL INSPECTION

A. Installer to provide letter to VA Resident/Project Engineer that upon completion, installer has visited the Project and has accomplished the following:
1. Re-adjust hardware.
2. Evaluate maintenance procedures and recommend changes or additions, and instruct VA personnel.
3. Identify items that have deteriorated or failed.
4. Submit written report identifying problems.

3.4 DEMONSTRATION

A. Demonstrate efficacy of mechanical hardware and electrical, and electronic hardware systems, including adjustment and maintenance procedures, to satisfaction of Resident/Project Engineer and VA Locksmith.

3.5 HARDWARE SETS

A. Following sets of hardware correspond to hardware symbols shown on drawings. Only those hardware sets that are shown on drawings will be required. Disregard hardware sets listed in specifications but not shown on drawings.

B. Hardware Consultant working on a project will be responsible for providing additional information regarding these hardware sets. The numbers shown in the following sets come from BHMA standards.

Hardware Sets

Set: 1H

Each Half Height Door to Have:

1	Gate Spring Pivot Hinge	K13311
1	Door Bolt	L04151

1	Wall Stop	L02101 CONVEX
2	Silencers	L03021

Set: 1L

1	Continuous Hinge	Integral Hinge Guard Channel x Adjusta Screws (note: all rated doors with continuous hinges must have fire labels for door and frame on top of door and on header.)
1	Institutional Privacy Lock	F26
1	Kick Plate	J102
1	Wall Stop	L02101
1	Gasketing	ROY154
1	Gasket Astragal	ANSI ROE15x
1	Edge Guard	J208M / J211

Set: AD-1

1	Barn Door	by Section 083616.13
1	Cylinder	complete/ permanent core compatible with barn door system

Set: HW-2G

1	Continuous Hinge	Integral Hinge Guard Channel x Adjusta Screws (note: all rated doors with continuous hinges must have fire labels for door and frame on top of door and on header.)
1	Keyed Privacy Lock	F13 x Occupancy Indicator
1	Wall Stop	L02101
1	Surface Closer	C02011/C02021
1	Kick Plate	J102
1	Gasketing	ROY154
1	Edge Guard	J208M / J211

Set: HW-3G

1	Continuous Hinge	Integral Hinge Guard Channel x Adjusta Screws (note: all rated doors with continuous hinges must have fire labels for door and frame on top of door and on header.)
1	Office Lock	F04
1	Wall Stop	L02101
1	Kick Plate	J102
1	Gasketing	ROY154

1	Door Bottom	R0Y346 (heavy duty)
1	Coat Hook	L03121

OMIT COAT HOOK WHERE GLASS LITE PREVENTS INSTALLATION.

HW-4H

Each [MHO] Door to Have:	RATED
Hinges	QUANTITY & TYPE AS REQUIRED
1 Classroom Lock	F05
1 Closer	C02011/C02021
1 Magnetic Holder	C00011 TRI-VOLTAGE
1 Set Self-Adhesive Seals	R0Y154

POWER, WIRING, CONDUIT, AND FIRE ALARM CONNECTION BY DIVISION 26

Set: HW-4S

1	Continuous Hinge	Integral Hinge Guard Channel x Adjusta Screws (note: all rated doors with continuous hinges must have fire labels for door and frame on top of door and on header.)
1	Classroom Lock	F05
1	Armor Plate	J101
1	Wall Stop	L02101
1	Gasketing	ROY154
1	Door Bottom	R0Y346 (heavy duty)

Set: HW-5B

1	Hinges	QUANTITY & TYPE AS REQUIRED
1	Storeroom Lock	F07
1	Surface Closer	C02011/C02021
1	Armor Plate	J101
1	Wall Stop	L02101
1	Gasketing	ROY154
1	Edge Guard	J208M / J211

Set: HW-5B.1

2	Hinges	QUANTITY & TYPE AS REQUIRED
1	Dust Proof Strike	L04021
2	Flush Bolt	L04251 / L04261
1	Storeroom Lock	F07
1		
2	Surface Closer	C02011/C02021
2	Kick Plate	J102
2	Wall Stop	L02101
1	Gasketing	ROY154
1	Gasket Astragal	ANSI ROE15x
1	Kick Plate	J102
2	Edge Guard	J208M / J211

Set: HW-R1.1

1	Continuous Hinge	Integral Hinge Guard Channel x Adjusta Screws (note: all rated doors with continuous hinges must have fire labels for door and frame on top of door and on header.)
1	Institutional Privacy Lock	F26 (F02 – keyed override for staff)
2	Kick Plate	J102
1	Wall Stop	L02101
2	Gasketing	ROY154
2	Edge Guard	J208M / J211
2	Viewer	L03221 (190 degrees)

Set: HW-R1

1	Continuous Hinge	Integral Hinge Guard Channel x Adjusta Screws
1	Card Reader, REX	Refer to Section 28 13 00 Physical Access Control System
1	Institutional Privacy Lock	F26 (card access resident and staff)
1	Power Supply	Regulated, Filtered, 24VDC x Amperage as Required
1	Kick Plate	J102
1	Wall Stop	L02101
2	Gasketing	ROY154
2	Edge Guard	J208M / J211
2	Viewer	L03221 (190 degrees)
1	Electric Strike	E09391
1	Alarm Contact	

Set: HW-R1.2

1	Continuous Hinge	Integral Hinge Guard Channel x Adjusta Screws
1	Classroom Lock	F05
1	Card Reader	Refer to Section 28 13 00 Physical Access Control System
1	Power Supply	Regulated, Filtered, 24VDC x Amperage as Required
1	Kick Plate	J102
1	Wall Stop	L02101
2	Gasketing	ROY154
2	Edge Guard	J208M / J211
1	Electric Strike	E09391
1	Alarm Contact	

Set: HW-R2B

1	Continuous Hinge	Integral Hinge Guard Channel x Adjusta Screws (note: all rated doors with continuous hinges must have fire labels for door and frame on top of door and on header.)
1	Classroom Lock	F05
1	Overhead Stop	C01541-ADJUSTABLE
1	Surface Closer	C02011/C02021
2	Kick Plate	J102
2	Gasketing	ROY154
1	Door Bottom	R0Y346 (heavy duty)
1	Edge Guard	J208M / J211

1. SECURITY HARDWARE ABBREVIATIONS LEGEND:
   AC = Access Control Device (Card reader, biometric reader, keypad, etc.)

   ADO = Automatic Door Operator

   DEML = Delayed Egress Magnetic Lock

   DEPH = Delayed Egress Panic Exit Device

   DPS = Door Position Switch (Door or Alarm Contact)

   EB = Exit Button

   EL = Electric Lock or Electric Lever Exit Device

   ES = Electric Strike

   PB = Push-button Combination Lock (stand-alone)

ELR = Electric Latch Retraction Exit Device

FSE = Fail Secure

FS = Fail Safe

REX = Request-to-Exit Switch in Latching Device Inside Trim

RLA = Remote Lock Activation

RLR = Remote Lock Release

Set: HW-SH-3D

Each (AC, ES, REX, DPS) door to have:

1	Continuous Hinge	Integral Hinge Guard Channel x Adjusta Screws (note: all rated doors with continuous hinges must have fire labels for door and frame on top of door and on header.)
1	Storeroom Lock	F07 x E01
1	Electric Strike	E09391 (fail secure at rated openings)
1	Surface Closer	C02011/C02021
2	Kick Plate	J102
1	Wall Stop	L02101
1	Kick Plate	J102
1	Gasketing	ROY154
1	Door Bottom	R0Y346 (heavy duty)
1	Edge Guard	J208M / J211
1	Alarm Contact	omit at door where DPS not noted
1	Card Reader	Refer to Section 28 13 00 Physical Access Control System
1	Power Supply	Regulated, Filtered, 24VDC x Amperage as Required

Loss of Power: Fail Secure (FSE), door remains locked; ingress via key in trim.

Set: HW-SH-3D.1

Each (AC, DEPH, REX, DPS, RLR) door to have:

1	Continuous Hinge	Integral Hinge Guard Channel x Adjusta Screws x Power Transfer (note: all rated doors with continuous hinges must have fire labels for door and frame on top of door and on header.)

1	DEPH Elect Exit Device	Q2131xType 8 Elect device (E01/E05/E06 – verify) x F13 lever (no dogging)
1	Surface Closer	C02011/C02021
1	Wall Stop	L02101
1	Gasketing	ROY154
1	Alarm Contact	as req'd
1	Card Reader	Refer to Section 28 13 00 Physical Access Control System – Card access from both sides of door
1	Power Supply	Regulated, Filtered, 24VDC x Amperage as Required
1	Remote Lock Release	(install at Nurse Station)
	DEPH Regulatory Signage	Per sections 08 71 00 2.14 & 28 13 00 2.14 D 2g

Notes: Door shall be normally closed and locked.

1. Authorized entry from waiting by valid card reader, or remote release button. (Card reader should also disable alarm from both sides)
2. Egress by panic bar (waiting to corridor) only after alarm and 30 second delay or card reader override to disable alarm.
3. Loss of Power: Disable Delayed Egress; Fail Safe - door remains unlocked for exiting
4. Fire Alarm: Disable Delayed Egress, Fail Safe - door remains unlocked for exiting.
5. Free egress from corridor to elevator lobby.

Set: HW-SH-4

Each (AC, DEPH, REX, DPS) Door to Have:

1	Continuous Transfer Hinge	A51031B x 4Wire (note: all rated doors with continuous hinges must have fire labels for door and frame on top of door and on header.)
1	DEPH Elect Exit Device	Q2131 x Type 8 Electrical device x E01 x E05/E06 x F13 Lever (no dogging)
1		
1	Surface Closer	C02011/C02021
2	Kick Plate	J102
1	Wall Stop	L02101
1	Gasketing	R0E154
2	Edge Guard	J208M / J211
1	Alarm Contact	as req'd
2	Card Reader	Refer to Section 28 13 00 Physical Access Control System – Card access from both sides of door (to override Delay egress on exiting into stair)

1	Power Supply	Regulated, Filtered, 24VDC x Amperage as Required
	DEPH Regulatory Signage	Per sections 08 71 00 2.14 & 28 13 00 2.14 D 2 g

Notes: Door is normally closed and locked from Stair side, Delayed egress from Corridor side.

1. Authorized entry from stair side by valid card reader will momentarily unlock door permitting entry, and disable alarm
2. Egress to stair by panic bar but only after alarm and 30 second delay..
3. Card reader on egress side or emergency alarm will bypass delay permitting immediate egress.
4. Loss of Power: Disable Delayed Egress; Fail Safe - door remains unlocked for exiting
5. Fire Alarm: Disable Delayed Egress, Fail Safe - door remains unlocked for exiting

HW-SH-4H

Each (AC, ES, DPS) door to have:

1	Continuous Hinge	Integral Hinge Guard Channel x Adjusta Screws (note: all rated doors with continuous hinges must have fire labels for door and frame on top of door and on header.)
1	Storeroom Lock	F07 x E01
1	Electric Strike	E09391 (fail secure at rated openings)
1	Kick plate	J102
1	Surface Closer	C02011/C02021 HO – manual hold open feature
1	Wall Stop	L02101
1	Gasketing	ROY154
1	Alarm Contact	
1	Card Reader	Refer to Section 28 13 00 Physical Access Control System
1	Power Supply	Regulated, Filtered, 24VDC x Amperage as Required

Notes: Door is normally held open during the day. Close and locked when not using rooms

1. Authorized entry from main corridor side by valid card reader.
2. Exiting available at all time from classroom side.

Set: HW-SH-8

Each (MHO) Pair Doors to Have: RATED

2	Push/Pull Trim	C02011/C02021 HO – manual hold open feature
2	Continuous Hinges	A51031B x WIDE THROW AS REQUIRED TO ACHIEVE FULL DOOR SWING (note: all rated doors with continuous hinges must have fire labels for door and frame on top of door and on header.)
2	Closers	C02011 (PT4D, PT4H) x 180° SWING

2	Magnetic Holders	C00011 TRI VOLTAGE
1	Set Self Adhesive Seals	R0E154
1	Overlapping Astragal	R0Y634 x R0Y154 x THRU-BOLTS
4	Armor Plate	J102
2	Edge Guard	J208M / J211 (VERIFY), CUT: HARDWARE
	Power, wiring conduit and fire alarm connection by division 26	

Set: HW-SH-8.1

Each (AC, REX, DPS) Pair Doors to have:

2	Continuous Hinge	A51031B x _Wire (note: all rated doors with continuous hinges must have fire labels for door and frame on top of door and on header.)
1	Exit Device	Q2331 x Type 8 (E04) x F01 (from office corridor only)
2	Surface Closer	C02011/C02021 HO – manual hold open feature
2	Armor Plate	J101
2	Wall Stop	L02101
1	Gasketing	R0E154
1	Kick Plate	J102
2	Alarm Contact	as req'd
1	Card Reader	Refer to Section 28 13 00 Physical Access Control System
1	Power Supply	Regulated, Filtered, 24VDC x Amperage as Required

Notes:
1. Doors normally held open during office hours or closed but unlocked.
2. After hours – doors locked from Main corridor side. Access by card reader-will bypass alarm.
3. Exiting always allowed from Office corridor side.

Set: HW-SH-12

Each (AC, ES, REX, DPS) Door to Have:

1	Continuous Hinge	Integral Hinge Guard Channel x Adjusta Screws x Power Transfer (note: all rated doors with continuous hinges must have fire labels for door and frame on top of door and on header.)
1	Exit Device	Q2131 x Type 8 (E01, E04) x F03 (outside cylinder no dogging)
1	Electric Strike	E09391 (fail secure at rated openings)
1	Anti Vandal Pull	

1	Surface Closer / overhead stop	C01541-ADJUSTABLE
1	Kick Plate	J102
1	Rain Guard	Overhead Rain Drip
1	Gasketing	R3G164 / R3G165
1	Gasketing	R0E154
1	Sweep	90100CNB
1	Edge Guard	J208M / J211
1	Protector	Latch Protector
1	Alarm Contact	as req'd
1	Card Reader	Refer to Section 28 13 00 Physical Access Control System
1	Power Supply	Regulated, Filtered, 24VDC x Amperage as Required

Notes:

1. Loss of Power: fail Secure (FSE), door remains locked; ingress via key in trim

- - - E N D - - -

SECTION 08 71 13

AUTOMATIC DOOR OPERATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Automatic operators for swinging doors.

1.2 RELATED WORK

A. Section 08 41 13, ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS: Aluminum Frames Entrance Work.

B. Section 08 71 00, DOOR HARDWARE: Door Hardware.

C. Division 26, ELECTRICAL Electric General Wiring, Connections and Equipment Requirements.

D. Division 28, ELECTRONIC SAFETY AND SECURITY: Access Control Devices:.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. ASTM International (ASTM):
1. B209-14 - Aluminum and Aluminum-Alloy Sheet and Plate.
2. A1008/A1008M-20 - Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Baked Hardenable.

C. Builders Hardware Manufacturers Association (BHMA):
1. BHMA A156.10-11 - Power Operated Pedestrian Doors.

D. National Fire Protection Association (NFPA):
1. 101-15 - Life Safety Code.

E. Underwriters Laboratories (UL):
1. 325-13 - Standard for Doors, Drapery, Gate, Louver, and Window Operators and Systems.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:
1. Show size, configuration, and fabrication and installation details.

C. Manufacturer's Literature and Data:
1. Description of each product.
2. Installation instructions.
3. Warranty.

D. Sustainable Construction Submittals:
1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.

E. Test reports: Certify each product complies with specifications.

F. Qualifications: Substantiate qualifications comply with specifications.
1. Manufacturer with project experience list .
2. Installer with project experience list .

G. Operation and Maintenance Data:
   1. Care instructions for each exposed finish product.
   2. Start-up, maintenance, troubleshooting, emergency, and shut-down instructions for each operational product.

1.5 QUALITY ASSURANCE

A. Manufacturer’s Qualifications:
   1. Regularly manufactures specified products.
   2. Manufactured specified products with satisfactory service on five similar installations for minimum five years.
      a. Provide contact names and addresses for completed projects when requested by Contracting Officer's Representative.

B. Installer’s Qualifications: Experienced installer, approved by the manufacturer.

1.6 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

B. Manufacturer's Warranty: Warrant automatic door operators against material and manufacturing defects.
   1. Warranty Period: Two years.

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

A. Comply with requirements of BHMA A156.10. Unless otherwise indicated on Drawings, provide operators that move doors from fully closed to fully opened position in five seconds maximum time interval, when speed adjustment is at maximum setting.

B. Equipment: Conforming to UL 325. Provide key operated power disconnect wall switch for each door installation.

C. Electrical Wiring, Connections and Equipment: Motors, starters, controls, associated devices, and interconnecting wiring required for installation. Equipment and wiring as specified in Division 26, ELECTRICAL.

2.2 PRODUCTS - GENERAL

A. Provide door operators from one manufacturer.

B. Provide one type of operator throughout project.

C. Sustainable Construction Requirements:
   1. Steel Recycled Content: 30 percent total recycled content, minimum.
   2. Aluminum Recycled Content: 80 percent total recycled content, minimum.

2.3 SWING DOOR OPERATORS

A. General:
   1. Type: Institutional type.
   2. Size: As recommended by manufacturer for door weight and sizes.

B. Function:
   1. Provide operators, enclosed in housing, permitting opening of door by energizing motor and stopped by electrically reducing Voltage and stalling motor against mechanical stop.
   2. Door to close by means of spring energy, and closing force controlled by gear system and motor being used as dynamic brake without power, or controlled by hydraulic closer in electro-hydraulic operators.
   3. Opening and Closing Speeds: Field adjustable.

4. Operators with checking mechanism providing cushioning action at last part of door travel, in both opening and closing cycle.
5. Operators capable of recycling doors instantaneously to full open position from any point in closing cycle when control switch is activated.
6. When automatic power is interrupted or shut-off, permit doors to easily open manually without damage to automatic operator system.

C. Connect hardware with drive arm attached to door with pin linkage rotating in a self-lubricating bearing. Prevent doors from pivoting on shaft of operator.

D. Operator Housing:
1. ASTM B209, Type 6063-T5 aluminum alloy, 112 mm (4-1/2 inches) wide by 140 mm (5.5 inches) high by 3.2 mm (0.125 inch) thick, aluminum extrusions with enclosed end caps for application to 100 mm (4 inches) and larger frame systems.

E. Power Operator:
1. Completely assembled and sealed unit including gear drive transmission, mechanical spring and bearings, located in aluminum case and filled with special lubricant for extreme temperature conditions. Rubber mounted units with provisions for easy maintenance and replacement, without removing door from pivots or frame.

F. Motors:
1. Provide with interlock to prevent operation when doors are electrically locked from opening.

G. Electrical Control:
1. Self-contained electrical control unit, including necessary transformers, relays, rectifiers, and other electronic components for proper operation and switching of power operator.
2. Connecting Harnesses: Interlocking plugs.

H. Accessories:
1. Metal mounting supports, brackets and other accessories necessary for installation of operators at head of door frames.

I. Microprocessor Controls:
1. Multi-function microprocessor control providing adjustable hold open time (1-30 seconds) with fully adjustable opening speed, LED indications for sensor input signals and operator status and power assist close options. Control capable of receiving activation signals from any device with normally open dry contact output.
2. Hold doors held open by low Voltage applied to the continuous duty motor.
3. Controls:
   a. Adjustable safety circuit that monitors door operation and stops opening direction of door if obstruction is sensed.
   b. Recycle feature that reopens door if obstruction is sensed at any point during closing cycle.
   c. Standard three position key switch with functions for ON, OFF, and HOLD OPEN, mounted on operator enclosure, door frame, or wall, as indicated on drawings.

2.4 POWER UNITS

A. Self-contained, electric operated and independent of door operator.
1. Capacity and size of power circuits according to automatic door operator manufacturer's specifications and Division 26 - ELECTRICAL.

2.5 DOOR CONTROLS

A. Control Devices: BHMA A156.10; control opening and closing functions.

B. Open doors when control device is actuated; hold doors in open positions; then, close doors after a set time period, unless safety device or reactivated control interrupts operation.

C. Manual Controls:

1. Push Plate Wall Switch: Recessed type, stainless steel push plate minimum 100 mm by 100 mm (4 inch by 4 inch), with 13 mm (l/2 inch) high letters "To Operate Door-Push" engraved on face of plate.

D. Motion Detector:
1. Mounting: Surface or concealed.
2. Detection Area: 1500 mm (60 inches) deep and 1500 mm (60 inches) across, plus or minus 150 mm (6 inches).
3. Response Time: 25 milliseconds, maximum.
4. Control Power: 24 Volt DC.
5. Design units to be unaffected by cleaning material, solvents, dust, dirt and outdoor weather conditions.

2.6 SAFETY DEVICES

A. Swing Doors: Install presence sensor on pull side of door to detect any person standing in door swing path and prevent door from opening.
1. Time delay Switches: Adjustable between 3 to 60 seconds and control closing cycle of doors.

B. Install decal signs with "In" or "Do Not Enter" on both faces of each door where shown.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.
1. Verify door opening is correctly sized and within acceptable tolerances.

B. Protect existing construction and completed work from damage.

3.2 INSTALLATION

A. Install products according to manufacturer's instructions and approved submittal drawings.
1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

B. Coordinate door installation with other related work.

C. Install manual controls and power disconnect switches recessed or semi-flush mounted in partitions.

D. Secure operator components to adjacent construction with suitable fastenings.

E. Conceal conduits, piping, and electric equipment, in finish work.

F. Install power units in locations shown.
1. Where units are mounted on walls, provide metal supports or shelves for units.
2. Ensure equipment, including time delay switches, are accessible for maintenance and adjustment.

G. Ensure operators are adjusted and function properly for type of expected traffic.

H. Synchronize each leaf of pair doors to open and close simultaneously. Permit each door leaf to be opened manually, independent of other door leaf.

I. Install controls at positions shown and ensuring convenience for expected traffic.

J. Push Plate Wall Switches Mounting Height: 1000 mm (40 inches) maximum, unless otherwise approved by Contracting Officer's Representative.

3.3 DEMONSTRATION AND TRAINING

A. Instruct VA personnel in proper automatic door operator operation and maintenance.
1. Trainer: Manufacturer approved instructor.

2. Training Time: 4 hours minimum.

B. Coordinate instruction to VA personnel with VA Contracting Officer's Representative.

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SECTION 08 80 00

GLAZING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the following:
   1. Glass.
   2. Plastic glazing.
   3. Glazing materials and accessories for both factory and field glazed assemblies.

1.2 RELATED WORK

A. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS: Sustainable Construction Requirements.

B. Section 08 11 13, HOLLOW METAL DOORS AND FRAMES, and Section 08 14 00, WOOD DOORS: Sound resistant doors.

C. Section 10 28 00, TOILET, BATH, AND LAUNDRY ACCESSORIES: Mirrors.

D.

E. Section 08 51 13, ALUMINUM WINDOWS: Aluminum Windows.

F. Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER AND CONDUCTORS AND CABLES: Wiring (120 V AC, 15A or 20A).

G. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Junction and Switch Boxes.

H. Section 28 13 00,PHYSICAL ACCESS CONTROL SYSTEMS: Access Control Systems.

1.3 LABELS

A. Temporary labels:
   1. Provide temporary label on each light of glass and plastic material identifying manufacturer or brand and glass type, quality and nominal thickness.
   2. Label in accordance with NFRC label requirements.
   3. Temporary labels are to remain intact until glass and plastic material is approved by Contracting Officer Representative (COR).

B. Permanent labels:
   1. Locate in corner for each pane.
   2. Label in accordance with ANSI Z97.1 and SGCC label requirements.
      a. Tempered glass.
      b. Laminated glass or have certificate for panes without permanent label.
      c. Organic coated glass.
   3. Fire rated glazing assemblies: Mark in accordance with IBC.

1.4 PERFORMANCE REQUIREMENTS

A. General: Design glazing system consistent with guidance and practices presented in the GANA Glazing Manual, GANA Laminated Glazing Manual, and GANA Sealant Manual, as applicable to project. Installed glazing is to withstand applied loads, thermal stresses, thermal movements, building movements, permitted tolerances, and combinations of these conditions without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; unsafe engagement of the framing system; deflections beyond specified limits; or other defects in construction.

B. Glazing Unit Design: Design glass, including engineering analysis meeting requirements of authorities having jurisdiction. Thicknesses listed are minimum. Coordinate thicknesses with framing system manufacturers.
   1. Design glass in accordance with ASTM E1300, and for conditions beyond the scope of ASTM E1300, by a properly substantiated structural analysis.
   2. Design Wind Pressures: s indicated on construction documents and In accordance with ASCE 7.
   3. Wind Design Data: s indicated on construction documents and In accordance with ASCE 7 .
   4. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than the structural capacity of the glazing unit, the threshold at which frame engagement is no longer safely assured, 1/100 times the short-side length, or 19 mm (0.75 inch), whichever is less.

C. Windborne-Debris-Impact Resistance: Comply with enhanced-protection testing requirements in ASTM E1996 for project wind zone when tested according to ASTM E1886, based upon testing of specimens not less than the size required for project and utilizing installation method identical to that specified for project.
   1. Project Wind Zone: . Wind Zone 2 .
   2. Large-Missile Test: For glazing located within 9.1 m (30 feet) of grade.
   3. Small-Missile Test: For glazing located more than 9.1 m (30 feet) above grade.

D. Building Enclosure Vapor Retarder and Air Barrier:
   1. Utilize the inner pane of multiple pane sealed units for the continuity of the air barrier and vapor retarder seal.
   2. Maintain a continuous air barrier and vapor retarder throughout the glazed assembly from glass pane to heel bead of glazing sealant.

1.5 SUBMITTALS

A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Sustainable Design Submittals, as described below:
   1. Volatile organic compounds per volume as specified in PART 2 - PRODUCTS.

C. Manufacturer's Certificates:
   1. Certificate stating that fire-protection and fire-resistive glazing units meet code requirements for fire-resistance-rated assembly and applicable safety glazing requirements.
   2. Certificate on solar heat gain coefficient when value is specified.
   3. Certificate on "R" value when value is specified.

D. Manufacturer Warranty.

E. Manufacturer's Literature and Data:
   1. Glass, each kind required.
   2. Insulating glass units.
   3. Transparent (one-way vision glass) mirrors.
   4. Elastic compound for metal sash glazing.
   5. Putty, for wood sash glazing.
   6. Glazing cushion.
   7. Sealing compound.
   8. Plastic glazing material, each type required.

F. Samples:
   1. Size: 305 mm by 305 mm (12 inches by 12 inches).
   2. Tinted glass.
   3. Reflective glass.
   4. Transparent (one-way vision glass) mirrors.

G. Preconstruction Adhesion and Compatibility Test Report: Submit glazing sealant manufacturer's test report indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.

1.6 DELIVERY, STORAGE AND HANDLING

A. Delivery: Schedule delivery to coincide with glazing schedules so minimum handling of crates is required. Do not open crates except as required for inspection for shipping damage.

B. Storage: Store cases according to printed instructions on case, in areas least subject to traffic or falling objects. Keep storage area clean and dry.

C. Handling: Unpack cases following printed instructions on case. Stack individual windows on edge leaned slightly against upright supports with separators between each.

D. Protect laminated security glazing units against face and edge damage during entire sequence of fabrication, handling, and delivery to installation location. Provide protective covering on exposed faces of glazing plastics, and mark inside as "INTERIOR FACE" or "PROTECTED FACE":
   1. Treat security glazing as fragile merchandise, and packaged and shipped in export wood cases with width end in upright position and blocked together in a mass. Storage and handling to comply with manufacturer's directions and as required to prevent edge damage or other damage to glazing resulting from effects of moisture, condensation, temperature changes, direct exposure to sun, other environmental conditions, and contact with chemical solvents.
   2. Protect sealed-air-space insulating glazing units from exposure to abnormal pressure changes, as could result from substantial changes in altitude during delivery by air freight. Provide temporary breather tubes which do not nullify applicable warranties on hermetic seals.
   3. Temporary protections: The glass front and polycarbonate back of glazing are to be temporarily protected with compatible, peelable, heat-resistant film which will be peeled for inspections and re-applied and finally removed after doors and windows are installed at destination. Since many adhesives will attack polycarbonate, the film used on exposed polycarbonate surfaces is to be approved and applied by manufacturer.
   4. Edge protection: To cushion and protect glass clad, and polycarbonate edges from contamination or foreign matter, the four (4) edges are to be sealed the depth of glazing with continuous standard-thickness thermoplastic rubber tape. Alternatively, continuous channel shaped extrusion of thermoplastic rubber are to be used, with flanges extending into face sides of glazing.
   5. Protect "Constant Temperature" units including every unit where glass sheet is directly laminated to or directly sealed with metal-tube type spacer bar to polycarbonate sheet, from exposures to ambient temperatures outside the range of 16 to 24 degrees C (60 to 75 degrees F), during the fabricating, handling, shipping, storing, installation, and subsequent protection of glazing.

1.7 PROJECT CONDITIONS:

A. Field Measurements: Field measure openings before ordering tempered glass products to assure for proper fit of field measured products.

1.8 WARRANTY

A. Construction Warranty: Comply with the FAR clause 52.246-21 "Warranty of Construction".

B. Manufacturer Warranty: Manufacturer shall warranty their glazing from the date of installation and final acceptance by the Government as follows. Submit manufacturer warranty.
   1. Insulating glass units to remain sealed for ten (10) years.
   2. Laminated glass units to remain laminated for five (5) years.

1.9 APPLICABLE PUBLICATIONS:

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

B. American Architectural Manufacturers Association (AAMA):
800 ..... Test Methods for Sealants

810.1-77 ..... Expanded Cellular Glazing Tape

C. American National Standards Institute (ANSI):
Z97.1-14 ..... Safety Glazing Material Used in Building - Safety Performance Specifications and Methods of Test

D. American Society of Civil Engineers (ASCE):
7-16 ..... Wind Load Provisions

E. ASTM International (ASTM):
C542-05(2017) ..... Lock-Strip Gaskets

C716-06(2020) ..... Installing Lock-Strip Gaskets and Infill Glazing Materials

C794-18..... Adhesion-in-Peel of Elastomeric Joint Sealants

C864-05(2019) ..... Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers

C920-18..... Elastomeric Joint Sealants

C964-20..... Standard Guide for Lock-Strip Gasket Glazing

C1036-16..... Flat Glass

C1048-18..... Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass.

C1172-19..... Laminated Architectural Flat Glass

C1349-17..... Standard Specification for Architectural Flat Glass Clad Polycarbonate

C1376-15..... Pyrolytic and Vacuum Deposition Coatings on Flat Glass

D635-18..... Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastic in a Horizontal Position

D4802-16..... Poly (Methyl Methacrylate) Acrylic Plastic Sheet

E84-20..... Surface Burning Characteristics of Building Materials

E119-20..... Standard Test Methods for Fire Test of Building Construction and Material

E1300-16..... Load Resistance of Glass in Buildings

E1886-19..... Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials

E1996-17..... Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes

E2141-14..... Test Methods for Assessing the Durability of Absorptive Electrochromic Coatings on Sealed Insulating Glass Units

E2190-19..... Insulating Glass Unit

E2240-06 ..... Test Method for Assessing the Current-Voltage Cycling Stability at 90 Degree C (194 Degree F) of Absorptive Electrochromic Coatings on Sealed Insulating Glass Units

E2241-06 ..... Test Method for Assessing the Current-Voltage Cycling Stability at Room Temperature of Absorptive Electrochromic Coatings on Sealed Insulating Glass Units

E2354-10 ..... Assessing the Durability of Absorptive Electrochromic Coatings within Sealed Insulating Glass Units

E2355-10 ..... Test Method for Measuring the Visible Light Transmission Uniformity of an Absorptive Electrochromic Coating on a Glazing Surface

F1233-08(2019) ..... Standard Test Method for Security Glazing Materials and Systems

F1642/F1642M-17 ..... Test Method for Glazing and Glazing Systems Subject to Airblast Loadings

F. Code of Federal Regulations (CFR):
16 CFR 1201-10 ..... Safety Standard for Architectural Glazing Materials

G. Glass Association of North America (GANA):
2010 Edition ..... GANA Glazing Manual

2008 Edition ..... GANA Sealant Manual

2019 Edition ..... GANA Laminated Glazing Reference Manual

2010 Edition ..... GANA Protective Glazing Reference Manual

H. International Code Council (ICC):
IBC ..... International Building Code

I. Insulating Glass Certification Council (IGCC)

J. Insulating Glass Manufacturer Alliance (IGMA):
TB-3001-13 ..... Guidelines for Sloped Glazing

TM-3000 ..... North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use

K. Intertek Testing Services – Warnock Hersey (ITS-WHI)

L. National Fire Protection Association (NFPA):
80-19 ..... Fire Doors and Windows

252-17 ..... Fire Tests of Door Assemblies

257-17 ..... Standard on Fire Test for Window and Glass Block Assemblies

M. National Fenestration Rating Council (NFRC)
1. Safety Glazing Certification Council (SGCC) 2012:
2. Certified Products Directory (Issued Semi-Annually).

N. Underwriters Laboratories, Inc. (UL):
9-08(R2009) ..... Fire Tests of Window Assemblies

263-14 ..... Fire Tests of Building Construction and Materials

752-11 ..... Bullet-Resisting Equipment.

O. Department of Veterans Affairs:
1. Physical Security and Resiliency Design Manual January 2021
2. Architectural Design Manual for VA Facilities (VASDM)

P. Environmental Protection Agency (EPA):
40 CFR 59(2014) .....National Volatile Organic Compound Emission Standards for Consumer and Commercial Products

PART 2 - PRODUCT

2.1 GLASS

A. Provide minimum thickness stated and as additionally required to meet performance requirements.
1. Provide minimum 6 mm (1/4 inch) thick glass units unless otherwise indicated.

B. Obtain glass units from single source from single manufacturer for each glass type.

C. Clear Glass:
1. ASTM C1036, Type I, Class 1, Quality q3.

D. Ultra-clear-Low-Iron Float Glass:
1. ASTM C1036, Type I, Class 1, Quality q3 and with visible light transmission of not less than 90 percent.

E. Tinted Heat reflective and low emissivity coated glass:
1. ASTM C1036, Type I, Class 2, Quality q3.

2.2 HEAT-TREATED GLASS

A. Roller Wave Limits for Heat-Treated Glass: Orient all roller wave distortion parallel to bottom surface of glazing, and provide units complying with the following limitations:
1. Measurement Parallel to Line: Maximum peak to valley 0.203 mm (0.008 inch).
2. Measurement Perpendicular to Line: Maximum 0.0254 mm (0.001 inch).
3. Bow/Warp: Maximum 50 percent of bow and warp allowed by ASTM C1048.

B. Clear Heat Strengthened Glass:
1. ASTM C1048, Kind HS, Condition A, Type I, Class 1, Quality q3.

C. Tinted Heat Strengthened Glass:
1. ASTM C1048, Kind HS, Condition A, Type I, Class 2, Quality q3.

D. Clear Tempered Glass:
1. ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality q3.

E. Tinted Tempered Glass.
1. ASTM C1048, Kind FT, Condition A, Type I, Class 2, Quality q3.

2.3 LAMINATED GLASS

A. Laminated Glass: ASTM C1172. Two or more lites of heat treated glass bonded with polyvinyl butyral, ionomeric polymer, or cast-in-place and cured-transparent-resin interlayer complying with interlayer manufacturer's written instructions. Minimum total laminated thickness of 1/4” for blast resistant glazing.

B. Interlayer: Use min. 0.75 mm (0.030 inch) thick interlayer for vertical glazing unless otherwise indicated in construction documents.

C. Interlayer: Use 1.5 mm (0.060 inch) thick interlayer for:
1. Horizontal or sloped glazing.
2. Acoustical glazing.
3. Assemblies requiring heat strengthened or fully tempered glass.

D. Interlayer: Use 2.28 mm (0.090 inch) thick interlayer where required to meet performance requirements.

E. Interlayer Color: Clear, unless otherwise indicated in construction documents .

2.4 INSULATING GLASS UNITS

A. Provide factory fabricated, hermetically sealed glass unit consisting of two panes of glass separated by a dehydrated air space and comply with ASTM E2190. The exterior glass unit shall be fully tempered and the inner glass unit shall be laminated annealed at a minimum for all blast resistant glazing.

B. Assemble units using glass types specified in Insulating Glass Schedule and Blast Glazing assembly requirements

2.5 FIRE PROTECTION AND FIRE RESISTANCE GLAZING

A. Fire-Protection-Rated Glazing: Glazing units tested for use in fire door assemblies or fire windows, UL, ITS-WHI or equivalent listed and labeled by testing agency in accordance with IBC, for fire-protection ratings as indicated on construction documents, based upon positive-pressure testing per NFPA 257 or UL 9, and complying with NFPA 80.
   1. Hose-Stream Test: Units must comply, except units having fire-protection rating of 20 minutes.
   2. Labeling: Permanently label fire-protection-rated glazing units in accordance with IBC.
   3. Safety Glazing: Comply with 16 CFR 1201, Category II.
   4. Fire-Protection-Rated Tempered Glass: For 20-minute fire-protection-rated door assemblies, of thickness scheduled.
   5. Fire-Protection-Rated Laminated Ceramic Glazing: Units made from two lites of clear, ceramic glass, 8 mm (5/16 inch) total thickness, for rating scheduled.
   6. Fire-Protection-Rated Laminated Glass with Intumescent Interlayers: Units made from multiple lites of uncoated, ultra-clear (low-iron) float glass, in intumescent interlayers, of thickness and rating scheduled.

B. Fire-Resistance-Rated Glazing: Glazing units tested for use in fire wall assemblies, UL, ITS-WHI or equivalent listed and labeled by testing agency in accordance with IBC for fire-resistance ratings of wall assemblies as indicated on construction documents based upon testing according to NFPA 252 and ASTM E119 or UL 263.
   1. Labeling: Permanently label fire-resistance-rated glazing units in accordance with IBC.
   2. Safety Glazing: Comply with 16 CFR 1201, Category II.
   3. Fire-Resistance-Rated Laminated Glass with Intumescent Interlayers: Units made from multiple lites of uncoated, ultra-clear low-iron float glass, in intumescent interlayers, of thickness and rating scheduled.
   4. Fire-Resistance-Rated Double Glazing Units with Gel Fill: Units made from two lites of uncoated, fully tempered, ultra-clear (low-iron) float glass, with perimeter metal spacer and edge seal forming cavity filled with clear, fully transparent, heat-absorbing gel, of thickness and fire-protection rating scheduled.

2.6 GLAZING ACCESSORIES

A. As required to supplement the accessories provided with the items to be glazed and to provide a complete installation. Ferrous metal accessories exposed in the finished work are to have a finish that will not corrode or stain while in service. Fire rated glazing to be installed with glazing accessories in accordance with the manufacturer's installation instructions.

B. Setting Blocks: ASTM C864:
   1. Silicone type.
   2. Channel shape; having 6 mm (1/4 inch) internal depth.
   3. Shore A hardness of 80 to 90 Durometer.
   4. Block lengths: 50 mm (2 inches) except 100 to 150 mm (4 to 6 inches) for insulating glass.
   5. Block width: Approximately 1.6 mm (1/16 inch) less than the full width of the rabbet.
   6. Block thickness: Minimum 4.8 mm (3/16 inch). Thickness sized for rabbet depth as required.

C. Spacers: ASTM C864:

1. Channel shape having a 6 mm (1/4 inch) internal depth.
2. Flanges not less 2.4 mm (3/32 inch) thick and web 3 mm (1/8 inch) thick.
3. Lengths: 25 to 76 mm (1 to 3 inches).
4. Shore A hardness of 40 to 50 Durometer.

D. Glazing Tapes:
1. Semi-solid polymeric based closed cell material exhibiting pressure-sensitive adhesion and withstanding exposure to sunlight, moisture, heat, cold, and aging.
2. Shape, size and degree of softness and strength suitable for use in glazing application to prevent water infiltration.
3. Complying with AAMA 800 for the following types:
   a. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
   b. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

E. Spring Steel Spacer: Galvanized steel wire or strip designed to position glazing in channel or rabbeted sash with stops.

F. Glazing Clips: Galvanized steel spring wire designed to hold glass in position in rabbeted sash without stops.

G. Glazing Points (Sprigs): Pure zinc stock, thin, flat, triangular or diamond shaped pieces, 6 mm (1/4 inch) minimum size.

H. Glazing Gaskets: ASTM C864:
1. Firm dense wedge shape for locking in sash.
2. Soft, closed cell with locking key for sash key.
3. Flanges may terminate above the glazing-beads or terminate flush with top of beads.

I. Lock-Strip Glazing Gaskets: ASTM C542, shape, size, and mounting as indicated.

J. Glazing Sealants: ASTM C920, silicone neutral cure:
1. Type S.
2. Class 25 or 50 as recommended by manufacturer for application.
3. Grade NS.
4. Shore A hardness of 25 to 30 Durometer.
5. VOC Content: For sealants used inside the weatherproofing system, not more than 250 g/L or less when calculating according to 40 CFR 59, (EPA Method 24).

K. Structural Sealant: ASTM C920, silicone acetoxy cure:
1. Type S.
2. Class 25.
3. Grade NS.
4. Shore a hardness of 25 to 30 Durometer.

L. Neoprene, EPDM, or Vinyl Glazing Gasket: ASTM C864.
1. Channel shape; flanges may terminate above the glazing channel or flush with the top of the channel.
2. Designed for dry glazing.

M. Color:
1. Color of glazing compounds, gaskets, and sealants used for aluminum color frames to match color of the finished aluminum and be nonstaining.
2. Color of other glazing compounds, gaskets, and sealants which will be exposed in the finished work and unpainted are to be black, gray, or neutral color.

N. Smoke Removal Unit Targets: Adhesive targets affixed to glass to identify glass units intended for removal for smoke control. Comply with requirements of local Fire Department.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:
   1. Examine openings for glass and glazing units; determine they are proper size; plumb; square; and level before installation is started.
   2. Verify that glazing openings conform with details, dimensions and tolerances indicated on manufacturer is approved shop drawings.

B. Review for conditions which may adversely affect glass and glazing unit installation, prior to commencement of installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

C. Verify that wash down of adjacent masonry is completed prior to erection of glass and glazing units.

3.2 PREPARATION

A. For sealant glazing, prepare glazing surfaces in accordance with GANA Sealant Manual.

B. Determine glazing unit size and edge clearances by measuring the actual unit to receive the glazing.

C. Shop fabricate and cut glass with smooth, straight edges of full size required by openings to provide GANA recommended edge clearances.

D. Verify that components used are compatible.

E. Clean and dry glazing surfaces.

F. Prime surfaces scheduled to receive sealants, as determined by preconstruction sealant-substrate testing.

3.3 INSTALLATION – GENERAL

A. Install in accordance with GANA Glazing Manual, GANA Sealant Manual, IGMA TB-3001, and IGMA TM-3000 unless specified otherwise.

B. Glaze in accordance with recommendations of glazing and framing manufacturers, and as required to meet the Performance Test Requirements specified in other applicable sections of specifications.

C. Set glazing without bending, twisting, or forcing of units.

D. Do not allow glass to rest on or contact any framing member.

E. Glaze doors and operable sash, in a securely fixed or closed and locked position, until sealant, glazing compound, or putty has thoroughly set.

F. Transparent (One-Way Vision Glass) Mirror: Use continuous channel glazing gasket.

G. Laminated Glass:
   1. Tape edges to seal interlayer and protect from glazing sealants.
   2. Do not use putty or glazing compounds.

H. Insulating Glass Units:
   1. Glaze in compliance with glass manufacturer's written instructions.
   2. When glazing gaskets are used, they are to be of sufficient size and depth to cover glass seal or metal channel frame completely.
   3. Do not use putty or glazing compounds.
   4. Do not grind, nip, cut, or otherwise alter edges and corners of fused glass units after shipping from factory.
   5. Install with tape or gunnable sealant in wood sash.

I. Fire Protective and Fire Resistance Glass:

1. Wire Glass: Glaze in accordance with NFPA 80.
2. Other fire protective and fire resistant glass: Glaze in accordance with manufacturer's installation instructions and NFPA 80.

3.4 INSTALLATION - WET/DRY METHOD (PREFORMED TAPE AND SEALANT)

A. Cut glazing tape to length and set against permanent stops, 5 mm (3/16 inch) below sight line. Seal corners by butting tape and dabbing with butyl sealant.

B. Apply heel bead of butyl sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete the continuity of the air and vapor seal.

C. Place setting blocks at 1/3 points with edge block no more than 152 mm (6 inches) from corners.

D. Rest glazing on setting blocks and push against tape and heel bead of sealant with sufficient pressure to achieve full contact at perimeter of pane or glass unit.

E. Install removable stops, with spacer strips inserted between glazing and applied stops, 6 mm (1/4 inch) below sight line. Place glazing tape on glazing pane or unit with tape flush with sight line.

F. Fill gap between glazing and stop with sealant to depth equal to bite of frame on glazing, but not more than 9 mm (3/8 inch) below sight line. Sealant type is to be compatible with glazing tape.

G. Apply cap bead of sealant along void between the stop and the glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.5 INSTALLATION - WET METHOD (SEALANT AND SEALANT)

A. Place setting blocks at 1/3 points and install glazing pane or unit.

B. Install removable stops with glazing centered in space by inserting spacer shims both sides at 600 mm (24 inch) intervals, 6 mm (1/4 inch) below sight line.

C. Fill gaps between glazing and stops with sealant to depth of bite on glazing, but not more than 9 mm (3/8 inch) below sight line to ensure full contact with glazing and continue the air and vapor seal.

D. Apply sealant to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.6 INSTALLATION - EXTERIOR BUTT GLAZED METHOD (SEALANT ONLY)

A. Perform adhesion testing in accordance with ASTM C794. Provide primer per sealant manufacturer's recommendations. Submit test results.

B. Temporarily brace glass in position for duration of glazing process. Mask edges of glass at adjoining glass edges and between glass edges and framing members.

C. Temporarily secure a small diameter non-adhering foamed rod on back side of joint.

D. Apply sealant to open side of joint in continuous operation; thoroughly fill the joint without displacing the foam rod. Tool the sealant surface smooth to concave profile.

E. Permit sealant to cure then remove foam backer rod. Apply sealant to opposite side, tool smooth to concave profile.

F. Remove masking tape.

3.7 INSTALLATION - INTERIOR WET/DRY METHOD (TAPE AND SEALANT)

A. Cut glazing tape to length and install against permanent stops, projecting 1.6 mm (1/16 inch) above sight line.

B. Place setting blocks at 1/3 points with edge block no more than 150 mm (6 inches) from corners.

C. Rest glazing on setting blocks and push against tape to ensure full contact at perimeter of pane or unit.

D. Install removable stops, spacer shims inserted between glazing and applied stops at 600 mm (24 inch) intervals, 6 mm (1/4 inch) below sight line.

E. Fill gaps between pane and applied stop with sealant to depth equal to bite on glazing, to uniform and level line. Sealant type is to be compatible with glazing tape.

F. Trim protruding tape edge.

3.8 INSTALLATION - INTERIOR WET METHOD (COMPOUND AND COMPOUND)

A. Install glazing resting on setting blocks. Install applied stop and center pane by use of spacer shims at 600 mm (24 inch) centers, kept 6 mm (1/4 inch) below sight line.

B. Locate and secure glazing pane glazers' clips.

C. Fill gaps between glazing and stops with glazing compound until flush with sight line. Tool surface to straight line.

3.9 INSTALLATION - REGLAZING HISTORIC FRAMING

A. Steel Windows: For glazing with glazing beads: ASTM C920.

B. Wood Sash: For glazing with glazing beads: Tape or ASTM C920, gunnable sealant.

C. Lock-strip Gaskets: Follow ASTM C716 for installation.

3.10 REPLACEMENT AND CLEANING

A. Clean new glass surfaces removing temporary labels, paint spots, and defacement after approval by COR.

B. Replace cracked, broken, and imperfect glass, or glass which has been installed improperly.

C. Leave glass, putty, and other setting material in clean, whole, and acceptable condition.

3.11 PROTECTION

A. Protect finished surfaces from damage during erection, and after completion of work. Strippable plastic coatings on colored anodized finish are not acceptable.

3.12 MONOLITHIC GLASS SCHEDULE

A. Glass Type MG# 1: Clear fully tempered float glass.
   1. Unit Thickness: /6 mm (0.23 inch)
   2. Safety glazing label required.

3.13 LAMINATED GLASS SCHEDULE

A. Glass Type LG# 1: Clear laminated glass with two (2) lites of fully tempered float glass.
   1. Minimum Thickness of Each Glass Lite: 3 mm (0.12 inch).
   2. Interlayer Thickness: 1.52 mm (0.060 inch).
   3. Safety glazing label required.
   4. Application: Interior glazing of units unless otherwise scheduled.
   5. .

3.14 INSULATING LAMINATED GLASS SCHEDULE (FORCE PROTECTION AND PHYSICAL SAFETY)

A. Glass Type IL# 1: Low-E-coated, clear insulating laminated glass.
   1. Overall Unit Thickness: 27.78 mm (1-3/32inch).
   2. Outdoor Lite: Clear annealed float glass, except heat-strengthened float glass where required, and fully tempered float glass where indicated.
      a. Minimum Thickness of Outdoor Lite: 6 mm (0.23 inch).
   3. Interspace Content: Argon.

4. Indoor Lite: Clear laminated glass with two lites of annealed float glass, except heat-strengthened float glass where required, and fully tempered float glass where indicated.
   a. Minimum Thickness of Each Glass Lite: 3 mm (0.12 inch)
   b. Interlayer Thickness: 2.29 mm (0.090 inch).
5. Low-E Coating: Sputtered on second surface.
6. Visible Light Transmittance: 77 percent minimum.
7. Solar Heat Gain Coefficient: .61 maximum.
8. Safety glazing label required.
9. Windborne debris-resistant glazing unit required.
10. Blast Resistance: Provide units meeting the following:
    a. GP Value 2

3.15 FIRE-PROTECTIVE AND FIRE-RESISTANCE GLAZING SCHEDULE

A. Glass Type FR# 1: Fire-protection-rated tempered glass.
   1. Thickness: 6 mm (0.23 inch).
   2. Rating: 20 minutes.
   1. Impact Safety Resistance: ANSI Z97.1 and CPSC 16CFR1201 (Cat. I and II).
   2. Application: Fire-protection-rated door assemblies with openings not over 0.65 square meter (100 square inch).

B. Glass Type FR# 2: Fire-protection-rated laminated ceramic glazing.
   1. Thickness: 8mm (5/16 inch)
   2. Approximate Visible Transmission: 85 percent.
   3. Approximate Visible Reflection: 9 percent.
   4. Rating: 20- minutes to3 hrs for doors, 20 minutes to 90 minutes for other applications..
   5. Impact Safety Resistance: ANSI Z97.1 and CPSC 16CFR1201 (Cat. I and II).
   6. STC Rating: Approximately 38 dB.
   7. Surface Finish:
      a. Standard Grade is polished for a surface quality that is comparable to alternative fire-rated ceramics marketed as having a premium finish.
   8. Positive Pressure Test: UL 10C; passes.
   9. Rating: See Schedule:

Rating	Assembly	Max. Exposed Area (Sq. In.)	Max. Width Of Exposed Glazing (In.)	**OR**	Max. Height Of Exposed Glazing (In.)	Stop Height
20 min.	Doors					
	HMS or Wood*	3,204	36		89	5/8”
	Fireframes D.S.	3,204	36		89	3/4"
	Other than doors	3,325	95		95	5/8”
	HMS or Wood	3,325	95		95	3/4"
	Fireframes D.S.					
45 min.	Doors					
	HMS or Wood	3,204	36		89	5/8”
	Fireframes D.S.	3,204	36		89	3/4"
	Other than doors	3,325	95		95	5/8”
	HMS or Wood	3,325	95		95	3/4"
	Fireframes D.S.					
60 min.	Doors (non-temp rise)	3,204	36		89	5/8”
		3,204	36		89	3/4"

	HMS or Wood	100	12	33	5/8”
	Fireframes D.S.				
	Doors (temp rise)	3,325	95	95	5/8”
	Other than doors	3,325	95	95	3/4"
	HMS or Wood				
	Fireframes D.S.				
90 min.	Doors (non-temp rise)	2,034	36	56 ½”	3/4”
	Doors (temp rise)	100	12	33	1/2”
	Other than doors				
	HMS	2,627	56 ½”	56 ½”	5/8”
	Fireframes D.S.	2,627	56 ½”	56 ½”	3/4"
3 hours	Doors	100	12	33	1/2”

* HMS indicates hollow metal steel framing. Fireframes D.S. indicates Designer Series narrow profile framing. For wood frames, check with manufacturer for maximum tested glass sizes.

10. Application: Fire-protection-rated door and window assemblies.

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SECTION 08 87 33

DECORATIVE FILM

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Decorative Film, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Manufacturer:
   1. Minimum ten (10) years experience in manufacture of decorative film.

B. Installer:
   1. Minimum five (5) years experience installing products of same type and scope as specified.

C. Products specified in this section shall be supplied by a single manufacturer

D. Products specified in this section shall be installed by a single installer.

1.3 SUBMITTALS

A. Project Information:
   1. Manufacturer’s data sheets for products specified, including:
      a. Preparation instructions and recommendations.
      b. Storage and handling requirements and recommendations.
      c. Installation methods.

B. Samples:
   1. Manufacturer's standard sample of specified film type.

C. Contract Closeout Information:
   1. Maintenance data.
   2. Warranty.

D. Interior finish fire performance data:
   1. Provide for each finish material and type specified:
      a. Manufacturer's printed information including:
         1) Fire class.
         2) NFPA test number.
         3) Photograph.
      b. Proof of purchase.

1.4 WARRANTY

Manufacturer’s standard warranty for a period of three (3) years against defects in material or workmanship.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Decorative Film:
   1. Base:
      a. 3M Commercial Graphics Division.

B. Other manufacturers to submit but meet the salient characteristics in this section.

2.2 MATERIALS

A. Scotchcal Graphic Film:
   1. 3650-114 Series.
   2. Transparent, 2 MIL thick vinyl film.
   3. Thickness with adhesive: 3 to 4 MIL.

B. Scotchcal Luster Overlaminate:
   1. Series as recommended by manufacturer.

C. Accessories:
   1. Edge Sealer, Premasking Tape, Prespacing Tape by 3M Commercial Graphics Division.
   2. Provide as required for installation and durability.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine glazing surfaces and conditions under which decorative film is to be installed.

B. Field verify film size for each glass panel, within tolerances and dimensions established.

C. Beginning of installation indicates acceptance of conditions and responsibility for performance.

3.2 INSTALLATION

A. Do not install on glass with edge damage.

B. Install in accordance with manufacturer's instructions.

C. Cut and trim film edges neatly at uniform at a distance of 1/16 IN to1/8 IN from edge of rebate or edge of glass at jambs, corners and joints.
   1. Maintain clean cut utilizing sharp blades.

3.3 CLEANING AND PROTECTION

A. Remove left over material and debris from work area.

B. Touch up, repair or replace damaged panels.

C. Protect from damage by other trades.

D. Clean per manufacturer's recommendations.

END OF SECTION

SECTION 08 90 00

LOUVERS AND VENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies fixed and operable wall louvers, door louvers and wall vents.

1.2 RELATED WORK

A. Section 08 11 13, HOLLOW METAL DOORS AND FRAMES: Louvers in Steel Doors.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings:
1. Each type, showing material, finish, size of members, operating devices, method of assembly, and installation and anchorage details.

C. Manufacturer's Literature and Data:
1. Each type of louver and vent.

D. Color samples.

1.4 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. The Master Painters Institute (MPI):
Approved Product List – Updated Monthly

C. ASTM International (ASTM):
A240/A240M-20 ..... Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

A653/A653M-20 ..... Steel Sheet Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot Dip Process

A1008/A1008M-20 ..... Steel, Sheet, Carbon, Cold Rolled, Structural, and High Strength Low-Alloy with Improved Formability

B209-14..... Aluminum and Aluminum Alloy, Sheet and Plate

B209M-14..... Aluminum and Aluminum Alloy, Sheet and Plate (Metric)

B221-14..... Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

B221M-13..... Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes (Metric)

D1187/D1187M-97(2018) ..... Asphalt-Base Emulsions for Use as Protective Coatings for Metal

D. National Association of Architectural Metal Manufacturers (NAAMM):
AMP 500-06 ..... Metal Finishes Manual

E. National Fire Protection Association (NFPA):
90A-15..... Installation of Air Conditioning and Ventilating Systems

F. American Architectural Manufacturers Association (AAMA):

2605-13 ..... High Performance Organic Coatings on Architectural Extrusions and Panels

G. Air Movement and Control Association, Inc. (AMCA):
500-L-07 ..... Testing Louvers

Department of Veterans Affairs:

VA Physical Security Design Manual for Life Safety Protected Facilities January 2015

H. Protective Design Center

I. PDC-TR-08 Single Degree of Freedom Structural Response Limits for Antiterrorism Design

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum, Extruded: ASTM B221M (B221).

B. Stainless Steel: ASTM A240/A240M, Type 302B.

C. Galvanized Steel Sheet: ASTM A653/A653M; G90 min.

D. Carbon Steel and Sheet: ASTM A1008/A1008M (interior use louvers only).

E. Aluminum, Plate and Sheet: ASTM B209M (B209); alloy 3003 or 5005 with temper as required for forming.

F. Fasteners: Fasteners for securing louvers and wall vents to adjoining construction, except as otherwise specified or indicated in construction documents, to be toggle or expansion bolts of size and type as required for each specific type of installation and service condition.
1. Where type, size, or spacing of fasteners is not shown or specified, submit shop drawings showing proposed fasteners, and method of installation.
2. Fasteners for louvers, louver frames, and wire guards to be of stainless steel or aluminum with same finish as louvers.
3. Fasteners for louvers, louver frames and wire guards within mental health areas to be non-removable/tamper-proof type.

G. Inorganic Zinc Primer: MPI No. 19.

H. Bituminous Coating: ASTM D1187/D1187M; cold applied asphalt mastic emulsion.

2.2 EXTERIOR WALL LOUVERS

A. General:
1. Provide fixed type louvers of size and design shown.
2. Heads, sills and jamb sections are to have formed caulking slots or be designed to retain caulking. Head sections are to have exterior drip lip, and sill sections an integral water stop.
3. Furnish louvers with sill extension or separate sill as shown.
4. Frame is to be mechanically fastened or welded construction with welds dressed smooth and flush.

B. Performance Characteristics:
1. Weather louvers are to have a minimum of 40 percent free area and to pass 2286 mm/s (450 fpm) free area velocity at a pressure drop not exceeding 1.27 mm (0.05inch) water gauge and carry not more than 0.28 g (0.01 ounces) of water per square meter (10.7639104 square foot) of free area for 15 minutes when tested per AMCA Standard 500-L.
2. Louvers are to bear AMCA certified rating seals for air performance and water penetration ratings.

C. Aluminum Louvers:

1. General: Frames, blades, sills and mullions (sliding interlocking type); 2 mm (0.078-inch) thick extruded 6063-T5 or –T52 aluminum. Blades to be drainable type and have reinforcing bosses.
2. Louvers, fixed: Make frame sizes 13 mm (1/2-inch) smaller than openings. Single louvers frames are not to exceed 1676 mm (66 inches) wide. When openings exceed 1676 mm (66 inches), provide twin louvers separated by mullion members.
3. Louvers are to withstand the effects or gravity loads and the following wind loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors.
    a. Wind load acting inward or outward of not less than 1915 Pa (40pound per square foot.).

2.3 CLOSURE ANGLES AND CLOSURE PLATES

A. Fabricate from 2 mm (0.078-inch) thick stainless steel or aluminum.

B. Provide continuous closure angles and closure plates on inside head, jambs and sill of exterior wall louvers.

C. Secure angles and plates to louver frames with screws, and to masonry or concrete with fasteners as indicated in construction documents.

2.4 WIRE GUARDS

A. Provide wire guards on outside of all exterior louvers, except on exhaust air louvers.

B. Fabricate frames from 2 mm (0.078-inch) thick extruded or sheet aluminum designed to retain wire mesh.

C. Wire mesh to be woven from not less than 1.6 mm (0.063-inch) diameter aluminum wire in 13 mm (1/2-inch) square mesh.

D. Miter corners and join by concealed corner clips or locks extending not less than 57 mm (2-1/4 inches) into rails and stiles. Equip wire guards over 1219 mm (4 feet) in height with a mid-rail constructed as specified for frame components.

E. Fasten frames to outside of louvers with aluminum or stainless steel devices of same finish as louvers designed to allow removal and replacement without damage to the wire guard or the louver.

2.5 BLANK-OFF PANELS

A. Insulated laminated panels consisting of an insulating core surfaced on back and front with metal sheets and attached to back of louver with clips on screws and gasketed or sealant sealed perimeter. Panel finish is to be same finish applied to louvers .
    1. Thickness: 50 mm (2 inches).
    2. Aluminum sheet for aluminum louver 0.81 mm (0.032 inch) minimum.
    3. Insulating Core: extruded-polystyrene foam.

2.6 WALL VENTS

A. Fabricate exterior wall vents from either 4.7 mm (0.185-inch) thick aluminum plate or 6 mm (1/4-inch) thick cast iron, perforated in diamond lattice pattern, with not over 19 mm (3/4-inch) openings.

B. Vents are to have aluminum screen frame with aluminum alloy insect screening mounted on back of vent by means of 19 mm x 5 mm (3/4-inch by 3/16-inch) top and bottom bars screwed to grille.

C. Vent Frames in Masonry: Fabricate of 45 mm x 30 mm x 5 mm (1-3/4 inch by 1-1/4 inch by 3/16-inch) steel angles bolted with 6 mm (1/4-inch) diameter expansion bolts at jambs.

2.7 AIR INTAKE VENTS

A. Fabricate exterior louvered wall ventilators for fresh air intake for air conditioning units from extruded aluminum, ASTM B221M (B221). Form with integral horizontal louvers and frame, with drip extending beyond face of wall and integral water stops.

B. Provide aluminum closures where shown for inside face of dummy vents.

C. Provide 0.8 mm (0.032-inch) thick aluminum sleeves in cavity walls and where indicated in construction documents.

2.8 BRICK VENTS

A. Vents are to be of size shown formed of approximately 3 mm (0.125 inch) thick cast aluminum, or 3 mm (0.118 inch) extruded aluminum.

B. Provide vents complete with aluminum screen frame with corrosion resistant insect screening mounted on back of vent.

C. Provide vents with required anchors.

2.9 FINISH

A. In accordance with NAAMM Metal Finishes Manual: AMP 500-505

B. Aluminum Louvers , Air Intake Vents ,Wire Guards, Blank Off Panels:
   1. Anodized finish
      a. AA-M10C22A42, Chemically etched medium matte, with integrally colored anodic coating, Class I Architectural, 0.17 mm (0.7 mils) thick.
   2. Organic Finish: AAMA 2605 (Fluorocarbon coating) with total dry film thickness of not less than 0.03 mm (1.2 mil).

C. Aluminum Wall Vents and Brick Vents: Sand blasted satin finish.

D. Stainless Steel: Mechanical finish No. 4 in accordance with NAAMM Metal Finishes Manual.

E. Steel: Surfaces of steel work, for which no other finish is specified, are to be cleaned free from scale, rust, oil and grease, and then given a light colored prime paint after fabrication, except ferrous metals concealed in finished work. Paint all contact surfaces of assembled work (except welded contact surfaces) with an additional shop coat of similar paint.

2.10 PROTECTION

A. Provide protection for aluminum against galvanic action wherever dissimilar materials are in contact, by painting the contact surfaces of the dissimilar material with a heavy coat of bituminous coating (complete coverage), or by separating the contact surfaces with a performed synthetic rubber tape having pressure sensitive adhesive coating on one side.

B. Isolate the aluminum from plaster, concrete and masonry by coating aluminum with zinc-chromate primer.

C. Protect finished surfaces from damage during fabrication, erection, and after completion of the work. Strippable plastic coating on colored anodized organic finish is not approved.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Set work accurately, in alignment and where indicated in construction documents. Install plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.

B. Furnish setting drawings and instructions for installation of anchors and for the positioning of items having anchors to be built into masonry construction. Provide temporary bracing for such items until masonry is set.

C. Provide anchoring devices and fasteners as shown and as necessary for securing louvers and vents to building construction as specified. Power actuated drive pins may be used, except for removal items and where members would be deformed or substrate damaged by their use.

D. Set wall louvers and vents in masonry walls during progress of the work. If wall louvers and vents are not delivered to job in time for installation in prepared openings, make provision for later installation. Set in cast-in-place concrete in prepared openings.

3.2 CLEANING AND ADJUSTING

A. After installation, all exposed prefinished and plated items and all items fabricated from stainless steel and aluminum are to be cleaned as recommended by the manufacturer and protected from damage until completion of the project.

B. All movable parts, including hardware, are to be cleaned and adjusted to operate as designed without binding or deformation of the members, so as to be centered in the opening of frame, and where applicable, to have all contact surfaces fit tight and even without forcing or warping the components.

C. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Contracting Officer Representative (COR) damaged units and replace with new units.

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SECTION 09 05 16

SUBSURFACE PREPARATION FOR FLOOR FINISHES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies subsurface preparation requirements for areas to receive the installation of applied and resinous flooring. This section includes removal of existing floor coverings, testing concrete for moisture and pH, remedial floor coating for concrete floor slabs having Unsatisfactory moisture or pH conditions, floor leveling and repair as required.

1.2 RELATED WORK

A. Section 07 92 00, JOINT SEALANTS.

B. Section 09 65 19, RESILIENT TILE FLOORING.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA and TEST DATA.

B. Written approval confirming product compatibility with subfloor material manufacturer and the flooring manufacturer

C. Product Data:
1. Moisture remediation system
2. Underlayment Primer
3. Cementitious Self-Leveling Underlayment
4. Cementitious Trowel-Applied Underlayment (Not suitable for resinous floor finishes)

D. Test Data:
1. Moisture test and pH results performed by a qualified independent testing agency

1.4 DELIVERY AND STORAGE

A. Deliver materials in containers with labels legible and intact and grade-seals unbroken.

B. Store material to prevent damage or contamination.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in text by basic designation only.

B. ASTM International(ASTM):
D638-14(2014) ..... Standard Test Method for Tensile Properties of Plastics

D4259-18(2019) ..... Standard Practice for Preparation of Concrete by Abrasion Prior to Coating Application.

C109/C109M-20b(2020) ..... Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens)

7234-19(2020)..... Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers

C. E96/E96M-16(2016) Standard Test Methods for Water Vapor Transmission of Materials
F710-1e1(2020) ..... Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring

F1869-16a ..... Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride

F2170-19a(2020) ..... Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes

C348-20(2020) ..... Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars

C191-19(2020) ..... Standard Test Method for Time of Setting of Hydraulic Cement by Vicat Needle

PART 2 - PRODUCTS

2.1 MOISTURE REMEDIATION COATING

A. System Descriptions:
   1. High-solids, epoxy system designed to suppress excess moisture in concrete prior to an overlayment. For use under resinous products, VCT, tile and carpet where issues caused by moisture vapor are a concern.

B. Products: Subject to compliance with applicable fire, health, environmental, and safety requirements for storage, handling, installation, and clean up.

C. System Components: Verify specific requirements as systems vary by manufacturer. Verify build up layers and installation method. Verify compatibility with substrate. Use manufacturer's standard components, compatible with each other and as follows:
   1. Liquid applied coating:
      a. Resin: epoxy.
      b. Formulation Description: Multiple component high solids.
      c. Application: Per manufacturer's written installation requirements.
      d. Thickness: minimum 10 mils

D. Material Vapor Permeance: Application shall achieve a permeance rating of less than 0.1 perm in accordance with ASTM E96/E96M.

E. Maximum RH requirement: 100% testing in accordance with ASTM F2170.

2.2

Property	Test	Value
Tensile Strength	ASTM D638	4,400 psi
Volatile Organic Compound Limits (V.O.C.)	SCAMD Rule 1113 (Ammended 02/05/2016)	25 grams per liter
Permeance	ASTM E96	0.1 perms
Tensile Modulus	ASTM D638	$1.9X10^5$ psi
Percent Elongation	ASTM D638	12%
Cure Rate	Per manufacture's Data	4 hours Tack free with 24hr recoat window
Bond Strength	ASTM D7234	100% bond to concrete failure

2.3 CEMENTITIOUS SELF-LEVELING UNDERLAYMENT

A. System Descriptions:
   1. High performance self-leveling underlayment resurfacer. Single component, self-leveling, cementitious material designed for easy application as an underlayment for all types of flooring materials. It is used for substrate repair and leveling.

B. Products: Subject to compliance with applicable fire, health, environmental, and safety requirements for storage, handling, installation, and clean up. Gypsum-based products are unacceptable.

C. System Characteristics:
   1. Wearing Surface: smooth
   2. Thickness: Per architectural drawings, ranging from feathered edge to 1”, per application. Applications greater than 1” require additional 3/8” aggregate to mix or as recommended by manufacturer.

D. Underlayment shall be calcium aluminate cement-based, containing Portland cement. Gypsum-based products are unacceptable.

E. Compressive Strength: Minimum 4100 psi in 28 days in accordance with ASTM C109/C109M.

F. Flexural Strength: Minimum 1000 psi in 28 days in accordance with ASTM C348

G. Dry Time: Underlayment shall receive the application of moisture insensitive tile in 6 hours, floor coverings in 16 hours, and resinous flooring in 3-7 days.

H. Primer: compatible and as recommended by manufacturer for use over intended substrate

I. System Components: Manufacturer's standard components that are compatible with each other and as follows:
   1. Primer:
      a. Resin: copolymer
      b. Formulation Description: single component ready to use.
      c. Application Method: Squeegee and medium nap roller.
         1) All puddles shall be removed, and material shall be allowed to dry, 1-2 hours at 70F/21C.
      d. Number of Coats: (1) one.
   2. Grout Resurfacing Base:
      a. Formulation Description: Single component, cementitious self-leveling high-early and high-ultimate strength grout.
      b. Application Method: colloidal mix pump, cam rake, spike roll.
         1) Thickness of Coats: Per architectural scope, 1” lifts.
         2) Number of Coats: More than one if needed.
      c. Aggregates: for applications greater than 1inch, require additional 3/8” aggregate to mix.

J.

2.4

Property	Test	Value
Compressive Strength	ASTM C109/C109M	2,200 psi @ 24 hrs 3,000 psi @ 7 days
Initial set time Final Set time	ASTM C191	30-45 min. 1 to 1.5 hours
Bond Strength	ASTM D7234	100% bond to concrete failure

2.5 CEMENTITIOUS TROWEL-APPLIED UNDERLAYMENT(NOT SUITABLE FOR RESINOUS FLOOR FINISHES)

A. Underlayment shall be calcium aluminate cement-based, containing Portland cement. Gypsum-based products are unacceptable.

B. Compressive Strength: Minimum 4000 psi in 28 days

C. Trowel-applied underlayment shall not contain silica quartz (sand).

D. Dry Time: Underlayment shall receive the application of floor covering in 15-20 minutes.

PART 3 - EXECUTION

3.1 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperature of work areas at not less than 16 degree C (60 degrees F), without interruption, for not less than 24 hours before testing and not less than three days after testing.

B. Maintain higher temperatures for a longer period of time where required by manufacturer's recommendation.

C. Do not install materials when the temperatures of the substrate or materials are not within 60-85 degrees F/ 16-30 degrees C.

3.2 SURFACE PREPARATION

A. Existing concrete slabs with existing floor coverings:
   1. Conduct visual observation of existing floor covering for adhesion, water damage, alkaline deposits, and other defects.
   2. Remove existing floor covering and adhesives. Comply with local, state and federal regulations and the RFCI Recommended Work Practices for Removal of Resilient Floor Coverings, as applicable to the floor covering being removed.

B. Concrete shall meet the requirements of ASTM F710 and be sound, solid, clean, and free of all oil, grease, dirt, curing compounds, and any substance that might act as a bond-breaker before application. As required prepare slab by mechanical methods. No chemicals or solvents shall be used.

C. General: Prepare and clean substrates according to flooring manufacturer's written instructions for substrate indicated.

D. Prepare concrete substrates per ASTM D4259 as follows:
   1. Dry abrasive blasting.
   2. Wet abrasive blasting.
   3. Vacuum-assisted abrasive blasting.
   4. Centrifugal-shot abrasive blasting.
   5. Comply with manufacturer's written instructions.

E. Repair damaged and deteriorated concrete according to flooring manufacturer's written recommendations.

F. Verify that concrete substrates are dry.

G. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with application only after substrates have maximum moisture-vapor-emission rate of per flooring manufactures formal and project specific written recommendation.

H. Perform in situ probe test, ASTM F2170. Proceed with application only after substrates do not exceed a maximum potential equilibrium relative humidity per flooring manufacture’s formal and project specific written recommendation.

I. Provide a written report showing test placement and results.

J. Prepare joints in accordance with Section 07 92 00, JOINT SEALANTS and material manufacturer’s instructions.

K. Alkalinity: Measure surface pH in accordance with procedures provided in ASTM F710 or as outlined by qualified testing agency or flooring manufacturer’s technical representative.

L. Tolerances: Subsurface shall meet the flatness and levelness tolerance specified on drawings or recommended by the floor finish manufacturer. Tolerance shall also not to exceed 1/4” deviation in 10’. As required, install underlayment to achieve required tolerance.

M. Other Subsurface: For all other subsurface conditions, such as wood or metal, contact the floor finish or underlayment manufacturer, as appropriate, for proper preparation practices.

3.3 MOISTURE REMEDIATION COATING:

A. Where results of relative humidity testing (ASTM F2170) exceed the requirements of the specified flooring manufacturer, apply remedial coating as specified to correct excessive moisture condition.

B. Prior to remedial floor coating installation mechanically prepare the concrete surface to provide a concrete surface profile in accordance with ASTM D4259.

C. Mix and apply moisture remediation coating in accordance with manufacturer’s instructions.

3.4 CEMENTITOUS UNDERLAYMENT

A. Install cementitious self-leveling underlayment as required to correct surface defects, floor flatness or levelness corrections to meet the tolerance requirements as or detailed on drawings, address non-moving cracks or joints, provide a smooth surface for the installation of floor covering, or meet elevation requirements detailed on drawings.

B. Mix and apply in accordance with manufacturer's instructions.

3.5 PROTECTION

A. Prior to the installation of the finish flooring, the surface of the underlayment should be protected from abuse by other trades by the use of plywood, tempered hardwood, or other suitable protection course

3.6 FIELD QUALITY CONTROL

A. Where specified, field sampling of products shall be conducted by a qualified, independent testing facility.

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SECTION 09 22 16

NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies steel studs wall systems, shaft wall systems, ceiling or soffit suspended or furred framing, wall furring, fasteners, and accessories for the screw attachment of gypsum board, plaster bases or other building boards.

1.2 RELATED WORK

A. Support for wall mounted items: Section 05 50 00, METAL FABRICATIONS.

B. Ceiling suspension systems for acoustical tile or panels and lay in gypsum board panels: Section 09 51 00, ACOUSTICAL CEILINGS and Section 09 29 00, GYPSUM BOARD.

1.3 TERMINOLOGY

A. Description of terms shall be in accordance with ASTM C754, ASTM C11, ASTM C841 and as specified.

B. Underside of Structure Overhead: In spaces where steel trusses or bar joists are shown, the underside of structure overhead shall be the underside of the floor or roof construction supported by beams, trusses, or bar joists. In interstitial spaces with walk-on floors the underside of the walk-on floor is the underside of structure overhead.

C. Thickness of steel specified is the minimum bare (uncoated) steel thickness.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:
1. Studs, runners and accessories.
2. Hanger inserts.
3. Channels (Rolled steel).
4. Furring channels.
5. Screws, clips and other fasteners.

C. Shop Drawings:
1. Typical ceiling suspension system.
2. Typical metal stud and furring construction system including details around openings and corner details.
3. Typical shaft wall assembly
4. Typical fire rated assembly and column fireproofing showing details of construction same as that used in fire rating test.

D. Test Results: Fire rating test designation, each fire rating required for each assembly.

1.5 DELIVERY, IDENTIFICATION, HANDLING AND STORAGE

A. In accordance with the requirements of ASTM C754.

1.6 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society For Testing And Materials (ASTM)
A641-09.....Zinc-Coated (Galvanized) Carbon Steel Wire

A653/653M-11 ..... Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.

C11-10 ..... Terminology Relating to Gypsum and Related Building Materials and Systems

C635-07 ..... Manufacture, Performance, and Testing of Metal Suspension System for Acoustical Tile and Lay-in Panel Ceilings

C636-08 ..... Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels

C645-09 ..... Non-Structural Steel Framing Members

C754-11 ..... Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products

C841-03(R2008) ..... Installation of Interior Lathing and Furring

C954-10 ..... Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness

E580-11 ..... Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Moderate Seismic Restraint.

PART 2 - PRODUCTS

2.1 PROTECTIVE COATING

A. Galvanize steel studs, runners (track), rigid (hat section) furring channels, "Z" shaped furring channels, and resilient furring channels, with coating designation of G40 or equivalent.

2.2 STEEL STUDS AND RUNNERS (TRACK)

A. ASTM C645, modified for thickness specified and sizes as shown.
   1. Use C 645 steel, 0.75 mm (0.0296-inch) minimum base-metal (30 mil).(20 GA)
   2. Runners same thickness as studs.
   3. Increase member thickness to minimum 54 MIL (16 GA) 1.37 MM studs at following conditions:
   4. Where walls do not extend to overhead structural deck, and without supporting diagonal bracing, or horizontal stiffeners.

B. Provide not less than two cutouts in web of each stud, approximately 300 mm (12 inches) from each end, and intermediate cutouts on approximately 600 mm (24-inch) centers.

C. Doubled studs for openings and studs for supporting concrete backer-board.

D. Studs 3600 mm (12 feet) or less in length shall be in one piece.

E. Shaft Wall Framing:
   1. Conform to rated wall construction.
   2. C-H Studs or C-T Studs.
   3. E Studs.
   4. J Runners.
   5. Steel Jamb-Strut.

2.3 FURRING CHANNELS

A. Rigid furring channels (hat shape): ASTM C645.

B. Resilient furring channels:
   1. Not less than 0.45 mm (0.0179-inch) thick bare metal.

2. Semi-hat shape, only one flange for anchorage with channel web leg slotted on anchorage side, channel web leg on other side stiffens fastener surface but shall not contact anchorage surface other channel leg is attached to.

C. "Z" Furring Channels:
1. Not less than 0.45 mm (0.0179-inch)-thick base metal, with 32 mm (1-1/4 inch) and 19 mm (3/4-inch) flanges.
2. Web furring depth to suit thickness of insulation.

D. Rolled Steel Channels: ASTM C754, cold rolled; or, ASTM C841, cold rolled.

2.4 FASTENERS, CLIPS, AND OTHER METAL ACCESSORIES

A. ASTM C754, except as otherwise specified.

B. For fire rated construction: Type and size same as used in fire rating test.

C. Fasteners for steel studs thicker than 0.84 mm (0.033-inch) thick. Use ASTM C954 steel drill screws of size and type recommended by the manufacturer of the material being fastened.

D. Clips: ASTM C841 (paragraph 6.11), manufacturer's standard items. Clips used in lieu of tie wire shall have holding power equivalent to that provided by the tie wire for the specific application.

E. Concrete ceiling hanger inserts (anchorage for hanger wire and hanger straps): Steel, zinc-coated (galvanized), manufacturers standard items, designed to support twice the hanger loads imposed and the type of hanger used.

F. Tie Wire and Hanger Wire:
1. ASTM A641, soft temper, Class 1 coating.
2. Gage (diameter) as specified in ASTM C754 or ASTM C841.

G. Attachments for Wall Furring:
1. Manufacturers standard items fabricated from zinc-coated (galvanized) steel sheet.
2. For concrete or masonry walls: Metal slots with adjustable inserts or adjustable wall furring brackets. Spacers may be fabricated from 1 mm (0.0396-inch) thick galvanized steel with corrugated edges.

H. Power Actuated Fasteners: Type and size as recommended by the manufacturer of the material being fastened, but no less than:
1. Power driven type, to withstand minimum 190 LBS 86 kg shear when driven.

I. Knee Wall Brace:
1. Steel tube and baseplate bolted to concrete floor slab with tube projecting vertically; concealed within framed walls to provide structural stability for knee walls.
2. Design components compatible with wall type.
3. Material: Cold-rolled steel tube and base plate, fully welded.
4. Overall height: Wall height less 2 IN 50 MM.
5. Spacing as recommended by manufacturer.

J. Shower Seat Support:
1. Conceal in framed walls.
2. Vertical steel channels with welded steel plate.
3. Anchor channels to floor and structure above with steel angles.
4. Provide stainless steel sleeves at each bolt that attach shower seat to support bracket in wall
   a. Extend past finish face of wall tile 1/8 IN 3 MM.
5. Components:
   a. C3 x 6 cold formed steel channel.
      1) Brace with horizontal channel at 96 IN 2.4 M AFF.
   b. Steel plate: 24 x 20 x 3/8 IN 610 x 510 x 10 MM.
      1) Weld to steel channels with top of plate at 20 IN 500 MM AFF.

c. Steel angles: 3 x 3 x 1/4 x 3 IN 75 x 75 x 6 x 75 MM.
d. Stainless steel sleeves: 3/8 IN 10 MM diameter.
e. Expansion bolts with 3-1/2 IN 90 MM embedment.

K. Closure:
1. Continuous 30 MIL (20 GA) 0.75 MM galvanized closure angle to receive vapor retarder and vapor retarder tape.

L. Metal Blocking (TYPE B):
1. C-shaped modified track runners.
2. G40 galvanized.
3. Backing height: 6 IN 150 MM minimum or deeper.
4. Flange width: 1-1/4 IN 32 MM minimum.
5. Thickness: 30 MIL (20 GA) 0.75 MM minimum.

M. General installations:
1. Dimensions: 2 to 12 IN 50 to 300 MM wide, as necessary for items to be supported.
2. Thickness: 30 MIL (20 GA) 0.75 MM minimum.
3. Use heavier gauge as necessary for items to be supported.

2.5 SUSPENDED CEILING SYSTEM FOR GYPSUM BOARD (OPTION)

A. Conform to ASTM C635, heavy duty, with not less than 35 mm (1-3/8 inch) wide knurled capped flange face designed for screw attachment of gypsum board.

B. Wall track channel with 35 mm (1-3/8 inch) wide flange.

PART 3 - EXECUTION

3.1 INSTALLATION CRITERIA

A. Where fire rated construction is required for walls, partitions, columns, beams and floor-ceiling assemblies, the construction shall be same as that used in fire rating test.

B. Construction requirements for fire rated assemblies and materials shall be as shown and specified, the provisions of the Scope paragraph (1.2) of ASTM C754 and ASTM C841 regarding details of construction shall not apply.

3.2 INSTALLING STUDS

A. Install studs in accordance with ASTM C754, except as otherwise shown or specified.
1. Gypsum Board Assemblies: Comply with additional requirements in ASTM C840 relative to framing installation.

B. Space studs not more than 610 mm (24 inches) on center.

C. Cut studs 6 mm to 9 mm (1/4 to 3/8-inch) less than floor to underside of structure overhead when extended to underside of structure overhead.

D. Where studs are shown to terminate above suspended ceilings, provide bracing as shown or extend studs to underside of structure overhead.

E. Extend studs to underside of structure overhead for fire, rated partitions, smoke partitions, shafts, and sound rated partitions.
1. Continue framing around ducts and similar items which penetrate partitions.

F. Openings:
1. Frame jambs of openings in stud partitions and furring with two studs placed back to back or as shown.
2. Fasten back to back studs together with 9 mm (3/8-inch) long Type S pan head screws at not less than 600 mm (two feet) on center, staggered along webs.

3. Studs fastened flange to flange shall have splice plates on both sides approximately 50 X 75 mm (2 by 3 inches) screwed to each stud with two screws in each stud. Locate splice plates at 600 mm (24 inches) on center between runner tracks.
4. Control Joints (CJ):
   a. Install additional stud, maximum 1/2 IN 13 MM from jamb studs.
   b. Do not fasten extra stud to track or jamb stud.
   c. Refer to specification Section 09 29 00 for control joint locations.
5. Door Openings:
   a. Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section for cripple studs at head and secure to jamb studs.
   b. Unless indicated otherwise, extend jamb studs through suspended ceilings and secure laterally to overhead structure.
   c. Jamb Studs:
      1) Install two studs at each jamb, unless otherwise indicated.
      2) Minimum thickness of jamb studs: 30 MIL (20 GA) 0.762 MM at openings.
      3) Securely attach jamb studs to door frames.
      4) Attach drywall to both studs equally.
6. Headers:
   a. Openings less than 4 FT 1.2 M wide:
      1) Cut-to-length section of floor runner above and below wall openings.
      2) Split flanges and bend webs at ends.
      3) Overlap and screw attach jamb studs to frames.
   b. Openings over 4 FT 1.2 M wide:
      1) Cut-to-length, horizontal box beam studs above and below wall openings.
      2) Design for actual span and loading.
   c. Incorporate miscellaneous steel members, specified in Section 05 50 00, and wood blocking, specified in Section 06 10 00, where indicated.
7. Control Joints at head of jambs:
   a. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2 IN 13 MM clearance from jamb stud to allow for installation of control joint in finished assembly.
8. Other Framed Openings:
   a. Frame openings other than door openings the same as required for door openings, unless otherwise indicated.
   b. Install framing below sills of openings to match framing required above door heads.
   c. Cripple Studs:
      1) Install cut-to-length intermediate vertical studs above and below openings.
      2) Spacing: As indicated for typical full-length studs.
   d. Incorporate miscellaneous steel members, specified in Section 05 50 00, and wood blocking, specified in Section 06 10 00, where indicated.

G. Fastening Studs:
1. Fasten studs located adjacent to partition intersections, corners and studs at jambs of openings to flange of runner tracks with two screws through each end of each stud and flange of runner.
2. Anchor studs to deflection track with wafer head screws on both flanges of each stud.
   a. Maintain deflection gap between top of stud and top of slotted track.
   b. Install screws at centerline of slot and secure allowing vertical movement.
3. Anchor fire rated partitions as required by fire resistance design, and firestopping design.

H. Chase Wall Partitions:
1. Locate cross braces for chase wall partitions to permit the installation of pipes, conduits, carriers and similar items.
2. Use studs or runners as cross bracing not less than 63 mm (2-1/2 inches wide).

I. Form building seismic or expansion joints with double studs back to back spaced 75 mm (three inches) apart plus the width of the seismic or expansion joint.

J. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

K. Form control joint, with double studs spaced 13 mm (1/2-inch) apart.

L. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

M. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

N. Position studs vertically engaging floor track and head of wall deflection track.
   1. Align stud knockouts to facilitate running of wires and conduit.

O. Provide additional studs at corners, partition intersections and terminations of partitions, and at each side of control joints.

P. Where partitions abut vertical structural elements, provide perimeter relief per Gypsum Association GA-600 Strain Relief System details.

Q. Head-of-Wall:
   1. Provide slotted top track for walls extended to structure.
   2. Configure to resist lateral loads while accommodating deflection of overhead building superstructure without inducing axial loading on partition framing.
   3. Secure deflection track to structure in accordance with industry standards and regulatory requirements.
   4. Secure at corners and at ends.
   5. Cut vertical studs 5/8 IN 16 MM short to create a deflection gap when installed into top track.
      a. Secure vertical studs to top track with framing screw at each stud flange, screwing through track slots for positive stud connection.
   6. Secure Gypsum Wallboard to vertical studs; do not secure Gypsum Wallboard to top track directly.

R. Wall furring-Stud System:
   1. Framed with 63 mm (2-1/2 inch) or narrower studs, 600 mm (24 inches) on center.
   2. Brace as specified in ASTM C754 for Wall Furring-Stud System or brace with sections or runners or studs placed horizontally at not less than three foot vertical intervals on side without finish.
   3. Securely fasten braces to each stud with two Type S pan head screws at each bearing.

S. Direct attachment to masonry or concrete; rigid channels or "Z" channels:
   1. Install rigid (hat section) furring channels at 600 mm (24 inches) on center, horizontally or vertically.
   2. Install "Z" furring channels vertically spaced not more than 600 mm (24 inches) on center.
   3. At corners where rigid furring channels are positioned horizontally, provide mitered joints in furring channels.
   4. Ends of spliced furring channels shall be nested not less than 200 mm (8 inches).
   5. Fasten furring channels to walls with power-actuated drive pins or hardened steel concrete nails. Where channels are spliced, provide two fasteners in each flange.
   6. Locate furring channels at interior and exterior corners in accordance with wall finish material manufacturers printed erection instructions. Locate "Z" channels within 100 mm (4 inches) of corner.
   7. Where furring channels are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

3.3 INSTALLING SUPPORTS REQUIRED BY OTHER TRADES

A. Provide for attachment and support of electrical outlets, plumbing, laboratory or heating fixtures, recessed type plumbing fixture accessories, access panel frames, wall bumpers, wood seats, toilet stall partitions, dressing booth partitions, urinal screens, chalkboards, tackboards, wall-hung casework, handrail brackets, recessed fire extinguisher cabinets and other items like auto door buttons and auto door operators supported by stud construction.

B. Provide additional studs where required. Install metal backing plates, or special metal shapes as required, securely fastened to metal studs.

C. Coordinate mounting height, location, and coverage with item to be supported.

D. Determine material width according to item to be supported.

E. Provide in-wall metal wall backing material to interior metal stud walls specified herein.

F. Attachment: Minimum 2 - #10 sheet metal screws at each stud.

3.4 INSTALLING FURRED AND SUSPENDED CEILINGS OR SOFFITS

A. Install furred and suspended ceilings or soffits in accordance with ASTM C754 or ASTM C841 except as otherwise specified or shown for screw attached gypsum board ceilings and for plaster ceilings or soffits.
   1. Space framing at 400 mm (16-inch) centers for metal lath anchorage.
   2. Space framing at 600 mm (24-inch) centers for gypsum board anchorage.

B. New exposed concrete slabs:
   1. Use metal inserts required for attachment and support of hangers or hanger wires with tied wire loops for embedding in concrete.
   2. Furnish for installation under Division 3, CONCRETE.
   3. Suspended ceilings under concrete rib construction shall have runner channels at right angles to ribs and be supported from ribs with hangers at ends and at 1200 mm (48-inch) maximum intervals along channels. Stagger hangers at alternate channels.

C. Concrete slabs on steel decking composite construction:
   1. Use pull down tabs when available.
   2. Use power activated fasteners when direct attachment to structural framing can not be accomplished.

D. Where bar joists or beams are more than 1200 mm (48 inches) apart, provide intermediate hangers so that spacing between supports does not exceed 1200 mm (48 inches). Use clips, bolts, or wire ties for direct attachment to steel framing.

E. Installing suspended ceiling system for gypsum board (ASTM C635 Option):
   1. Install only for ceilings to receive screw attached gypsum board.
   2. Install in accordance with ASTM C636.
      a. Install main runners spaced 1200 mm (48 inches) on center.
      b. Install 1200 mm (four foot) tees not over 600 mm (24 inches) on center; locate for edge support of gypsum board.
      c. Install wall track channel at perimeter.

F. Installing Ceiling Bracing System:
   1. Construct bracing of 38 mm (1-1/2 inch) channels for lengths up to 2400 mm (8 feet) and 50 mm (2 inch) channels for lengths over 2400 mm (8 feet) with ends bent to form surfaces for anchorage to carrying channels and over head construction. Lap channels not less than 600 mm (2 feet) at midpoint back to back. Screw or bolt lap together with two fasteners.
   2. Install bracing at an approximate 45 degree angle to carrying channels and structure overhead; secure as specified to structure overhead with two fasteners and to carrying channels with two fasteners or wire ties.

3. Brace suspended ceiling or soffit framing in seismic areas in accordance with ASTM E580.

3.5 TOLERANCES

A. Fastening surface for application of subsequent materials shall not vary more than 3 mm (1/8-inch) from the layout line.

B. Plumb and align vertical members within 3 mm (1/8-inch.)

C. Level or align ceilings within 3 mm (1/8-inch.)

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SECTION 09 29 00

GYPSUM BOARD

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies installation and finishing of gypsum board.

1.2 RELATED WORK

A. Installation of steel framing members for walls, partitions, furring, soffits, and ceilings: Section 09 22 16, NON-STRUCTURAL METAL FRAMING.

B. Acoustical Sealants: Section 07 92 00, JOINT SEALANTS.

C. Lay in gypsum board ceiling panels: Section 09 51 00, ACOUSTICAL CEILING.

1.3 TERMINOLOGY

A. Definitions and description of terms shall be in accordance with ASTM C11, C840, and as specified.

B. Underside of Structure Overhead: In spaces where steel trusses or bar joists are shown, the underside of structure overhead shall be the underside of the floor or roof construction supported by the trusses or bar joists.

C. "Yoked": Gypsum board cut out for opening with no joint at the opening (along door jamb or above the door).

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:
1. Cornerbead and edge trim.
2. Finishing materials.
3. Laminating adhesive.
4. Gypsum board, each type.

C. Shop Drawings:
1. Typical gypsum board installation, showing corner details, edge trim details and the like.
2. Typical sound rated assembly, showing treatment at perimeter of partitions and penetrations at gypsum board.
3. Typical shaft wall assembly.
4. Typical fire rated assembly and column fireproofing, indicating details of construction same as that used in fire rating test.

D. Samples:
1. Cornerbead.
2. Edge trim.
3. Control joints.

E. Test Results:
1. Fire rating test, each fire rating required for each assembly.
2. Sound rating test.

F. Certificates: Certify that gypsum board types, gypsum backing board types, cementitious backer units, and joint treating materials do not contain asbestos material.

1.5 DELIVERY, IDENTIFICATION, HANDLING AND STORAGE

A. In accordance with the requirements of ASTM C840.

1.6 ENVIRONMENTAL CONDITIONS

A. In accordance with the requirements of ASTM C840.

1.7 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society for Testing And Materials (ASTM):

C11-15.....Terminology Relating to Gypsum and Related Building Materials and Systems

C475-15.....Joint Compound and Joint Tape for Finishing Gypsum Board

C840-13.....Application and Finishing of Gypsum Board

C919-12.....Sealants in Acoustical Applications

C954-15.....Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Stud from 0.033 in. (0.84mm) to 0.112 in. (2.84mm) in thickness

C1002-14.....Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs

C1047-14.....Accessories for Gypsum Wallboard and Gypsum Veneer Base

C1177-13.....Glass Mat Gypsum Substrate for Use as Sheathing

C1178/C1178M-18.....Specification for Coated Glass Mat Water Resistant Backing Panel

C1658-13.....Glass Mat Gypsum Panels

C1396-14.....Gypsum Board

C1629.....Abuse-Resistant Non-decorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels.

D3273.....Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.

E84 .....Surface-Burning Characteristics of Building Materials.

E90 .....Sound Transmission Testing.

E119 .....Fire Tests of Building Construction.

E413 .....Classification for Rating Sound Insulation

C. Underwriters Laboratories Inc. (UL):
Latest Edition.....Fire Resistance Directory

D. Inchcape Testing Services (ITS):
Latest Editions.....Certification Listings

E. Gypsum Association (GA):
1. GA-216 Application and Finishing of Gypsum Panel Products.
2. GA-234 Control Joints for Fire-Resistance Rated Systems.
3. GA-238 Guidelines for Prevention of Mold Growth on Gypsum Board.

F. Fire Resistant Rated Assemblies:
   1. For fire resistance rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.
   2. Provide materials listed by UL, or other approved testing laboratory, for construction and rating type indicated.

G. STC Rated Assemblies:
   1. Provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.
   2. Facility Guidelines Institute (FGI):
      a. FGI Guidelines for Design and Construction of Healthcare Facilities:
         1) Sound and Vibration Requirements.
   3. American National Standards Institute (ANSI):
      a. S1.1 American National Standard Acoustical Terminology.
      b. S1.4 American National Standard Specification for Sound Level Meters.
      c. S1.4 American National Standard Specification for Sound Level Meters.
      d. S1.43 American National Standard Specifications for Integrating-Averaging Sound Level Meters.
   4. ASTM International (ASTM):
      a. C423 Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
      b. C634 Standard Terminology Relating to Building and Environmental Acoustics.
      c. C840 Standard Specification for Application and Finishing of Gypsum Board.
      d. E90 Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
      e. E336 Standard Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings.
      f. E413 Classification for Rating Sound Insulation.
      g. E966 Standard Guide for Field Measurements of Airborne Sound Insulation of Building Facades and Façade Elements.
   5. American Society of Heating Refrigerating and Air-Conditioning Engineers (ASHRAE):
      a. ASHRAE Handbook: Sound and Vibration Control.
   6. South Coast Air Management District (SCAQMD):
      a. SCAQMD Rule 1113 Architectural Coatings.
      b. SCAQMD Rule 1168 - Adhesive and Sealant Applications.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Furnish in maximum available lengths, consistent with installation requirements.
   1. Long Edge: Tapered.
   2. Short Ends: Square.

B. Upgrade listed types to fire rated equivalent products when used in fire rated assemblies.

C. Provide listed GWB products to mold and moisture resistant types, where wallboard is installed in Electrical, Communication Rooms, Mechanical shafts, Stair Shafts and similar locations where wallboard is installed prior to building being weathertight.

D. Framing and suspension systems for Gypsum Board Ceilings: Specified in Section 09 22 16.

E. Firestopping: Specified in Section 07 84 00.

F. Paper facings shall contain 100 percent post-consumer recycled paper content.

2.2 GYPSUM BOARD

A. Gypsum Board:
   1. ASTM C1396.
   2. Thickness: 16 mm (5/8 inch) thick unless shown otherwise.
   3. Type X core

B. Shaftwall Liner Panel, Fire rated:
   1. Panel size: 1 IN x 24 IN 25 MM x 610 MM wide.
   2. Type X core.
   3. Mold and moisture resistant:
   4. Mold resistance score: 10 per ASTM D3273.
   5. Fiberglass coated glass mats, both faces per ASTM C1658.

C. Acoustically Enhanced Gypsum Wallboard (AEGWB):
   1. Two-ply high density, mold resistant, paper faced gypsum wallboard laminated together with viscoelastic dampening polymer.
   2. Composite Thickness: 5/8 IN 15 MM.
   3. Fire resistant, Type X gypsum core.
      a. ASTM C1396.
      b. Products which do not include a Type X core may be used in partitions that do not have a fire resistance requirement.

D. Interior face of exterior walls and rooms where moisture or high humidity is present:
   1. Mold and moisture resistant gypsum panels (MRGWB).
   2. Gypsum panels, with glass mat facer per ASTM C1658.
   3. Thickness: 5/8 IN 15 MM.
   4. Mold resistance score: 10 per ASTM D3273.
   5. Apply continuously to interior face of exterior stud walls prior to framing interior partitions and ceilings.
   6. Where MR wallboard is scheduled in fire rated walls, provide approved fire resistive products with comparable moisture resistance.

E. Tile Backer Board (TBB):
   1. Moisture resistant treated gypsum core, glass mats on both sides, and acrylic water barrier or water resistant gypsum coating on finished side.
   2. Provide TBB at walls of showers, tub rooms, toilet rooms, decontamination rooms, and similar walls where tile is scheduled.
   3. Thickness: 1/2 IN 12.5 MM.
   4. Thickness: 5/8 IN 15 MM type X at rated walls.
   5. Mold resistance score: 10 per ASTM D3273.
   6. Include Level 5 finish at non-tiled portions.

F. Abuse Resistant Gypsum Wallboard (ARGWB):
   1. Thickness: 5/8 IN.
   2. Type X core.
   3. Tested in accordance with ASTM C1629.
   4. Surface Abrasion: Level 2.
   5. Surface Indentation: Level 1.
   6. Soft Body Impact: Level 1.
   7. Upgrade metal studs to 30 MILS (20 GA) minimum where used with ARGWB.

G. Impact Resistant Gypsum Wallboard (IRGWB):
   1. Thickness: 5/8 IN 15 MM.
   2. Type X core.
   3. Mold resistance score: 10 per ASTM D3273.
   4. Tested in accordance with ASTM C1629.
   5. Soft Body Impact: Level 2, minimum.
   6. Hard Body Impact: Level 2, minimum.

7. Upgrade metal studs to 30 MILS (20 GA) minimum where used with IRGWB.
8. Base product, glass mat facer – ASTM C1658

2.3 ACCESSORIES

A. ASTM C1047, except form of 0.39 mm (0.015 inch) thick zinc coated steel sheet or rigid PVC plastic.

B. Flanges not less than 22 mm (7/8 inch) wide with punchouts or deformations as required to provide compound bond.

C. Trim:
1. Interior Trim:
   a. Material: Galvanized or aluminum coated steel sheet, rolled zinc, paper faced galvanized steel sheet, or paper faced structural laminate.
   b. Material for wet areas: Zinc.
   c. Shapes:
      1) Corner bead.
      2) LC-Bead: J-shaped; exposed long flange receives joint compound.
      3) L-Bead: L-shaped; exposed long flange receives joint compound.
      4) U-Bead: J-shaped; exposed short flange does not receive joint compound.
      5) Control joint.
      6) Other items as indicated.
   d. Compatible with joint compound and finish materials indicated.
2. Exterior Trim:
   a. Material: Zinc.
   b. Shapes:
      1) Corner bead.
      2) LC-Bead: J-shaped; exposed long flange receives joint compound.
      3) Control joint.
      4) Other items as indicated.
3. Specialty trim:
   a. Profiles and dimensions indicated.
   b. Material: 6063-T5 Aluminum.
   c. Finish: Factory primed for field finishing.
   d. Finish: Class II anodic finish.
   e. Finish: Factory painted, baked enamel finish.
   f. Flanges to be embedded: Corrosion resistant primer compatible with joint compound and finish materials indicated.
4. Base products:
   a. Wall Reveals: SRW Series by Pittcon.
   b. Trim Reveals: STR Series by Pittcon.
   c. Edge Trims: ST & STFR Series by Pittcon.
   d. Wall Fabric Joiner: SWX-025 by Pittcon.
   e. Wall Caps: _____ Series by Pittcon.
   f. Bullnosed Outside Corners:_____ by Pittcon.
   g. Chamfered Outside Corners:_____ by Pittcon.
   h. 45-Degree Outside Corners:_____ by Pittcon.
   i. 60-Degree Outside Corners:_____ by Pittcon.

D. Joint Treatment Materials:
1. Use product types recommended by wallboard manufacturer for each condition.
2. Materials compatible with other compounds applied previously or on successive coats.
3. Provide dust control products in occupied areas or adjacent to occupied areas.
4. Joint tape:
   a. Interior gypsum wallboard: Paper.
   b. Tile backing panels: As recommended by panel manufacturer.
5. Joint compounds for interior gypsum wallboard:

a. Setting type joint compound:
1) Filling open joints and voids.
2) Embedding tape and first coat over joints, fasteners and trim flanges.

6. Lightweight setting type joint compound:
a. Second coat.
b. Final, skim coat on surfaces receiving a Level 5 finish.

7. Drying type all-purpose joint compound:
a. Second and third coats.
b. Final, skim coat, on surfaces receiving a Level 5 finish.
c. Spray applied coating compound:
d. Final, skim coat, on surfaces receiving a Level 5 finish.

8. Joint compounds for moisture resistant gypsum wallboard:
a. Setting type joint compound:
1) Filling open joints and voids.
2) Embedding tape and first coat over joints, fasteners and trim flanges.
b. Lightweight setting type joint compound:
1) Second and third coats.
2) Final, skim coat on surfaces receiving a Level 5 finish.

E. Acoustical Materials:
1. Provide where indicated.
2. Include for use at electrical outlets, switches and service devices.
3. Preformed acoustical seal for wall boxes:
a. Box Seal by STC Sound Control
b. Molded neoprene, durometer A-40 complying with ASTM D2000.
c. Formed to fit the electrical device, outlet and service boxes.
d. STC improvement: 6 db in accordance to ASTM E90.
4. Provide at electrical and service box penetrations in sound rated walls.

F. Security Mesh:
1. Comply with ASTM C847.
2. Minimum Weight: ____ LBS/SF kg/m2.
3. Install with Secura Clips.
4. Base Product: Security Mesh by Amico.

G. Polyethylene Sheet:
1. Polyethylene sheet conforming to ASTM D4397.
2. Nominal thickness: 0.15 mm (6 mils).

2.4 FASTENERS

A. ASTM C1002 and ASTM C840, except as otherwise specified.

B. ASTM C954, for steel studs thicker than 0.04 mm (0.33 inch).

C. Select screws of size and type recommended by the manufacturer of the material being fastened.

D. For fire rated construction, type and size same as used in fire rating test.

E. Clips: Zinc-coated (galvanized) steel; gypsum board manufacturer's standard items.

2.5 FINISHING MATERIALS AND LAMINATING ADHESIVE

A. ASTM C475 and ASTM C840. Free of antifreeze, vinyl adhesives, preservatives, biocides and other VOC. Adhesive shall contain a maximum VOC content of 50 g/l.

B. Manufacturer's recommended type for use with selected materials, mildew resistant, non-staining type, and with a VOC content of 50 g/L or less.

C. Adhesives shall contain no carcinogen or reproductive toxicant components present at more than 1 PCT of total mass of the product as defined in the California Office of Environmental Health Hazard Assessment's (OEHHA) list entitled Chemicals Known to the State to Cause Cancer or the Reproductive Toxicity, Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65).

D. Backing for Control Joints:
   1. Fire rated board.

E. Backing for control joints:
   1. Firestopping.

F. Support straps:
   1. Galvanized steel sheet for retaining and bracing in length and width indicated or as required for adequate support of assembly.
   2. Minimum Base-Metal Thickness: 30 MILS (20 gauge).

G. Sealer for Moisture Resistant Gypsum Wallboard:
   1. Manufacturer's standard compound.
   2. Use at joints, cut edges and screw penetrations.

PART 3 - EXECUTION

3.1 GYPSUM BOARD HEIGHTS

A. Extend all layers of gypsum board from floor to underside of structure overhead on following partitions and furring:
   a. All Walls, unless noted otherwise.
   2. One side of partitions or furring:
      a. Furring for pipes and duct shafts, except where fire rated shaft wall construction is shown.
   3. Extend all layers of gypsum board construction used for fireproofing of columns from floor to underside of structure overhead, unless shown otherwise.

B. In locations other than those specified, extend gypsum board from floor to heights as follows:
   1. Not less than 100 mm (4 inches) above suspended acoustical ceilings.
   2. At ceiling of suspended gypsum board ceilings.
   3. At existing ceilings.

3.2 INSTALLING GYPSUM BOARD

A. Coordinate installation of gypsum board with other trades and related work.

B. Install gypsum board in accordance with ASTM C840, except as otherwise specified.

C. Moisture and Mold–Resistant Assemblies: Provide and install moisture and mold-resistant glass mat gypsum wallboard products with moisture-resistant surfaces complying with ASTM C1658 where shown, specified herein, and in locations which might be subject to moisture exposure during construction.
   1. Products proposed are subject to COR approval.
   2. Exposure time shall be limited by manufacturer requirements.

D. Use gypsum boards in maximum practical lengths to minimize number of end joints.

E. Bring gypsum board into contact, but do not force into place.

F. Ceilings:
   1. For single-ply construction, use perpendicular application.
   2. For two-ply assembles:
      a. Use perpendicular application.
      b. Apply face ply of gypsum board so that joints of face ply do not occur at joints of base ply with joints over framing members.

G. Walls (Except Shaft Walls):
1. When gypsum board is installed parallel to framing members, space fasteners 300 mm (12 inches) on center in field of the board, and 200 mm (8 inches) on center along edges.
2. When gypsum board is installed perpendicular to framing members, space fasteners 300 mm (12 inches) on center in field and along edges.
3. Stagger screws on abutting edges or ends.
4. For single-ply construction, apply gypsum board with long dimension either parallel or perpendicular to framing members as required to minimize number of joints except gypsum board shall be applied vertically over "Z" furring channels.
5. For two-ply gypsum board assemblies, apply base ply of gypsum board to assure minimum number of joints in face layer. Apply face ply of wallboard to base ply so that joints of face ply do not occur at joints of base ply with joints over framing members.
6. For three-ply gypsum board assemblies, apply plies in same manner as for two-ply assemblies, except that heads of fasteners need only be driven flush with surface for first and second plies. Apply third ply of wallboard in same manner as second ply of two-ply assembly, except use fasteners of sufficient length enough to have the same penetration into framing members as required for two-ply assemblies.
7. No offset in exposed face of walls and partitions will be permitted because of single-ply and two-ply or three-ply application requirements.
8. Control Joints ASTM C840 and as follows:
   a. Locate at both side jambs of openings if gypsum board is not "yoked". Use one system throughout.
   b. Not required for wall lengths less than 9000 mm (30 feet).
   c. Extend control joints the full height of the wall or length of soffit/ceiling membrane.

H. Acoustical or Sound Rated Partitions, Fire and Smoke Partitions:
1. Cut gypsum board for a space approximately 3 mm to 6 mm (1/8 to 1/4 inch) wide around partition perimeter.
2. Coordinate for application of caulking or sealants to space prior to taping and finishing.
3. For sound rated partitions, use sealing compound (ASTM C919) to fill the annular spaces between all receptacle boxes and the partition finish material through which the boxes protrude to seal all holes and/or openings on the back and sides of the boxes. STC minimum values as shown.

I. Electrical and Telecommunications Boxes:
1. Seal annular spaces between electrical and telecommunications receptacle boxes and gypsum board partitions.
2. Preformed Acoustical Seal for Wall Boxes:
   a. Place preformed seal over exposed outlet box flush with wall surface with device protruding through preformed or precut opening in seal.
   b. Secure in place with outlet cover plate.

J. Accessories:
1. Set accessories plumb, level and true to line, neatly mitered at corners and intersections, and securely attach to supporting surfaces as specified.
2. Install in one piece, without the limits of the longest commercially available lengths.
3. Corner Beads:
   a. Install at all vertical and horizontal external corners and where shown.
   b. Use screws only. Do not use crimping tool.
4. Edge Trim (casings Beads):
   a. At both sides of expansion and control joints unless shown otherwise.
   b. Where gypsum board terminates against dissimilar materials and at perimeter of openings, except where covered by flanges, casings or permanently built-in equipment.
   c. Where gypsum board surfaces of non-load bearing assemblies abut load bearing members.
   d. Where shown.

3.3 CAVITY SHAFT WALL

A. Coordinate assembly with Section 09 22 16, NON-STRUCTURAL METAL FRAMING, for erection of framing and gypsum board.

B. Conform to UL Design No. V473or FM WALL CONSTRUCTION 12-2/HR (Nonbearing for two-hour fire rating.

C. Conform to UL Design No. V473FM WALL CONSTRUCTION 25-1/HR (Non-loadbearing) for one-hour fire rating where shown.

D. Cut coreboard (liner) panels 25 mm (one inch) less than floor-to-ceiling height, and erect vertically between J-runners on shaft side.
   1. Where shaft walls exceed 4300 mm (14 feet) in height, position panel end joints within upper and lower third points of wall.
   2. Stagger joints top and bottom in adjacent panels.
   3. After erection of J-struts of opening frames, fasten panels to J-struts with screws of sufficient length to secure to framing staggered from those in base, spaced 300 mm (12 inches) on center.

E. Gypsum Board:
   1. Two hour wall:
      a. Erect base layer (backing board) vertically on finish side of wall with end joints staggered. Fasten base layer panels to studs with 25 mm (one inch) long screws, spaced 600 mm (24 inches) on center.
      b. Use laminating adhesive between plies in accordance with UL or FM if required by fire test.
      c. Apply face layer of gypsum board required by fire test vertically over base layer with joints staggered and attach with screws of sufficient length to secure to framing staggered from those in base, spaced 300 mm (12 inches) on center.
   2. One hour wall with one layer on finish side of wall: Apply face layer of gypsum board vertically. Attach to studs with screws of sufficient length to secure to framing, spaced 300 mm (12 inches) on center in field and along edges.
   3. Where coreboard is covered with face layer of gypsum board, stagger joints of face layer from those in the coreboard base.

F. Treat joints, corners, and fasteners in face layer as specified for finishing of gypsum board.

G. Elevator Shafts:
   1. Protrusions including fasteners other than flange of shaft wall framing system or offsets from vertical alignments more than 3 mm (1/8-inch) are not permitted unless shown.
   2. Align shaft walls for plumb vertical flush alignment from top to bottom of shaft.

3.4 FINISHING OF GYPSUM BOARD

A. Finish joints, edges, corners, and fastener heads in accordance with ASTM C840. Use Level 4 finish for al finished areas open to public view.
   1. After drying, sand or otherwise smooth final coat of compound as needed to eliminate high spots or excess compound to leave smooth, even, and level surface.
   2. Draw down final coat of compound to a smooth even plane.
   3. Locations:
      a. Wallboard scheduled to be finished with Gloss Level 1 (flat), Level 2 (velvet), or Level 3 (eggshell) paint, glazed coating, textured coating, or wall covering.
      b. Wallboard scheduled to be finished with Level 1 (flat) paint, textured coating, or wallcovering.
      c. Where above listed surfaces are to be finished with textured decorative treatments, wall covering, paneling, or wall guard.
      d. Remaining locations, unless noted otherwise.

B. Level 5 Finish:

1. Trowel skim coat of joint compound leaving a thin film covering the entire surface, in accordance with manufacturer's recommendations.
2. Make surfaces free of tool marks and ridges.
3. Locations:
   a. Exposed ceiling, soffit, or wall areas abutting window mullions, skylights, or receiving direct indoor lighting.
   b. Hallways or corridors unbroken by doorways or windows in excess of twenty feet 6 m.
   c. Atriums, Lobbies, Auditoriums and similar large spaces.
   d. Multi-story spaces.
   e. Wall board scheduled to be finished with Gloss Level 4 (satin), Level 5 (semi-gloss), Level 6 (gloss), Level 7 (high gloss), paint, glazed coating, textured coating, or wall covering.
   f. Surfaces using Moisture Resistant Gypsum Wallboard, Tile Backer Board or other wallboard types with a glass mat facer on finished side.

C. Glass Mat, Water Resistant Backing Panels (TBB):
1. Finish according to manufacturer's written instructions.
2. TCNA Systems W245-1.
3. Coordinate install of Glass Mat, Water Resistant Backing Panels (TBB) with Section 09 30 13, CERAMIC PORCELAIN TILING.
4. Walls:
   a. In showers or other wet areas cover studs with polyethylene sheet.

D. Cementitious Backer Units:
1. Finish according to manufacturer's written instructions.

E. Before proceeding with installation of finishing materials, assure the following:
1. Gypsum board is fastened and held close to framing or furring.
2. Fastening heads in gypsum board are slightly below surface in dimple formed by driving tool.

F. Finish joints, fasteners, and all openings, including openings around penetrations, on that part of the gypsum board extending above suspended ceilings to seal surface of non-decorated smoke barrier, fire rated and sound rated gypsum board construction. After the installation of hanger rods, hanger wires, supports, equipment, conduits, piping and similar work, seal remaining openings and maintain the integrity of the smoke barrier, fire rated, and sound rated construction/ Sanding is not required of non-decorated surfaces.

3.5 REPAIRS

A. After taping and finishing has been completed, and before decoration, repair all damaged and defective work, including nondecorated surfaces.

B. Patch holes or openings 13 mm (1/2 inch) or less in diameter, or equivalent size, with a setting type finishing compound or patching plaster.

C. Repair holes or openings over 13 mm (1/2 inch) diameter, or equivalent size, with 16 mm (5/8 inch) thick gypsum board secured in such a manner as to provide solid substrate equivalent to undamaged surface.

D. Tape and refinish scratched, abraded or damaged finish surfaces including cracks and joints in non-decorated surface to provide smoke tight construction, fire protection equivalent to the fire rated construction, and STC equivalent to the sound rated construction.

3.6 CEILINGS

A. At Mental Health and Behavioral Nursing Units, areas accessible to patients and not continuously observable by staff (e.g., patient bedrooms, day rooms), ceilings should be a solid material such as gypsum board. This will limit patient access. Access doors are needed to

access electrical and mechanical equipment above the ceiling. These doors should be locked to prevent unauthorized access and secured to ceiling using tamper resistant fasteners.

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SECTION 09 30 13
CERAMIC/PORCELAIN TILING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies interior ceramic, porcelain, engineered thresholds and window stools, terrazzo divider strips, waterproofing membranes for thin-set applications, and crack isolation membranes.

1.2 RELATED WORK

A. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS: Sustainable Design Requirements.

B. Section 07 92 00, JOINT SEALANTS: Sealing of Joints.

C. Tile Backer Board: Section 09 29 00, GYPSUM BOARD.

D. Section 09 65 19, RESILIENT TILE FLOORING: Metal and Resilient Edge Strips at Joints with New Resilient Flooring.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Sustainable Design Submittals as described below:
   1. Volatile organic compounds per volume as specified in PART 2 - PRODUCTS.

C. Samples:
   1. Base tile, each type, each color, each size.
   2. Mosaic floor tile panels, 228 by 228 mm (9 by 9 inches), each type, color, size and pattern.
   3. Porcelain tile, each type, color, patterns and size.
   4. Wall (or wainscot) tile, each color, size and pattern.
   5. Trim shapes, bullnose cap and cove including bullnose cap and base pieces at internal and external corners of vertical surfaces, each type, color, and size.

D. Product Data:
   1. Ceramic and porcelain tile, marked to show each type, size, and shape required.
   2. Chemical resistant mortar and grout (epoxy and furan).
   3. Cementitious backer unit.
   4. Dry-set portland cement mortar and grout.
   5. Divider strip.
   6. Elastomeric membrane and bond coat.
   7. Reinforcing tape.
   8. Leveling compound.
   9. Latex-portland cement mortar and grout.
   10. Commercial portland cement grout.
   11. Organic adhesive.
   12. Slip resistant tile.
   13. Waterproofing isolation membrane.
   14. Fasteners.

E. Certification:
   1. Master grade certificate, ANSI A137.1.
   2. Manufacturer's certificates indicating that the following materials comply with specification requirements:
      a. Chemical resistant mortar and grout (epoxy and furan).

b. Modified epoxy emulsion.
c. Commercial portland cement grout.
d. Cementitious backer unit.
e. Dry-set portland cement mortar and grout.
f. Elastomeric membrane and bond coat.
g. Reinforcing tape.
h. Latex-portland cement mortar and grout.
i. Leveling compound.
j. Organic adhesive.
k. Waterproof isolation membrane.
l. Factory back mounted tile documentation for suitability for application in wet area.

F. Installer Qualifications:
1. Submit letter stating installer's experience.

1.4 DELIVERY AND STORAGE

A. Deliver materials in containers with labels legible and intact and grade-seals unbroken.

B. Store material to prevent damage or contamination.

1.5 QUALITY ASSURANCE

A. Installers to be from a company specializing in performing installation of products specified and have a minimum of three (3) years' experience.

B. Each type and color of tile to be provided from a single source.

C. Each type and color of mortar, adhesive, and grout to be provided from the same source.

1.6 WARRANTY

A. Construction Warranty: Comply with FAR clause 52.246-21, "Warranty of Construction".

1.7 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in text by basic designation only.

B. American National Standards Institute (ANSI):

A10.20-06(R2016).....Safe Operating Practices for Tile, Terrazzo and Marble Work

A108/A118/A136.1:2019.....Installation of Ceramic Tile

A108.01-18.....Subsurfaces and Preparations by Other Trades

A108.02-19.....Materials, Environmental, and Workmanship

A108.1A-17 .....Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar

A108.1B-17 .....Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar

A108.1C-17 .....Contractors Option; Installation of Ceramic Tile in the Wet-Set method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar

A108.4-09.....Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive

A108.5-10 .....Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar

A108.6-10 ..... Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy

A108.8-10 ..... Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout

A108.9-10 ..... Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout

A108.10-17 ..... Grout in Tilework

A108.11-18 ..... Interior Installation of Cementitious Backer Units

A108.12-10 ..... Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar

A108.13-16 ..... Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone

A108.14-10 ..... Paper-Faced Glass Mosaic Tile

A108.15-19 ..... Alternate Method: Paper-Faced Glass Mosaic Tile

A108.17-16 ..... Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone

A118.1-19 ..... Dry-Set Portland Cement Mortar

A118.3-13 ..... Chemical Resistant, Water Cleanable Tile-Setting and –Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive

A118.4-19 ..... Modified Dry-Set Cement Mortar

A118.5-16 ..... Chemical Resistant Furan Mortars and Grouts

A118.6-19 ..... Standard Cement Grouts for Tile Installation

A118.7-1 ..... High Performance Cement Grouts for Tile Installation

A118.8-16 ..... Modified Epoxy Emulsion Mortar/ Grout

A118.9-19 ..... Cementitious Backer Units

A118.10-14 ..... Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation

A118.11-17 ..... EGP (Exterior Glue Plywood) Modified Dry-set Mortar

A118.12-14 ..... Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation

A118.13-14 ..... Bonded Sound Reduction Membranes for Thin-Set Ceramic Tile Installation

A118.15-19 ..... Improved Modified Dry-Set Cement Mortar

A136.1-13 ..... Organic Adhesives for Installation of Ceramic Tile

A137.1-17 ..... American National Standard Specifications for Ceramic Tile

C. ASTM International (ASTM):

A666-15 ..... Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar

A1064/A1064M-18a ..... Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

C109/C109M-20b ..... Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 inch. or [50-mm] Cube Specimens)

C241/C241M-15e1 ..... Abrasion Resistance of Stone Subjected to Foot Traffic

C348-20 ..... Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars

C627-18 ..... Evaluating Ceramic Floor Tile Installation Systems Using the Robinson-Type Floor Tester

C954-18 ..... Steel Drill Screws for the Application of Gypsum Board on Metal Plaster Base to Steel Studs from 0.033 in (0.84 mm) to 0.112 in (2.84 mm) in thickness

C979/C979M-16 ..... Pigments for Integrally Colored Concrete

C1002-18 ..... Steel Self-Piercing Tapping Screws for the Application of Panel Products

C1027-19 ..... Test Method for Determining Visible Abrasion Resistance of Glazed Ceramic Tile

C1127/C1127M-15 ..... Standard Guide for Use of High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane with an Integral Wearing Surface

C1178/C1178M-18 ..... Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel

C1325-19 ..... Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units

C1353/C1353M-20e1 ..... Abrasion Resistance of Dimension Stone Subjected to Foot Traffic Using a Rotary Platform, Double-Head Abraser

D1204-14(2020) ..... Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature

D2240-15e1 ..... Test Method for Rubber Property – Durometer Hardness

D2497-07(2018) ..... Tolerances for Manufactured Organic-Base Filament Single Yarns

D3045-2018 ..... Heat Aging of Plastics Without Load

D4397-16 ..... Standard Specification for Polyethylene Sheeting for Construction, Industrial and Agricultural Applications

D5109-12(Withdrawn2020) ... Standard Test Methods for Copper-Clad Thermosetting Laminates for Printed Wiring Boards (recommend deletion)

D. Code of Federal Regulation (CFR):
40 CFR 59 ..... Determination of Volatile Matter Content, Water Content, Density Volume Solids, and Weight Solids of Surface Coating

E. Marble Institute of America (MIA)/ Building Stone Institute (BSI): Dimension Stone Design Manual VIII-2016

F. Tile Council of North America, Inc. (TCNA):
Handbook for Ceramic Tile Installation (2020)G. TCNA DCOF AcuTest-2012,Dynamic Coefficient of Friction Test

PART 2 - PRODUCTS

2.1 TILE

A. Comply with ANSI A137.1, Standard Grade, except as modified:
1. Inspection procedures listed under the Appendix of ANSI A137.1.

2. Abrasion Resistance Classification:
   a. Tested in accordance with values listed in Table 1, ASTM C1027.
   b. Class V, 12000 revolutions for floors in Corridors, Kitchens, Storage including Refrigerated Rooms
   c. Class IV, 6000 revolutions for remaining areas.
3. Slip Resistant Tile for Floors:
   a. Coefficient of friction, when tested in accordance with ANSI A137.1 and measured per the TCNA DCOF AcuTest.
      1) Equal to or greater than .42 for level interior tile floors that will be walked on when wet.
   b. Tile Having Abrasive Grains:
      1) Unglazed Ceramic Mosaic Tile: Abrasive grains throughout body of the tile.
   c. Porcelain Paver Tile: Matte surface finish with raised ridges spaced uniformly over tile surface.
4. Mosaic tile may be mounted or joined by a resinous bonding material along tile edges.
5. Back mounted tiles in showers. Provide certification that the factory mounted tile has been used successfully in service at three (3) projects and is suitable for wet locations.
6. Factory Blending: For tile with color variations, within the ranges selected during sample submittals blend tile in the factory and package so tile units taken from one (1) package show the same range in colors as those taken from other packages and match approved samples.
7. Factory-Applied Temporary Protective Coating:
   a. Protect exposed face surfaces (top surface) of tile against adherence of mortar and grout by pre-coating with a continuous film of hot applied petroleum paraffin wax.
   b. Do not coat unexposed tile surfaces.
   c. Pre-wax tiles set or grouted with epoxy or latex modified mortars.

B. Unglazed Ceramic Mosaic Tile: Nominal 6 mm (1/4 inch) thick with cushion edges.

C. Glazed Wall Tile: Cushion edges, glazing.

D. Porcelain Paver Tile: Nominal 8 mm (5/16 inch) thick, with cushion edges. Porcelain tile produced by the dust pressed method are to be made of approximately 50 percent feldspar; the remaining 50 percent is to be made up of various high-quality light firing ball clays yielding a tile with a water absorption rate of 0.5 percent or less and a breaking strength of between 176 to 181 kg (390 to 400 pounds).

E. Trim Shapes:
   1. Conform to applicable requirements of adjoining floor and wall tile.
   2. Use slip resistant trim shapes for horizontal surfaces of showers.
   3. Use trim shapes sizes conforming to size of adjoining field wall tile including existing spaces unless detailed on construction documents or specified otherwise.
   4. Internal and External Corners:
      a. Square internal and external corner joints are not acceptable.
      b. External corners including edges: Use bullnose shapes.
      c. Internal corners: Use cove shapes.
      d. Base to floor internal corners: Use special shapes providing integral cove vertical and horizontal joint.
      e. Base to floor external corners: Use special shapes providing bullnose vertical edge with integral cove horizontal joint. Use stop at bottom of openings having bullnose return to wall.
      f. Wall top edge internal corners: Use special shapes providing integral cove vertical joint with bullnose top edge.
      g. Wall top edge external corners: Use special shapes providing bullnose vertical and horizontal joint edge.

h. For unglazed ceramic mosaic and glazed wall tile installed in portland cement mortar setting bed, use cove and bullnose shapes as applicable. When ceramic mosaic wall and base tile is required, use C Series cove and bullnose shapes.
i. For unglazed ceramic mosaic and glazed wall tile installed in dry-set portland cement mortar, latex-portland cement mortar, and organic adhesive (thin set methods), use cove and surface bullnose shapes as applicable.
j. For quarry tile work, use cove and bullnose shapes as applicable.
k. Provide cove and bullnose shapes where indicated in construction documents, and required to complete tile work.

2.2 SETTING MATERIALS OR BOND COATS

A. Conform to TCNA Handbook for Ceramic Tile Installation.

B. Portland Cement Mortar: ANSI A108.02.

C. Latex-Portland Cement Mortar: ANSI A118.4.
1. For wall applications, provide non-sagging, latex-portland cement mortar complying with ANSI A118.4.
2. Prepackaged Dry-Mortar Mix: Factory-prepared mixture of portland cement; dry, redispersible, ethylene vinyl acetate additive; and other ingredients to which only water needs to be added at Project site.

D. Dry-Set Portland Cement Mortar: ANSI A118.1. For wall applications, provide non-sagging, latex-portland cement mortar complying with ANSI A118.1.

E. Organic Adhesives: ANSI A136.1, Type 1.

F. Chemical-Resistant Bond Coat:
1. Epoxy Resin Type: ANSI A118.3.
2. Furan Resin Type: ANSI A118.5.

2.3 GROUTING MATERIALS

A. Coloring Pigments:
1. Pure mineral pigments, lime proof and nonfading, complying with ASTM C979/C979M.
2. Coloring pigments may only be added to grout by the manufacturer.
3. Job colored grout is not acceptable.
4. Use is required in Commercial Portland Cement Grout, Dry-Set Grout, and Latex-Portland Cement Grout.

B. Sand-Portland Cement Grout: ANSI A108.10, consisting of white or gray cement and white or colored aggregate as required to produce color indicated. Zero VOC content.

C. Standard Cement Grout: ANSI A118.6.

D. High Performance Tile Grout: ANSI A118.7 with a VOC content of 65 g/L or less when calculated according to 40 CFR 59 (EPA Method 24).
1. Polymer Type: Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.
2. Polymer Type: Acrylic resin or styrene-butadiene rubber in liquid-latex form for addition to prepackaged dry-grout mix.

E. Water-Cleanable Epoxy Grout: ANSI A118.3, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59 (EPA Method 24).
1. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 60 and 100 degrees C (140 and 212 degrees F), respectively, and certified by manufacturer for intended use.

2.4 PATCHING AND LEVELING COMPOUND

A. Portland cement base, polymer-modified, self-leveling compound, manufactured specifically for resurfacing and leveling concrete floors. Products containing gypsum are not acceptable.

B. Provide a patching and leveling compound with the following minimum physical properties:
   1. Compressive strength - 25 MPa (3500 psig) per ASTM C109/C109M.
   2. Flexural strength - 7 MPa (1000 psig) per ASTM C348 (28 day value).
   3. Tensile strength – 4.1 MPa (600 psi) per ANSI 118.7.
   4. Density – 1.9.

C. Capable of being applied in layers up to 38 mm (1-1/2 inches) thick without fillers and up to 101 mm (4 inches) thick with fillers, being brought to a feather edge, and being trowelled to a smooth finish.

D. Primers, fillers, and reinforcement as required by manufacturer for application and substrate condition.

E. Ready for use in 48 hours after application.

2.5 SOLID SURFACE ENGINEERED THRESHOLDS & STOOLS:

A. Solid Surface Material:
   1. Non-porous, homogeneous material maintaining the same composition throughout the part with a composition of acrylic polymer, aluminum trihydrate filler and pigment; not coated, laminated or of composite construction; meeting following criteria:
      a. Flammability: Class 1 and A when tested to UL 723.
   2. **Finish: Ensure surfaces have uniform finish:**
      a. **Matte, with a 60° gloss rating of 5 - 20.**
      b. Wet Dynamic Coefficient of Friction: 0.65.
   3. Thickness and contour as indicated in construction documents.
   4. **Fabrication:**
      a. **Fabricate components in shop to greatest extent practical to sizes and shapes indicated, in accordance with approved Shop Drawings and solid polymer manufacturer requirements. Form joints between components using manufacturer's standard joint adhesive without conspicuous joints. Provide factory cutouts for plumbing fittings and bath accessories as indicated on Drawings.**
      b. **Ensure no blistering, whitening and cracking of components during forming.**
      c. **Fabricate joints between components using manufacturer's standard joint adhesive. Ensure joints are inconspicuous in appearance and without voids.**
      d. **Rout and finish component edges to a smooth, uniform finish. Rout cutouts, then sand edges smooth. Repair or reject defective or inaccurate work.**
   5. Set not more than 6 mm (1/4-inch) above adjoining finished floor surfaces, with transition edges beveled on a slope of no greater than 1:2.
   6. One piece full width of door opening. Notch thresholds to match profile of doorjambs.

B. Window Stools:
   1. 1/2" thick solid surfacing material, adhesively joined with inconspicuous seams, edge details as indicated on Drawings.
      a. Color selected later by Architect from manufacturer's full color range.
   2. Size and thickness as indicated in construction documents.

2.6 METAL DIVIDER STRIPS

A. Terrazzo type divider strips.

B. Heavy top type strip with 5 mm (3/16 inch) wide top and 38 mm (1 1/2 inch) long leg. Height to match tile and setting-bed thickness.

C. Embedded leg perforated and deformed for keying to mortar.

D. Stainless-steel, ASTM A666, 300 Series exposed-edge material.

2.7 WATER

A. Clean, potable and free from salts and other injurious elements to mortar and grout materials.

2.8 CLEANING COMPOUNDS

A. Specifically designed for cleaning masonry and concrete and which will not prevent bond of subsequent tile setting materials including patching and leveling compounds and elastomeric waterproofing membrane and coat.

B. Materials containing acid or caustic Material are not acceptable.

2.9 FLOOR MORTAR BED REINFORCING

A. ASTM A1064/A1064M welded wire fabric without backing, MW3 x MW3 (2 x 2-W0.5 x W0.5).

PART 3 - EXECUTION

3.1 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperature of work areas at not less than 16 degrees C (60 degrees F), without interruption, for not less than 24 hours before installation and not less than three (3) days after installation.

B. Maintain higher temperatures for a longer period of time where required by manufacturer's recommendation and ANSI Specifications for installation.

C. Do not install tile when the temperature is above 38 degrees C (100 degrees F).

D. Do not install materials when the temperature of the substrate is below 16 degrees C (60 degrees F).

E. Do not allow temperature to fall below 10 degrees C (50 degrees F) after third day of completion of tile work.

3.2 ALLOWABLE TOLERANCE

A. Variation in plane of sub-floor, including concrete fills leveling compounds and mortar beds:
   1. Not more than 6 mm in 3048 mm (1/4 inch in 10 feet) from required elevation where portland cement mortar setting bed is used.
   2. Not more than 3 mm in 3048 mm (1/8 inch in 10 feet) where dry-set portland cement, and latex-portland cement mortar setting beds and chemical-resistant bond coats are used.

B. Variation in Plane of Wall Surfaces:
   1. Not more than 6 mm in 2438 mm (1/4 inch in 8 feet) from required plane where portland cement mortar setting bed is used.
   2. Not more than 3 mm in 2438 mm (1/8 inch in 8 feet) where dry-set or latex-portland cement mortar or organic adhesive setting materials is used.

3.3 SURFACE PREPARATION

A. Cleaning New Concrete or Masonry:
   1. Chip out loose material, clean off all oil, grease dirt, adhesives, curing compounds, and other deterrents to bonding by mechanical method, or by using products specifically designed for cleaning concrete and masonry.
   2. Use self-contained power blast cleaning systems to remove curing compounds and steel trowel finish from concrete slabs where ceramic tile will be installed directly on concrete surface with thin-set materials.
   3. Steam cleaning or the use of acids and solvents for cleaning will not be permitted.

B. Patching and Leveling:
   1. Mix and apply patching and leveling compound in accordance with manufacturer's instructions.

2. Fill holes and cracks and align concrete floors that are out of required plane with patching and leveling compound.
   a. Thickness of compound as required to bring finish tile system to elevation shown on construction documents.
   b. Float finish except finish smooth for elastomeric waterproofing.
   c. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.
3. Apply patching and leveling compound to concrete and masonry wall surfaces that are out of required plane.
4. Apply leveling coats of material compatible with wall surface and tile setting material to wall surfaces, other than concrete and masonry that are out of required plane.

C. Mortar Bed for Slopes to Drains:
1. Slope compound to drain where drains are shown on construction documents.
2. Install mortar bed in depressed slab sloped to drains not less than 3.2 mm in 305 mm (1/8 inch per foot).
3. Allow not less than 50 mm (2 inch) depression at edge of depressed slab.
4. Screed for slope to drain and float finish.
5. Cure mortar bed for not less than seven (7) days. Do not use curing compounds or coatings.
6. Perform flood test to verify mortar bed slopes to drain before installing tile. Contracting Officer Representative (COR) to be present during flood test.

D. Additional preparation of concrete floors for tile set with epoxy, or furan-resin is to be in accordance with the manufacturer's printed instructions.

E. Walls:
1. In showers or other wet areas cover studs with polyethylene sheet.
2. Apply patching and leveling compound to concrete and masonry surfaces that are out of required plane.
3. Apply leveling coats of material compatible with wall surface and tile setting material to wall surfaces, other than concrete and masonry that are out of required plane.
4. Apply metal lath to framing in accordance with ANSI A108.1:
   a. Use fasteners specified in paragraph "Fasteners." Use washers when lath opening is larger than screw head.
   b. Apply scratch and leveling coats to metal lath in accordance with ANSI A108.1C.
   c. Total thickness of scratch and leveling coats:
      1) Apply 9 mm to 16 mm (3/8 inch to 5/8 inch) thick over solid backing.
      2) 16 mm to 19 mm (5/8 to 3/4 inch) thick on metal lath over studs.
      3) Where wainscots are required to finish flush with wall surface above, adjust thickness required for flush finish.
   d. Apply scratch and leveling coats more than 19 mm (3/4 inch) thick in two (2) coats.

F. Existing Floors and Walls:
1. Remove existing composition floor finishes and adhesive. Prepare surface by grinding, chipping, self-contained power blast cleaning or other suitable mechanical methods to completely expose uncontaminated concrete or masonry surfaces. Follow safety requirements of ANSI A10.20.
2. Clean and level the substrate for new setting bed and waterproof membrane.

3.4 GLASS MAT WATER-RESISTANT BACKING BOARD

A. Install in accordance with manufacturer’s instructions. TCNA Systems W245-1.

B. Treat joints with tape and latex-portland cement mortar or adhesive.

3.5 SOLID SURFACE ENGINEERED THRESHOLDS AND STOOLS:

A. Install components plumb, level, rigid, scribed to adjacent finishes in accordance with reviewed Shop Drawings and Product installation details and instructions.

B. Fabricate field joints using manufacturer's recommended adhesive, with joints being inconspicuous in finished work. Exposed joints/seams are not permitted. Keep components and hands clean when making joints. Reinforce field joints as specified herein. Cut and finish component edges with clean, sharp returns.

C. Set threshold to finish 13 mm (1/2 inch) above ceramic tile floor unless shown otherwise on construction documents, with bevel edge joint top flush with adjacent floor similar to TCNA detail TR611-14.

3.6 METAL DIVIDER STRIPS

A. Install metal divider strips in floor joints between ceramic and quarry tile floors and between tile floors and adjacent flooring of other materials where the finish floors are flush unless shown otherwise on construction documents.

B. Set divider strip in mortar bed to line and level centered under doors or in openings.

C. At preformed sealant joint:
1. Comply with recommendations in TCNA for Vertical and Horizontal Joint Design Essentials. TCNA Systems EJ 171.
   a. Locate joint in tile surfaces directly above joint in sub-floor or where indicated when used with isolation membranes to allow off-setting of joint location from sub-floor joint.
   b. Fasten full length to sub-floor using a construction adhesive.
   c. Trowel setting material with full coverage over the entire leg.
2. Set tile up against the joint ensuring that the top edge of the joint is flush or slightly below the top of the tile.

3.7 CERAMIC TILE – GENERAL

A. Comply with ANSI A108/A118/A136 series of tile installation standards applicable to methods of installation and TCNA Installation Guidelines.

B. Installing Mortar Beds for Floors:
1. Install mortar bed in a manner that does not damage cleavage or waterproof membrane; 32 mm (1-1/2 inch) minimum thickness.
2. Install floor mortar bed reinforcing centered in mortar fill.
3. Screed finish to level plane or slope to drains shown on construction documents, float finish.
4. For thin set systems cure mortar bed not less than seven (7) days. Do not use curing compounds or coatings.
5. For tile set with portland cement paste over plastic mortar bed coordinate to set tile before mortar bed sets.

C. Setting Beds or Bond Coats:
1. Where recessed or depressed floor slabs are filled with portland cement mortar bed, set ceramic mosaic floor tile in either portland cement paste over plastic mortar bed or latex-portland cement mortar over cured mortar bed except as specified otherwise, ANSI A108-1C, TCNA System F121-14 or F111-14.
2. Set trim shapes in same material specified for setting adjoining tile.

D. Workmanship:
1. Lay out tile work so that no tile less than one-half full size is used. Make all cuts on the outer edge of the field.
2. Set tile firmly in place with finish surfaces in true planes. Align tile flush with adjacent tile unless shown otherwise on construction documents.
3. Form intersections and returns accurately.
4. Cut and drill tile neatly without marring surface.
5. Cut edges of tile abutting penetrations, finish, or built-in items:
   a. Fit tile closely around electrical outlets, piping, fixtures and fittings, so that plates, escutcheons, collars and flanges will overlap cut edge of tile.

b. Seal tile joints water tight as specified in Section 07 92 00, JOINT SEALANTS, around electrical outlets, piping fixtures and fittings before cover plates and escutcheons are set in place.

6. Completed work is to be free from hollow sounding areas and loose, cracked or defective tile.
7. Remove and reset tiles that are out of plane or misaligned.
8. Floors:
   a. Extend floor tile beneath casework and equipment, except those units mounted in wall recesses.
   b. Align finish surface of new tile work flush with other and existing adjoining floor finish where indicated in construction documents.
   c. In areas where floor drains occur, slope tile to drains.
   d. Push and vibrate tiles over 203 mm (8 inches) square to achieve full support of bond coat.
9. Walls:
   a. Cover walls and partitions, including pilasters, furred areas, and freestanding columns from floor to ceiling, or from floor to nominal wainscot heights as indicated in construction documents with tile.
   b. Finish reveals of openings with tile, except where other finish materials are indicated in construction documents.
   c. At window openings, provide tile stools and reveals.
   d. Finish wall surfaces behind and at sides of casework and equipment, except those units mounted in wall recesses, with same tile as scheduled for room proper.
10. Joints:
    a. Keep all joints in line, straight, level, perpendicular and of even width unless shown otherwise on construction documents.
    b. Make joints 2 mm (1/16 inch) wide for glazed wall tile and mosaic tile work.
    c. Make joints in quarry tile work not less than 6 mm (1/4 inch) nor more than 9 mm (3/8 inch) wide. Finish joints flush with surface of tile.
    d. Make joints in paver tile, porcelain type; maximum 3 mm (1/8 inch) wide.
11. Back Buttering: For installations indicated below, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108/A118/A136 series of tile installation standards:
    a. Tile wall installations in wet areas, including showers, tub enclosures, laundries and swimming pools.
    b. Tile installed with chemical-resistant mortars and grouts.
    c. Tile wall installations composed of tiles 203 by 203 mm (8 by 8 inches) or larger.
    d. Exterior tile wall installations.

3.8 THIN SET CERAMIC AND PORCELAIN TILE INSTALLED WITH DRY-SET PORTLAND CEMENT AND LATEX-PORTLAND CEMENT MORTAR

A. Installation of Tile: ANSI A108.1B, except as specified otherwise.

B. Slope tile work to drains at not less than 6 mm in 305 mm (1/4 inch per foot).

3.9 GROUTING

A. Grout Type and Location:
   1. Grout for glazed wall and base tile, paver tile and unglazed mosaic tile portland cement grout, latex-portland cement grout, dry-set grout, or commercial portland cement grout.
   2. Grout for tile of therapeutic pools: Portland cement grout.

B. Workmanship:
   1. Install and cure grout in accordance with the applicable standard.
   2. Sand Portland Cement Grout: ANSI A108.10.
   3. Standard Cement Grout: ANSI A118.6.
   4. High Performance Grout: ANSI A118.7.
   5. Epoxy Grout: ANSI A108.6.

6. Water-Cleanable Epoxy Grout: ANSI A118.3.
7. Furan and Commercial Portland Cement Grout: ANSI A118.5 and in accordance with the manufacturer's printed instructions.

3.10 MOVEMENT JOINTS

A. Prepare tile expansion, isolation, construction and contraction joints for installation of sealant. Refer to Section 07 92 00, JOINT SEALANTS.

B. TCNA details EJ 171-14.

C. At expansion joints, rake out joint full depth of tile and setting bed and mortar bed. Do not cut waterproof or isolation membrane.

D. Rake out grout at joints between tile at toe of base, and where indicated in construction documents not less than 6 mm (1/4 inch) deep.

3.11 CLEANING:

A. Thoroughly sponge and wash tile. Polish glazed surfaces with clean dry cloths.

B. Methods and materials used are not permitted to damage or impair appearance of tile surfaces.

C. The use of acid or acid cleaners on glazed tile surfaces is prohibited.

D. Clean tile grouted with epoxy, furan and commercial portland cement grout and tile set in elastomeric bond coat as recommended by the manufacturer of the grout and bond coat.

3.12 PROTECTION

A. Keep traffic off tile floor, until grout and setting material is fully set and cured.

B. Where traffic occurs over tile floor is unavoidable, cover tile floor with not less than 9 mm (3/8 inch) thick plywood, wood particle board, or hardboard securely taped in place. Do not remove protective cover until time for final inspection. Clean tile of any tape, adhesive and stains.

3.13 TESTING FINISH FLOOR

A. Test floors in accordance with ASTM C627 to show compliance with codes 1 through 10.

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SECTION 09 51 00

ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Acoustical units.
2. Metal ceiling suspension system for acoustical ceilings.
3. Adhesive application.

1.2 RELATED REQUIREMENTS

A. Adhesive VOC Limits: Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

B. Color, pattern, and location of each type of acoustical unit: See Construction Documents.

C. Ceiling Suspension System: Section 09 22 16, NON-STRUCTURAL METAL FRAMING.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. ASTM International (ASTM):
1. A641/A641M-09a(2014) - Zinc-coated (Galvanized) Carbon Steel Wire.
2. A653/A653M-15e1 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-coated (Galvannealed) by the Hot-Dip Process.
3. C423-09a - Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
4. C634-13 - Terminology Relating to Environmental Acoustics.
5. C635/C635M-13a - Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
6. C636/C636M-13 - Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
7. D1779-98(2011) - Adhesive for Acoustical Materials.
8. E84-15b - Surface Burning Characteristics of Building Materials.
9. E119-16 - Fire Tests of Building Construction and Materials.
10. E413-16 - Classification for Rating Sound Insulation.
11. E580/E580M-14 - Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions.
12. E1264-14 - Classification for Acoustical Ceiling Products.

C. International Organization for Standardization (ISO):
1. ISO 14644-1 - Classification of Air Cleanliness.

1.4 PREINSTALLATION MEETINGS

A. Conduct preinstallation meeting at project site minimum 30 days before beginning Work of this section.
1. Required Participants:
a. Contracting Officer's Representative.
b. VA Interior Designer.
c. Inspection and Testing Agency.
d. Contractor.
e. Installer.
f. Manufacturer's field representative.
g. Other installers responsible for adjacent and intersecting work, including sprinkler, HVAC and lighting installers.

2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.
   a. Installation schedule.
   b. Installation sequence.
   c. Preparatory work.
   d. Protection before, during, and after installation.
   e. Installation.
   f. Terminations.
   g. Transitions and connections to other work.
   h. Inspecting and testing.
   i. Other items affecting successful completion.
3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.5 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:
   1. Show size, configuration, and fabrication and installation details.

C. Manufacturer's Literature and Data:
   1. Description of each product.
   2. Ceiling suspension system indicating manufacturer recommendation for each application.
   3. Installation instructions.
   4. Warranty.

D. Samples:
   1. Acoustical units, 150 mm (6 inches) in size, each type, including units specified to match existing.
      a. Submit quantity required to show full color and texture range.
   2. Suspension system, trim and molding, 300 mm (12 inches) long.
   3. Colored markers for access service.
   4. Approved samples may be incorporated into work.

E. Sustainable Construction Submittals:
   1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.
   2. Biobased Content:
      a. Show type and quantity for each product.
      b. Show volatile organic compound types and quantities.

F. Certificates: Certify each product complies with specifications.
   1. Acoustical units, each type.

G. Qualifications: Substantiate qualifications comply with specifications.
   1. Manufacturer with project experience list.

H. Operation and Maintenance Data:
   1. Care instructions for each exposed finish product.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Regularly manufactures specified products.
   2. Manufactured specified products with satisfactory service on five similar installations for minimum five years.
      a. Project Experience List: Provide contact names and addresses for completed projects.

1.7 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.

B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.

C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.8 STORAGE AND HANDLING

A. Store products indoors in dry, weathertight conditioned facility.

B. Protect products from damage during handling and construction operations.

1.9 FIELD CONDITIONS

A. Environment:
1. Product Temperature: Minimum 21 degrees C (70 degrees F) for minimum 48 hours before installation.
2. Work Area Ambient Conditions: HVAC systems are complete, operational, and maintaining facility design operating conditions continuously, beginning 48 hours before installation until Government occupancy.
3. Install products when building is permanently enclosed and when wet construction is completed, dried, and cured.

1.10 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Ceiling System: Acoustical ceilings units on exposed grid suspension systems.

2.2 SYSTEM PERFORMANCE

A. Design product complying with specified performance:
1. Maximum Deflection: 1/360of span, maximum.

B. Surface Burning Characteristics: When tested according to ASTM E84.
1. Flame Spread Rating: 25 maximum.
2. Smoke Developed Rating: 450 maximum.

2.3 PRODUCTS - GENERAL

A. Basis of Design: See Construction Documents.

B. Provide acoustical units from one manufacturer.
1. Provide each product exposed to view from one production run.

C. Provide suspension system from same manufacturer.

D. Sustainable Construction Requirements:
1. Mineral Base Recycled Content: 65 percent total recycled content, minimum.
2. Steel Recycled Content: 30 percent total recycled content, minimum.
3. Aluminum Recycled Content: 80 percent total recycled content, minimum.
4. Biobased Content: 37 percent by weight biobased material, minimum.
5. Low Pollutant-Emitting Materials: Comply with VOC limits specified in Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for the following products:
   a. Non-flooring adhesives and sealants.

2.4 ACOUSTICAL UNITS

A. General:
1. Ceiling Panel and Tile: ASTM E1264, bio-based content according to USDA Bio-Preferred Product requirements.
   a. Mineral Fiber: 3.6 kg/sq. m (3/4 psf) weight, minimum.
2. Classification: Provide type and form as follows:
   a. Type III Units - Mineral base with water-based painted finish maximum 10 g/l VOC; Form 2 - Water felted, minimum 16 mm (5/8 inch) thick.
   b. Type IV Units - Mineral base with membrane-faced overlay, Form 2 - Water felted, minimum 16 mm (5/8 inch) thick. Apply poly (vinyl) chloride over paint coat.
   c. Type V Units - Perforated steel facing (pan) with mineral or glass fiber base backing.
      1) Steel: Galvanized steel, ASTM A653, with G30 coating. minimum 0.38 mm (0.015 inch) thick.
      2) Bonderize both sides. Apply two coats of baked-on enamel finish on surfaces exposed to view and one coat on concealed surfaces.
   d. Type VI Units - Perforated stainless steel facing (pan) with mineral or glass fiber base backing.
   e. Type VII Units - Perforated aluminum facing (pan) with mineral or glass fiber base backing.
      1) Aluminum sheets, minimum 0.635 mm (0.025 inch) thick.
      2) Apply two coats of baked-on enamel finish, free from gloss or sheen, on face and flanges.
   f. NRC (Noise Reduction Coefficient): ASTM C423, minimum 0.55 unless specified otherwise.
   g. CAC (Ceiling Attenuation Class): ASTM E413, 40-44 range unless specified otherwise.
   h. LR (Light Reflectance): Minimum 0.75.
3. Lay-in panels: Sizes as indicated on Drawings, with square edges.
   a. Sizes:
      1) Edge and Joint Detail: Square edges and joints as required to suit suspension and access system.

B. SPECIAL FACED ACOUSTICAL TILE UNITS AT(SP): Anti-microbial coated surfaces suitable for use in Class 5 Clean Rooms per ISO 14644-1. Special faced acoustical tile units shall meet all general requirements stated in this specification.
1. Type XX-A Units - Perforated Ceramic Units for Wet Service.
   a. Mineral wool material, fired in kiln to produce a stable panel, totally unaffected by moisture when submerged in water.
   b. No damage when subjected to 10 cycles of steam at 135 degrees C (275 degrees F) and cooling to 10 degrees C (50 degrees F).
   c. Minimum of 16 mm (5/8 inch) thick.
   d. Not affected when immersed in five percent chlorine solution, except for paint finish.
2. Type III-A Units - Mineral base with painted finish.
   a. Form 1, modular, cast or molded.
   b. NRC: 0.75 minimum.
   c. Thickness: 19 mm (3/4 inch) minimum.
   d. Weight, 4.9 kg/sq. m (one pound per square foot).
3. Type XX-B Units - Combination mineral base and glass fiber with fabric finish.
   a. Back Half of Panel: Perforated water felted mineral fiber.
   b. Face Half of Panel: Glass fiber with glass cloth face.
   c. NRC: 0.75 minimum.
   d. Thickness: 28 mm (1 1/8 inches) minimum.

2.5 METAL SUSPENSION SYSTEM

A. General: ASTM C635, heavy-duty system, except as otherwise specified.
   1. Suspension System: Provide the following:
      a. Galvanized cold-rolled steel, bonderized.
   2. Main and Cross Runner: Use same construction Do not use lighter-duty sections for cross runners.

B. Exposed Grid Suspension System: Support of lay-in panels.
   1. Grid Width: 22 mm (7/8 inch) minimum with8 mm (5/16 inch) minimum panel bearing surface.
   2. Molding: Fabricate from the same material with same exposed width and finish.
   3. Finish: Baked-on enamel flat texture finish.
      a. Color: To match adjacent acoustical units unless specified otherwise in Construction Documents.

C. Concealed Grid Suspension System: Mineral base acoustical tile support.
   1. Concealed grid upward access suspension system initial opening, 300 mm by 600 mm (12 by 24 inches).
   2. Flange Width: 22 mm (7/8 inch) minimum except:
      a. Access Hook and Angle: 11 mm (7/16 inch) minimum.

D. Suspension System Support of Metal Type V, VI, and VII Tiles: Concealed grid type with runners for snap-in attachment of metal tile (pans).

E. Carrying Channels Secondary Framing: Cold-rolled or hot-rolled steel, black asphaltic paint finish, rust free.
   1. Weight per 300 m (per thousand linear feet), minimum:

Size		Cold-rolled		Hot-rolled	
mm	inches	kg	pound	kg	pound
38	1-1/2	215.4	475	508	1120
50	2	267.6	590	571.5	1260

F. Anchors and Inserts: Provide anchors or inserts to support twice the loads imposed by hangers.
   1. Hanger Inserts: Steel, zinc-coated (galvanized after fabrication).
      a. Nailing type option for wood forms:
         1) Upper portion designed for anchorage in concrete and positioning lower portion below surface of concrete approximately 25 mm (one inch).
         2) Lower portion provided with minimum 8 mm (5/16 inch) hole to permit attachment of hangers.
      b. Flush ceiling insert type:
         1) Designed to provide a shell covered opening over a wire loop to permit attachment of hangers and keep concrete out of insert recess.
         2) Insert opening inside shell approximately 16 mm (5/8 inch) wide by 9 mm (3/8 inch) high over top of wire.
         3) Wire 5 mm (3/16 inch) diameter with length to provide positive hooked anchorage in concrete.

G. Clips: Galvanized steel, designed to secure framing member in place.

H. Tile Splines: ASTM C635.

I. Wire: ASTM A641.
   1. Size:
      a. Wire Hangers: Minimum diameter 2.68 mm (0.1055 inch).
      b. Bracing Wires: Minimum diameter 3.43 mm (0.1350 inch).

2.6 ACCESSORIES

A. Adhesives: Low pollutant-emitting, water based type recommended by adhered product manufacturer for each application.

B. Perimeter Seal: Vinyl, polyethylene or polyurethane open cell sponge material, density of 1.3 plus or minus 10 percent, compression set less than 10 percent with pressure sensitive adhesive coating on one side.
   1. Thickness: As required to fill voids between back of wall molding and finish wall.
   2. Size: Minimum 9 mm (3/8 inch) wide strip.

C. Access Identification Markers: Colored markers with pressure sensitive adhesive on one side, paper or plastic, 6 to 9 mm (1/4 to 3/8 inch) diameter.
   1. Color Code: Provide the following color markers for service identification:

Color	Service
Red	Sprinkler System: Valves and Controls
Green	Domestic Water: Valves and Controls
Yellow	Chilled Water and Heating Water
Orange	Ductwork: Fire Dampers
Blue	Ductwork: Dampers and Controls
Black	Gas: Laboratory, Medical, Air and Vacuum

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.

B. Protect existing construction and completed work from damage.

C. Remove existing acoustical panels, suspension system to permit new installation.
   1. Dispose of removed materials.

3.2 INSTALLATION - GENERAL

A. Install products according to manufacturer's instructions and approved submittal drawings.
   1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

3.3 ACOUSTICAL UNIT INSTALLATION

A. Applications:
   1. Cut acoustic units for perimeter borders and penetrations to fit tight against penetration for joint not concealed by molding.

B. Layout acoustical unit symmetrically, with minimum number of joints.

C. Installation:
   1. Install acoustic tiles after wet finishes have been installed and solvents have cured.
   2. Install lay-in acoustic panels in exposed grid with minimum 6 mm (1/4 inch) bearing at edges on supports.
      a. Install tile to lay level and in full contact with exposed grid.
      b. Replace cracked, broken, stained, dirty, or tile.
   3. Tile in concealed grid upward access suspension system:
      a. Install acoustical tile with joints close, straight and true to line, and with exposed surfaces level and flush at joints.
      b. Make corners and arises full, and without worn or broken places.
      c. Locate acoustical units providing access to service systems.
   4. Adhesive applied tile:
      a. Condition of surface according to ASTM D1779, Note 1, Cleanliness of Surface, and Note 4, Rigidity of Base Surface.
      b. Size or seal surface as recommended by manufacturer of adhesive and allow to dry before installing units.
   5. Markers:

a. Install color coded markers to identify the various concealed piping, mechanical, and plumbing systems.
b. Attach colored markers to exposed grid on opposite sides of the units providing access.
c. Attach marker on exposed ceiling surface of upward access acoustical unit.

D. Touch up damaged factory finishes.
1. Repair painted surfaces with touch up primer.

3.4 CEILING SUSPENSION SYSTEM INSTALLATION

A. General: Install according to ASTM C636.
1. Use direct or indirect hung suspension system or combination of both.
2. Support a maximum area of 1.48 sq. m (16 sq. ft.) of ceiling per hanger.
3. Prevent deflection in excess of 1/360 of span of cross runner and main runner.
4. Provide additional hangers located at each corner of support components.
5. Provide minimum 100 mm (4 inch) clearance from the exposed face of the acoustical units to the underside of ducts, pipe, conduit, secondary suspension channels, concrete beams or joists; and steel beam or bar joist unless furred system is shown.
6. Provide main runners minimum 1200 mm (48 inches) in length.
7. Install hanger wires vertically. Angled wires are not acceptable except for seismic restraint bracing wires.

B. Direct Hung Suspension System: ASTM C635.
1. Support main runners by hanger wires attached directly to the structure overhead.
2. Maximum spacing of hangers, 1200 mm (4 feet) on centers unless interference occurs by mechanical systems. Use indirect hung suspension system where not possible to maintain hanger spacing.

C. Anchorage to Structure:
1. Concrete:
a. Install hanger inserts and wire loops required for support of hanger and bracing wire. Install hanger wires with looped ends through steel deck when steel deck does not have attachment device.
b. Use eye pins or threaded studs with screw-on eyes in existing or already placed concrete structures to support hanger and bracing wire. Install in sides of concrete beams or joists at mid height.
2. Steel:
a. Install carrying channels for attachment of hanger wires.
1) Size and space carrying channels to support load within performance limit.
2) Attach hangers to steel carrying channels, spaced four feet on center, unless area supported or deflection exceeds the amount specified.
b. Attach carrying channels to the bottom flange of steel beams spaced not 1200 mm (4 feet) on center before fireproofing is installed. Weld or use steel clips for beam attachment.
c. Attach hangers to bottom chord of bar joists or to carrying channels installed between the bar joists when hanger spacing prevents anchorage to joist. Rest carrying channels on top of the bottom chord of the bar joists, and securely wire tie or clip to joist.

D. Indirect Hung Suspension System: ASTM C635.
1. Space carrying channels for indirect hung suspension system maximum 1200 mm (4 feet) on center. Space hangers for carrying channels maximum 2400 mm (8 feet) on center or for carrying channels less than 1200 mm (4 feet) or center so as to insure that specified requirements are not exceeded.
2. Support main runners by specially designed clips attached to carrying channels.

E. Seismic Ceiling Bracing System:
1. Install according to ASTM E580.

2. Connect bracing wires to structure above as specified for anchorage to structure and to main runner or carrying channels of suspended ceiling at bottom.

3.5 CEILING TREATMENT

A. Moldings:
1. Install metal wall molding at perimeter of room, column, or edge at vertical surfaces.
2. Install special shaped molding at changes in ceiling heights and at other breaks in ceiling construction to support acoustical units and to conceal their edges.

B. Perimeter Seal:
1. Install perimeter seal between vertical leg of wall molding and finish wall, partition, and other vertical surfaces.
2. Install perimeter seal to finish flush with exposed faces of horizontal legs of wall molding.

C. Existing ceiling:
1. Where extension of existing ceilings occurs, match existing.
2. Where acoustical units are salvaged and reinstalled or joined, use salvaged units within a space. Do not mix new and salvaged units within a space which results in contrast between old and new acoustic units.
3. Comply with specifications for new acoustical units for new units required to match appearance of existing units.

3.6 CLEANING

A. Remove excess adhesive before adhesive sets.

B. Clean exposed surfaces. Remove contaminants and stains.

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SECTION 09 65 13

RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Resilient base (RB) adhered to interior walls and partitions.
2. Resilient stair treads (RST) adhered to interior stair treads.
3. Sheet rubber flooring (SRF) adhered to interior stair landings.

1.2 RELATED REQUIREMENTS

A. Rubber Tile Flooring at Landings: Section 09 65 19, RESILIENT TILE FLOORING.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. ASTM International (ASTM):
1. F1344-15 Rubber Floor Tile.
2. F1859-14e1 Rubber Sheet Floor Covering without Backing.
3. F1860-14e1 Rubber Sheet Floor Covering with Backing.
4. F1861-16 Resilient Wall Base.
5. D4259-18 Preparation of Concrete by Abrasion Prior to Coating Application.

C. Federal Specifications (Fed. Spec.):
1. RR-T-650E (1994) Treads, Metallic and Non-Metallic, Skid-Resistant.

D. International Concrete Repair Institute (ICRI):
1. 310.2R-2013 Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:
1. Description of each product.
2. Adhesives and primers indicating manufacturer's recommendation for each application.
3. Installation instructions.

C. Samples:
1. Resilient Base: 150 mm (6 inches) long, each type and color.
2. Resilient Stair Treads: 150 mm (6 inches) long, each type and color.
3. Sheet Rubber Flooring: 300 mm (12 inches) square, each type and color.

D. Sustainable Construction Submittals:
1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.
2. Low Pollutant-Emitting Materials:
   a. Stair Treads and Sheet Rubber Flooring: Submit Floor Score label.
   b. Show volatile organic compound types and quantities.

E. Operation and Maintenance Data:
1. Care instructions for each exposed finish product.

1.5 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.

B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.

C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.6 STORAGE AND HANDLING

A. Store products indoors in dry, weathertight facility.

B. Protect products from damage when handling and during construction operations.

1.7 FIELD CONDITIONS

A. Environment:
1. Product Temperature: Minimum 21 degrees C (70 degrees F) for minimum 48 hours before installation.
2. Work Area Ambient Temperature Range: 21 to 27 degrees C (70 to 80 degrees F) continuously, beginning 48 hours before installation.
3. Install products when building is permanently enclosed and when wet construction is completed, dried, and cured.

1.8 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Basis of Design: See Construction Documents.

B. Provide each product from one manufacturer and from one production run.

C. Provide resilient stair treads and sheet rubber flooring from same manufacturer.

D. Sustainable Construction Requirements:
1. Sheet Rubber Flooring Recycled Content: 90 percent total recycled content, minimum.

E. Low Pollutant-Emitting Materials: Comply with VOC limits specified in Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for the following products:
1. Flooring Adhesives and Sealants.

2.2 RESILIENT BASE

A. Resilient Base: 3 mm (1/8 inch) thick, 100 mm (4 inches) high.

B. Type: Rubber or vinyl; use one type throughout.

C. ASTM F1861, Type TP thermoplastic rubber or Type TV thermoplastic vinyl, Group 2 - layered.

D. Applications:
1. Other Locations: Style B - Cove.

E.

2.3 ADHESIVES

A. Adhesives: Low pollutant-emitting, water based type recommended by adhered product manufacturer for each application.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.

B. Protect existing construction and completed work from damage.

C. Remove existing base to permit new installation.

D. Dispose of removed materials.

E. Correct substrate deficiencies.

F. Fill cracks, pits, and depressions with leveling compound.

G. Remove protrusions; grind high spots.

H. Apply leveling compound to achieve 3 mm (1/8 inch) in 3 m (10 feet) maximum surface variation.

I. Clean substrates. Remove contaminants capable of affecting subsequently installed product's performance.

J. Mechanically clean concrete floor substrate according to ASTM D4259.

K. Surface Profile: ICRI Guideline No. 310.2R.

L. Allow substrate to dry and cure.

M. Perform flooring manufacturer’s recommended bond, substrate moisture content, and pH tests.

3.2 INSTALLATION GENERAL

A. Install products according to manufacturer's instructions.

B. When instructions deviate from specifications, submit proposed resolution for Contracting Officer consideration.

3.3 RESILIENT BASE INSTALLATION

A. Applications:

B. Install resilient base in rooms scheduled on Drawings.

C. Install resilient base on casework and locker toe spaces, and other curb supported fixed equipment.

D. Extend resilient base into closets, alcoves, and cabinet knee spaces, and around columns within scheduled room.

E. Lay out resilient base with minimum number of joints.

F. Length: 600 mm (24 inches) minimum, each piece.

G. Locate joints 150 mm (6 inches) minimum from corners and intersection of adjacent materials.

H. Installation:

I. Apply adhesive uniformly for full contact between resilient base and substrate.

J. Set resilient base with hairline butted joints aligned along top edge.

K. Field form corners and end stops.

L. V-groove back of outside corner.

M. V-groove face of inside corner and notch cove for miter joint.

N. Roll resilient base ensuring complete adhesion.

3.4 CLEANING

A. Remove excess adhesive before adhesive sets.

B. Clean exposed resilient base surfaces. Remove contaminants and stains.

C. Clean with mild detergent. Leave surfaces free of detergent residue.

D. Polish exposed resilient base to gloss sheen.

3.5 PROTECTION

A. Protect products from construction traffic and operations.

B. Maintain protection until directed by Contracting Officer's Representative.

C. Replace damaged products and re-clean.

D. Damaged Products include cut, gouged, scraped, torn, and unbonded products.

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SECTION 09 65 19

RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies the installation of luxury vinyl tile and accessories required for a complete installation.

1.2 RELATED WORK:

A. Sustainable Design Requirements: Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

B. Resilient Base: Section 09 65 13, RESILIENT BASE AND ACCESSORIES.

C. Subfloor Testing and Preparation: Section 09 05 16, SUBSURFACE PREPARATION FOR FLOOR FINISHES.

D. Removal of Existing Construction Containing Asbestos: Section 02 82 13.19, ASBESTOS FLOOR TILE AND MASTIC ABATEMENT.

E. Color, Pattern and Texture for Resilient Tile Flooring and Accessories: See Construction Documents.

1.3 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Sustainable Design Submittals as described below:
   1. Volatile organic compounds per volume as described in PART 2 - PRODUCTS.
   2. Postconsumer and preconsumer recycled content as described in PART 2 - PRODUCTS.

C. Manufacturer's Literature and Data:
   1. Description of each product.
   2. Resilient material manufacturer’s recommendations for adhesives, underlayment, primers, and polish.
   3. Application, installation and maintenance instructions.

D. Samples:
   1. Tile: Each type, color, thickness and finish.
   2. Edge Strips: Each type, color, thickness and finish.
   3. Feature Strips: Each type, color, thickness and finish.

E. Shop Drawings:
   1. Layout of patterns as shown on the construction documents.
   2. Edge strip locations showing types and detail cross sections.

F. Test Reports:
   1. Abrasion resistance: Depth of wear for each tile type and color and volume loss of tile, certified by independent laboratory. Tested per ASTM F510/F510M.
   2. Moisture and pH test results as per Section 09 05 16, SUBSURFACE PREPARATION FOR FLOOR FINISHES.

1.4 DELIVERY:

A. Deliver materials to the site in original sealed packages or containers, clearly marked with the manufacturer's name or brand, type and color, production run number and date of manufacture.

B. Materials from containers which have been distorted, damaged or opened prior to installation are not acceptable.

1.5 STORAGE:

A. Store materials in a clean, dry, enclosed space off the ground, protected from harmful weather conditions and at temperature and humidity conditions recommended by the manufacturer. Protect adhesives from freezing. Store flooring, adhesives, and accessories in the spaces where they will be installed for at least 48 hours before beginning installation.

1.6 QUALITY ASSURANCE:

A. Installer Qualifications: A company specializing in installation with minimum three (3) years' experience and employs experienced flooring installers who have retained, and currently hold, an INSTALL Certification, or a certification from a comparable certification program.
   1. Installers to be certified by INSTALL or a comparable certification program with the following minimum criteria:
      a. US Department of Labor approved four (4) year apprenticeship program, 160 hours a year.
      b. Career long training.
      c. Manufacturer endorsed training.
      d. Fundamental journeyman skills certification.

B. Furnish product type materials from the same production run.

1.7 WARRANTY:

A. Construction Warranty: Comply with FAR clause 52.246-21, "Warranty of Construction".

1.8 APPLICABLE PUBLICATIONS:

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. ASTM International (ASTM):

D2047-11 ..... Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine

D2240-05(R2010) ..... Test Method for Rubber Property—Durometer Hardness

D4078-02(R2008) ..... Water Emulsion Floor Finish

E648-14c ..... Critical Radiant Flux of Floor Covering Systems Using a Radiant Energy Source

E662-14 ..... Specific Optical Density of Smoke Generated by Solid Materials

E1155/E1155M-14 ..... Determining Floor Flatness and Floor Levelness Numbers

F510/F510M-14 ..... Resistance to Abrasion of Resilient Floor Coverings Using an Abrader with a Grit Feed Method

F710-11 ..... Preparing Concrete Floors to Receive Resilient Flooring

F925-13 ..... Test Method for Resistance to Chemicals of Resilient Flooring

F1344-12(R2013) ..... Rubber Floor Tile

F1700-13a ..... Solid Vinyl Floor Tile

F1869-11 ..... Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride

F2170-11 ..... Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in Situ Probes

F2195-13 ..... Linoleum Floor Tile

C. Code of Federal Regulation (CFR):
40 CFR 59 ..... Determination of Volatile Matter Content, Water Content, Density Volume Solids, and Weight Solids of Surface Coating

D. International Standards and Training Alliance (INSTALL):

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS:

A. Provide adhesives, underlayment, primers, and polish recommended by resilient floor material manufacturer.

B. Critical Radiant Flux: 0.45 watts per sq. cm or more, Class I, per ASTM E648.

C. Smoke Density: Less than 450 per ASTM E662.

D. Slip Resistance – Not less than 0.5 when tested with ASTM D2047.

2.2 LUXURY VINYL TILE:

A. ASTM F1700, Class III, Printed Film Vinyl Tile, Type B.

B. Thickness: 12 mil (1/8 inch)

C. Size:
1. 152.4 mm x 1219.2mm (6 inches x 48 inches) Plank
2. 457.2 mm x 457.2 mm (18 inches x 18 inches)

D. Provide products with recycled content with not less than 25 percent.

E. Chemical Resistance: ASTM F925; pass.

2.3 ADHESIVES:

A. Provide water resistant type adhesive for flooring, base and accessories as recommended by the manufacturer to suit substrate conditions. VOC content to be less than the 50 grams/L when calculated according to 40 CFR 59 (EPA Method 24). Submit manufacturer's descriptive data, documentation stating physical characteristics, and mildew and germicidal characteristics.

2.4 PRIMER FOR CONCRETE SUBFLOORS:

A. Provide in accordance with Section 09 05 16, SUBSURFACE PREPARATION FOR FLOOR FINISHES.

2.5 LEVELING COMPOUND FOR CONCRETE FLOORS:

A. Provide cementitious products with latex or polyvinyl acetate resins in the mix in accordance with Section 09 05 16, SUBSURFACE PREPARATION FOR FLOOR FINISHES.

2.6 POLISH AND CLEANERS:

A. Cleaners: As recommended in writing by floor tile manufacturer.

B. Polish: ASTM D4078.

2.7 MOULDING:

A. Provide tapered mouldings of clear anodized aluminum type as indicated on the construction documents for both edges and transitions of flooring materials specified. Provide vertical lip on moulding of maximum 6 mm (1/4 inch). Provide bevel change in level between 6 and 13 mm (1/4 and 1/2 inch) with a slope no greater than 1:2.

B. Fasteners for Aluminum Mouldings: Stainless steel of type required for substrate condition.

PART 3 - EXECUTION

3.1 ENVIRONMENTAL REQUIREMENTS:

A. Maintain flooring materials and areas to receive resilient flooring at a temperature above 20 degrees C (68 degrees F) for three (3) days before application, during application and two (2) days after application, unless otherwise directly by the flooring manufacturer for the flooring being installed. Maintain a minimum temperature of 13 degrees C (55 degrees F) thereafter. Provide adequate ventilation to remove moisture from area and to comply with regulations limiting concentrations of hazardous vapors.

B. Do not install flooring until building is permanently enclosed and wet construction in or near areas to receive tile materials is complete, dry and cured.

3.2 SUBFLOOR TESTING AND PREPARATION:

A. Prepare and test surfaces to receive resilient tile and adhesive as per Section 09 05 16, SUBSURFACE PREPARATION FOR FLOOR FINISHES.
   1. Remove existing resilient floor and existing adhesive.

B. Prepare concrete substrates in accordance with ASTM F710.

C. Perform work regarding removal of flooring and adhesive containing asbestos as specified in Section 02 82 13.19, ASBESTOS FLOOR TILE AND MASTIC ABATEMENT.

3.3 INSTALLATION:

A. Install in accordance with manufacturer's instructions for application and installation unless specified otherwise.

B. Mix tile from at least two containers. An apparent line either of shades or pattern variance is not acceptable.

C. Tile Layout:
   1. If layout is not shown on construction documents, lay tile symmetrically about center of room or space with joints aligned.
   2. Vary edge width as necessary to maintain full size tiles in the field, no edge tile to be less than 1/2 the field tile size, except where irregular shaped rooms make it impossible.
   3. Place tile pattern in the same direction; do not alternate tiles unless specifically indicated in the construction documents to the contrary.

D. Application:
   1. Adhere floor tile to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
   2. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
   3. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
   4. Roll tile floor with a minimum 45 kg (100 pound) roller.

E. Seal joints at pipes with sealants in accordance with Section 07 92 00, JOINT SEALANTS.

F. Installation of Edge Strips:
   1. Locate edge strips under center line of doors unless otherwise shown on construction documents.
   2. Set resilient edge strips in adhesive. Anchor metal edge strips with anchors and screws.
   3. Where tile edge is exposed, butt edge strip to touch along tile edge.
   4. Where thin set ceramic tile abuts resilient tile, set edge strip against floor file and against the ceramic tile edge.

3.4 CLEANING AND PROTECTION:

A. Clean adhesive marks on exposed surfaces during the application of resilient materials before the adhesive sets. Exposed adhesive is not acceptable.

B. Keep traffic off resilient material for a minimum 72 hours after installation.

C. Clean flooring as recommended in accordance with manufacturer's printed maintenance instructions and within the recommended time frame. As required by the manufacturer, apply the recommended number of coats and type of polish and/or finish in accordance with manufacturer's written instructions.

D. When construction traffic occurs over tile, cover resilient materials with reinforced kraft paper properly secured and maintained until removal is directed by COR. At entrances and where wheeled vehicles or carts are used, cover tile with plywood, hardboard, or particle board over paper, secured and maintained until removal is directed by COR.

E. When protective materials are removed and immediately prior to acceptance, replace damaged tile and mouldings, re-clean resilient materials.

3.5 LOCATION:

A. Unless otherwise indicated in construction documents, install tile flooring, under areas where casework, laboratory and pharmacy furniture and other equipment occur.

B. Extend tile flooring for room into adjacent closets and alcoves.

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SECTION 09 67 23.20
RESINOUS (EPOXY BASE) WITH VINYL CHIP BROADCAST (RES-2)

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies Resinous (Resinous epoxy base with vinyl chip flake broadcast) flooring with integral cove base :
   1. Res-2 Resinous (epoxy) vinyl chip flake broadcast flooring system.

1.2 RELATED WORK

A. Concrete and Moisture Vapor Barrier: Section 03 30 00, CAST-IN-PLACE CONCRETE.
B. Substrate Preparation for Floor Finishes: Section 09 05 16.
C. Color and location of each type of resinous flooring: As indicated in in Construction Documents.
D. Floor Drains: Division 22, PLUMBING.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
B. Manufacturer's Literature and Data:
   1. Description of each product to be provided.
   2. Application and installation instructions.
   3. Maintenance Instructions: Submit manufacturer’s written instructions for recommended maintenance practices.
C. Qualification Data: For Installer.
D. Sustainable Submittal:
   1. Product data for products having recycled content, submit documentation indicating percentages by weight of post-consumer and pre-consumer recycled content.
      a. Include statements indicating costs for each product having recycled content.
   2. Product data for field applied, interior, paints, coatings, and primers, include printed statement of VOC content indicating compliance with environmental requirements.
E. Samples:
   1. Each color and texture specified in Section 09 06 00, SCHEDULE FOR FINISHES.
   2. Samples for verification: For each (color and texture) resinous flooring system required, 6 inches (152 mm) square, applied to a rigid backing by installer for this project.
   3. Sample showing construction from substrate to finish surface in thickness specified and color and texture of finished surfaces. Finished flooring must match the approved samples in color and texture.
F. Shop Drawings: Include plans, sections, component details, and attachment to other trades. Indicate layout of the following:
   1. Patterns.

2. Edge configuration.

G. Certifications and Approvals:

1. Manufacturer's certification of material and substrate compliance with specification.
2. Manufacturer's approval of installer.
3. Contractor's certificate of compliance with Quality Assurance requirements.

H. Warranty: As specified in this section.

1.4 QUALITY ASSURANCE

A. Manufacture Certificate: Manufacture shall certify that a particular resinous flooring system has been manufactured and in use for a minimum of five (5) years.

B. Installer Qualifications: Engage an experienced installer (applicator) who is experienced in applying resinous flooring systems similar in material, design, and extent to those indicated for this project for a minimum period of five (5) years, whose work has resulted in applications with a record of successful in-service performance, and who is acceptable to resinous flooring manufacturer.

1. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.
2. Contractor shall have completed at least ten (10) projects of similar size and complexity. Include list of at least five (5) projects. List must include owner (purchaser); address of installation, contact information at installation project site; and date of installation.
3. Installer's Personnel: Employ persons trained for application of specified product.

C. Source Limitations:

1. Obtain primary resinous flooring materials including primers, resins, hardening agents, grouting coats and finish or sealing coats from a single manufacturer.
2. Provide secondary materials, including patching and fill material, joint sealant, and repair material of type and from source recommended by manufacturer of primary materials.

D. Pre-Installation Conference:

1. Convene a meeting not less than thirty days prior to starting work.
2. Attendance:
   a. Contractor
   b. VA COR
   c. Manufacturer and Installer's Representative
3. Review the following:
   a. Environmental requirements
      1) Air and surface temperature
      2) Relative humidity
      3) Ventilation
      4) Dust and contaminates

b. Protection of surfaces not scheduled to be coated
c. Inspect and discus condition of substrate and other preparatory work performed
d. Review and verify availability of material; installer's personnel, equipment needed
e. Design and edge conditions.
f. Performance of the coating with chemicals anticipated in the area receiving the resinous (urethane and epoxy mortar/cement) flooring system
g. Application and repair
h. Field quality control
i. Cleaning
j. Protection of coating systems
k. One-year inspection and maintenance
l. Coordination with other work

E. Manufacturer's Field Services: Manufacturer's representative shall provide technical assistance and guidance for surface preparation and application of resinous flooring systems.

F. Contractor Job Site Log: Contractor shall document daily; the work accomplished environmental conditions and any other condition event significant to the long term performance of the urethane and epoxy mortar/cement flooring materials installation. The Contractor shall maintain these records for one year after Substantial Completion.

1.5 MATERIAL PACKAGING DELIVERY AND STORAGE

A. Deliver materials to the site in original sealed packages or containers, clearly marked with the manufacturer's name or brand, type and color, production run number and date of manufacture.

B. Protect materials from damage and contamination in storage or delivery, including moisture, heat, cold, direct sunlight, etc.

C. Maintain temperature of storage area between 60 and 80 degrees F (15 and 26 degrees C).

D. Keep containers sealed until ready for use.

E. Do not use materials beyond manufacturer's shelf life limits.

F. Package materials in factory pre-weighed and in single, easy to manage batches sized for ease of handling and mixing proportions from entire package or packages. No On site weighing or volumetric measurements are allowed.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.

1. Maintain material and substrate temperature between 65 and 85 degrees F (18 and 30 degrees C) during resinous flooring application and for not less than 24 hours after application.

2. Concrete substrate shall be properly cured per referenced section 03 30 00, CAST-IN-PLACE CONCRETE. Standard cure time a minimum of 30 days. A vapor barrier must be present for concrete subfloors on or below grade.
   a. Resinous flooring applications where moisture testing resulting in readings exceeding limits as defined in this specification under part 3, section 3.4, paragraph B, shall employ an multiple component 15 mil thick system designed to suppress excess moisture in concrete.
   b. Application at a minimum thickness of 15 mils, over properly prepared concrete substrate as defined in section 3.4.
   c. Moisture suppression system must meet the design standards as follows:

Property	Test	Value
Tensile Strength	ASTM D638	4,400 psi
Volatile Organic Compound Limits (V.O.C.)	EPA & LEED	25 grams per liter
Permeance	ASTM E96 @ 16mils/ 0.4mm on concrete	0.1 perms
Tensile Modulus	ASTM D638	$1.9X10^5$ psi
Percent Elongation	ASTM D638	12%
Cure Rate	Per manufactures Data	4 hours Tack free with 24hr recoat window
Bond Strength	ASTM D7234	100% bond to concrete failure

B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.
C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.

1.7 WARRANTY

A. Work subject to the terms of the Article “Warranty of Construction” FAR clause 52.246-21.
B. Warranty: Manufacture shall furnish a single, written warranty covering the full assembly (including substrata) for both material and workmanship for a extended period of three (3) full years from date of installation, or provide a joint and several warranty signed on a single document by manufacturer and applicator jointly and severally warranting the materials and

workmanship for a period of three (3) full years from date of installation. A sample warranty letter must be included with bid package or bid may be disqualified.

1.8 APPLICABLE PUBLICATIONS

A. The publication listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. ASTM Standard C722-04 (2012), "Standard Specification for Chemical-Resistant Monolithic Floor Surfacings," ASTM International, West Conshohocken, PA, 2006, DOI: 10.1520/C0722-04R12, www.astm.org.

1. Specification covers the requirements for aggregate-filled, resin-based, monolithic surfacings for use over concrete.

C. ASTM International(ASTM):

C413-18 .....Absorption of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes

C531-18 .....Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes

D638-14 .....Tensile Properties of Plastics

D790-17 .....Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

D1308-02 .....Effect of Household Chemicals on Clear and Pigmented Organic Finishes

D2240-15e1 .....Rubber Property—Durometer Hardness

D4060-19 .....Abrasion Resistance of Organic Coatings by the Taber Abraser

D4226-19 .....Impact Resistance of Rigid (Poly-Vinyl Chloride) (PVC) Building Products

D4259-18 .....Abrading Concrete to alter the surface profile of the concrete and to remove foreign materials and weak surface laitance

E96/E96M-16) .....Water Vapor Transmission of Materials

F1869-16a .....Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride

F2170-19a .....Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes

D. American National Standards Institute (ANSI)

A326.3-17.....Standard Test Method for Measuring Dynamic Coefficient of Friction of Hard Surface Flooring Materials

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION FOR RES-2 (BROADCAST VINYL CHIP FLAKE)

A. System Descriptions:
   1. Monolithic, multi-component epoxy chemistry resinous flooring system. Primer with broadcast quartz aggregates, High performance multi-component solvent free epoxy undercoat, Vinyl chip flake broadcast media in desired flake size (1/8”, 1/4”). High performance multi component epoxy and solvent free sealers. System overall thickness 2-3mm.

B. Products: Subject to compliance with applicable fire, health, environmental, and safety requirements for storage, handling, installation, and clean up.

C. System Components: Verify specific requirements as systems vary by manufacturer. Verify build up layers of broadcast and installation method. Verify compatibility with substrate. Use manufacturer’s standard components, compatible with each other and as follows:
   1. Primer with Broadcast quartz (primer coat):
      a. Resin: epoxy.
      b. Formulation Description: Multiple component high solids.
      c. Application Method: squeegee, back roll and broadcast.
      d. Thickness of coat(s): 10-20 mil.
      e. Number of Coats: One.
      f. Aggregates: Quartz broadcast into wet epoxy primer.
   2. Undercoat: (body coat)
      a. Resin: Epoxy.
      b. Formulation Description: Pigmented multi-component, high solids.
      c. Application Method: Notched squeegee and Back roll
      d. Number of Coats: One.
      e. Aggregates: vinyl chip flake broadcast into wet Undercoat.
      f. Thickness of coat(s): 30-60 mils.
      g. Number of Coats: One.
   3. Sealer coat:
      a. Resin: Epoxy.
      b. Formulation Description: Multiple component high solids, no solvent UV stable.
      c. Type/Finsh: Clear Gloss.
      d. Thickness of coat(s): 5-10 mils.
      e. Number of Coats: (2) two.
      f. Application: Squeegee and finish roll.

D. System Characteristics:
   1. Color and Pattern: As selected by COR from manufacturer's standard colors.

2. Integral cove base: ½ inch radius epoxy mortar cove keyed into concrete substrate and or resinous flooring mortar system. No fillers integral cove base must be troweled in place with specified resinous mortar base.
3. Overall System Thickness: Nominal 1/8", 2 to 3 mm.
4. Finish: anti-slip resistant.
5. Temperature Range: Systems vary by manufacturer; approximate range from a minimum of 45 to 150 degrees F.

E. Physical Properties:

1. In accordance with ANSI A326.3 the DCOF (Dynamic Coefficient of Friction) shall be 0.42 or greater when the flooring surface is wet
2. Physical Properties of flooring system when tested as follows

F. Chemical Resistance in accordance ASTM D1308 - 02(2007) "Standard Test Method for Effect of

Property	Test	Value
Tensile Strength	ASTM D638	5,200 psi
Volatile Organic Compound Limits (V.O.C.)	EPA & LEED	Below 100 g/l
Flexural Strength	ASTM D790	4,000 psi
Water Absorption	ASTM C413	0.056%
Impact Resistance	ASTM D4226	> 160 in. lbs
Abrasion Resistance	ASTM D4060 CS-17	0.03 gm maximum weight loss
Thermal Coefficient of Linear Expansion	ASTM C531	17 x 10-6 in/in ºF
Hardness Shore D	ASTM D2240	85 to 90
Bond Strength	ASTM D7234	100% bond to concrete failure

Household Chemicals on Clear and Pigmented Organic Finishes". ASTM International, West Conshohocken, PA, 2006, DOI: 10.1520/D1308-02R07, www.astm.org. No effect to the following exposures:

1. Acetic acid (5 percent)
2. Ammonium hydroxide (10 percent)
3. Citric Acid (50 percent)
4. Fatty Acid
5. Motor Oil, 20W
6. Hydrochloric acid (20 percent)

7. Sodium Chloride
8. Sodium Hypochlorite (10 percent)
9. Sodium Hydroxide (30 percent)
10. Sulfuric acid (25 percent)
11. Urine, Feces
12. Hydrogen peroxide (10 percent)

2.2 SUPPLEMENTAL MATERIALS

A. Textured Top Coat: Type recommended or produced by manufacturer of seamless resinous flooring system, slip resistance for desired final finish.

B. Joint Sealant: Type recommended or produced by resinous flooring manufacturer for type of service or joint conditioned indicated.

C. Waterproof Membrane: Type recommended or produced by manufacturer of resinous floor coatings for type of service and conditions as indicated in Drawings.

D. Crack Isolation Membrane: Type recommended or produced by manufacturer of resinous flooring for conditions as specified.

E. Anti-Microbial Additive: Incorporate anti-microbial chemical additive to prevent growth of most bacteria, algae, fungi, mold, mildew, yeast, etc..

F. Patching and Fill Material: Resinous product of or approved by resinous coating manufacturer for application indicated. Resinous based materials only. Cementitious or single component product are not expectable.

2.3 BASE CAP STRIP

A. Zinc cove strip.

B. Shape for 2mm depth of base material, "J" or “L” configuration.

C. Finish:

1. Finish exposed surfaces in accordance with NAAMM Metal Finishes Manual.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where monolithic resinous system with integral base is to be installed with the VA COR.

B. Moisture Vapor Emission Testing: Perform moisture vapor transmission testing in accordance with ASTM F1869 to determine the MVER of the substrate prior to commencement of the work. See section 3.4, 3.

3.2 PROJECT CONDITIONS

A. Maintain temperature of rooms (air and surface) where work occurs, between 70- and 90-degrees F (21 and 32 degrees C) for at least 48 hours, before, during, and 24 hours after installation. Maintain temperature at least 70 degrees F (21 degrees C) during cure period.

B. Maintain relative humidity less than 75 percent.

C. Do not install materials until building is permanently enclosed and wet construction is complete, dry, and cured.

D. Maintain proper ventilation of the area during application and curing time period.

1. Comply with infection control measures of the VA Medical Center.

3.3 INSTALLATION REQUIREMENTS

A. The manufacturer's instructions for application and installation shall be reviewed with the VA COR for the seamless resinous (urethane and epoxy mortar) flooring system with integral cove base .

B. Substrate shall be approved by manufacture technical representative.

3.4 PREPARATION

A. General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry, and neutral Ph substrate for resinous flooring application.

B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.

1. Prepare concrete substrates as follows:

a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and re circulates the shot by vacuum pickup.

b. Comply with ASTM D4259 requirements, unless manufacturer's written instructions are more stringent.

2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written recommendations.

3. Verify that concrete substrates are dry.

a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with application only after substrates have maximum moisture-vapor-emission rate of [**3 lb of water/1000 square feet (1.36 kg of water/92.9 square meters)** in 24 hours. Per manufacturers recommendations.

b. MVT threshold for monolithic resinous flooring shall not exceed 3 lbs/1000 square feet (0.0001437 kPa) in a 24-hour period.

c. When MVT emission exceeds this limit, apply manufacturer’s recommended vapor control primer or other corrective measures as recommended by manufacturer prior to application of flooring or membrane systems.

d. Perform in situ probe test, ASTM F2170. Proceed with application only after substrates do not exceed a maximum potential equilibrium relative humidity of 85 percent.

e. Provide a written report showing test placement and results.

4. Verify that concrete substrates have neutral Ph and that resinous flooring will adhere to them. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.

C. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

D. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.

E. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written recommendations. Allowances should be included for flooring manufacturer recommended joint fill material, and concrete crack treatment.

F. Prepare wall to receive integral cove base :

1. Verify wall material is acceptable for resinous flooring application, if not, install material (e.g. cement board) to receive base.
2. Fill voids in wall surface to receive base, install undercoats (e.g. water proofing membrane, and/or crack isolation membrane) as recommended by resinous flooring manufacturer.
3. Install base prior to flooring if required by resinous flooring manufacturer.
4. Grind, cut or sand protrusions to receive base application.

3.5 APPLICATION

A. General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.

1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
3. At substrate expansion and isolation joints, provide joint in resinous flooring to comply with resinous flooring manufacturer's written recommendations.
   a. Apply joint sealant to comply with manufacturer's written recommendations.

B. Apply Primer: over prepared substrate at manufacturer's recommended spreading rate for all areas to receive integrated cove base.

C. Apply cove base: Trowel to wall surfaces at a 1-inch radius, before applying flooring. Apply according to manufacturer's written instructions and details including those for taping, mixing, priming, and troweling, sanding, and top coating of cove base. Round internal and external corners.

D. Apply Primer: over prepared substrate at manufacturer's recommended spreading rate.

E. Trowel mortar base: Mix mortar material according to manufacturer's recommended procedures. Climatic and non-climatic resinous flooring systems may vary slightly on mode of application.

Application should be based upon the following: Uniformly spread mortar over substrate using a specially designed screed box adjusted to manufacturer's recommended height. Metal trowel (hand or power) single mortar coat in thickness indicated for flooring system, grout to fill substrate voids. When cured, sand to remove trowel marks and roughness.

F. Broadcast: Immediately broadcast quartz silica aggregate into the primer using manufacturer's spray caster. Strict adherence to manufacturer's installation procedures and coverage rates is imperative.

G. Under Coat: Mix base material according to manufacturer's recommended procedures. Uniformly spread mixed material over previously primed substrate using manufacturer's installation tool. Roll material with strict adherence to manufacturer's installation procedures and coverage rates.

H. Broadcast: Immediately broadcast vinyl flakes into the body coat. Strict adherence to manufacturer's installation procedures and coverage rates is imperative.

I. First Sealer: Remove excess un-bonded flakes by lightly brushing and vacuuming the floor surface. Mix and apply sealer with strict adherence to manufacturer's installation procedures.

J. Second Sealer: Lightly sand first sealer coat. Mix and apply second sealer coat with strict adherence to manufacturer's installation procedures.

3.6 TOLERANCE

A. From line of plane: Maximum 1/8 inch (3.18 mm) in total distance of flooring and base. Broadcast resinous flooring system will contour substrate. Deviation and tolerance are subject to concrete tolerance.

B. From radius of cove: Maximum of 1/8 inch (3.18 mm) plus or 1/16-inch (1.59 mm) minus.

3.7 ENGINEERING DETAILS

A. Chase edges to “lock” the flooring system into the concrete substrate along lines of termination.

B. Penetration Treatment: Lap and seal resinous system onto the perimeter of the penetrating item by bridging over compatible elastomer at the interface to compensate for possible movement.

C. Trenches: Continue flooring system into trenches to maintain monolithic protection. Treat cold joints to assure bridging of potential cracks.

D. Treat floor drains by chasing the flooring system to lock in place at point of termination.

E. Treat control joints to bridge potential cracks and to maintain monolithic protection. Treat cold joints and construction joints to bridge potential cracks and to maintain monolithic protection on horizontal and vertical surfaces as well as horizontal and vertical interfaces.

F. Discontinue Resinous floor system at vertical and horizontal contraction and expansion joints by installing backer rod and compatible sealant after coating installation is completed. Provide sealant type recommended by manufacturer for traffic conditions and chemical exposures to be encountered.

3.8 CURING, PROTECTION AND CLEANING

A. Cure resinous flooring materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of application and prior to completion of curing process.

B. Close area of application for a minimum of 24 hours.

C. Protect resinous flooring materials from damage and wear during construction operation.

1. Cover flooring with kraft type paper.
2. Optional 6 mm (1/4 inch) thick hardboard, plywood, or particle board where area is in foot or vehicle traffic pattern, rolling or fixed scaffolding and overhead work occurs.

D. Remove temporary covering and clean resinous flooring just prior to final inspection. Use cleaning materials and procedures recommended by resinous flooring manufacturer.

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SECTION 09 72 61

SOLID SURFACE WET WALL ASSEMBLY AND SHOWER BASE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Vertical, solid surface wall cladding for wet applications.

B. Accessories

1.2 REFERENCES

A. ASTM International
1. ASTM D256; Impact Resistance of Plastics and Electrical Insulating Materials.
2. ASTM D570; Water Absorption of Plastics.
3. ASTM D638; Tensile Properties of Plastics.
4. ASTM D696; Coefficient of Linear Thermal Expansion of Plastics.
5. ASTM D790; Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
6. ASTM D2583; Indentation Hardness of Rigid Plastics by Means of a Barcol Impresser.
7. ASTM E84; Surface Burning Characteristics of Building Materials.
8. ANSI A137.1; Tile Slip Test

B. International Association of Plumbing and Mechanical Officials.
1. IAPMO/ANSI Standard Z124.1.2: Plastic Bathtub and Shower Units

C. National Electrical Manufacturers Association (NEMA) LD.3 High Pressure Decorative Laminates.

1.3 SUBMITTALS

A. Refer to Section 01 33 23 Submittal Procedures.

B. Product Data: Submit manufacturer's current product literature for each product indicated, including maintenance instructions.

C. Samples: Provide manufacturer's color sample for products indicated.

D. Shop Drawings: Include details, and attachments to other work.
1. Submit shop drawings showing seams, termination points, and details of edges.
2. Submit coordination drawings indicating electrical and plumbing work.

E. LEED Submittal:
1. Credit EQ 4.1 Indoor Air Quality
2. Manufacturer's product data for installation adhesives, including printed statement of VOC content and material safety data sheets.
3. Credit MR 5 Regional Materials.
4. Product data indicating that materials are regionally manufactured within 500 miles.
5. Credit ID 1-4 Innovative Design
6. Solis surface products are extremely durable with an extensive life cycle and can be reused in new applications. Selecting custom sized products can lower costs and reduce waste.

F. Manufacturer Instructions: Provide manufacturer's written installation instructions.

G. Installer Certification: Submit a signed copy of the installer's certificate, acknowledging the employee has been trained and approved by manufacturer.

H. Closeout Submittals

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer authorized installer shall fabricate and install solid surface products, and demonstrate successful experience in installing finished carpentry items similar in type and quality to those required for this project.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver sheets, fabricated items, materials and components in manufacturer's original, unopened, undamaged containers with identification labels intact.

B. Store solid surface products and accessories as recommended by manufacturer.

1.6 WARRANTY

A. Provide manufacturer's limited ten-year warranty against defective material and workmanship.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Avonite® acrylic solid surface is manufactured by Aristech Surfaces LLC; 7350 Empire Drive, Florence, KY 41042, USA; Phone 1.800.354.9858 or 859.283.1501, fax 859.283.7378; website www.aristechsurfaces.com.

2.2 WET WALL PANEL SYSTEM

A. Provide wet wall panel system of solid polymer components to include: panels, inside corner trim; and outside finish trim. Dimensions of all components shall be standard manufacturer's dimensions to be field cut to fit. Panels shall be formed from manufacturer's standard 6mm (~1/4 inch) thick sheet product. Panels shall be full width and height with seams occurring only at the inside corners of the enclosure.

2.3 PANEL MATERIALS

A. Basis of Design: Avonite® Acrylic Solid Surface

B. Description: Non-porous, homogeneous material maintaining the same composition throughout the part with a composition of polyester or acrylic polymer, aluminum trihydrate filler and pigment.

C. Sheet Size: 36" x 96", 48" x 96", 60" x 96".

D. Colors: Kokoura 9117

E. Vertical Wet Wall Characteristics: (solid colors)
   1. Thickness: 6mm
   2. Barcol Hardness: 59, when tested in accordance with ASTM D2583
   3. Elongation: 2.2%, when tested in accordance with ASTM D638
   4. Tensile strength: 3,800psi, when tested in accordance with ASTM D638
   5. Tensile Modulus: 11 x $10^{5,}$ when tested in accordance with ASTM D638
   6. Water Absorption after 24 hours: .07%, when tested in accordance with ASTM D570
   7. Charpy Impact (Foot Pounds/Inch): 1.5, when tested in accordance with ASTM D6110
   8. Impact Resistance 1/2 Pound: No Fracture, when tested in accordance with NEMA LD3-3.8
   9. Linear Thermal Expansion: 2.0 x 10^{-5}, when tested in accordance with ASTM D696
   10. High Temperature Resistance: Slight Effect, when tested in accordance with NEMA LD3-3.6
   11. Boiling Water Resistance: No Effect, when tested in accordance with ISFA 2-01
   12. Stain Resistance: No Effect, when tested in accordance with NEMA LD3-3.4
   13. Weight per sq. ft., 6mm thickness: 2.2 pounds

2.4 TRIM ACCESSORIES

A. Provide matching inside corner trim and outside finish trim to conceal corner sealant and provide transition from shower to wall covering.

2.5 OPTIONAL SOAP/SHAMPOO COMPONENTS

A. Provide matching cast recessed shampoo/soap holder.

2.6 INSTALLATION ACCESSORIES

A. Panel Adhesive: Manufacturer recommended color matched adhesive

B. Silicone Sealant: Mildew-resistant, FDA compliant, 100% clear silicone sealant

2.7 FABRICATION

A. Solid surface shall be factory fabricated by an authorized fabricator.

B. Solid surface paneling and shower/tub enclosures shall be fabricated of 6mm (~1/4”) thick material unless otherwise indicated.

C. Solid surface shall be fabricated to field measurements.

D. Cut and finish component edges with clean, sharp returns.

E. Finished edges shall have a 1/16” radius

PART 3 - EXECUTION

3.1 GENERAL

A. Install solid surfaces in accordance with manufacturer’s installation guidelines and recommendations.

3.2 EXAMINATION

A. Inspect materials and location of installation for conditions affecting performance of work in accordance with shop drawings.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 PANEL INSTALLATION

A. Panels shall be provided to heights shown on the drawings with no horizontal seaming.

B. Panels shall utilize the maximum panel dimension available to minimize vertical seams.

C. Panels shall be full width and height with seams only at inside corners of enclosure.

D. Field cut panels as required for plumbing fixtures and bath accessories.

E. Apply quarter size dots of silicone adhesive approximately 1” inside of perimeter of solid surface panels. Apply additional dots of silicone every 8-10” apart over remaining surface. Apply hot melt glue to back of panel for temporary adhesion of panels to substrate while adhesive cures.

F. Allow panels to cure for 24 hours, minimum, before exposure to moisture or pressure.

G. Corner and vertical joints: Form 1/8-inch-wide joints, sealed with clear 100% silicone sealant.

3.4 CLEANING AND PROTECTION

A. Remove adhesives, sealants and other stains.

B. Protect shower/bath enclosure from damage. Repair or replace damaged work, to COR’s satisfaction.

END OF SECTION

SECTION 09 91 00

PAINTING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the painting and finishing as shown on the construction documents and/or specified herein, including, but not limited to, the following:
   1. Prime coats which may be applied in shop under other sections.
   2. Prime painting unprimed surfaces to be painted under this Section.
   3. Painting items furnished with a prime coat of paint, including touching up of or repairing of abraded, damaged or rusted prime coats applied by others.
   4. Painting ferrous metal (except stainless steel) exposed to view.
   5. Painting galvanized ferrous metals exposed to view.
   6. Painting interior concrete block exposed to view.
   7. Painting gypsum drywall exposed to view.
   8. Painting of wood exposed to view, except items which are specified to be painted or finished under other Sections of these specifications. Back painting of all wood in contact with concrete, masonry or other moisture areas.
   9. Painting pipes, pipe coverings, conduit, ducts, insulation, hangers, supports and other mechanical and electrical items and equipment exposed to view.
   10. Painting surfaces above, behind or below grilles, gratings, diffusers, louvers lighting fixtures, and the like, which are exposed to view through these items.
   11. Painting includes shellacs, stains, varnishes, coatings specified, and striping or markers and identity markings.
   12. Incidental painting and touching up as required to produce proper finish for painted surfaces, including touching up of factory finished items.
   13. Painting of any surface not specifically mentioned to be painted herein or on construction documents, but for which painting is obviously necessary to complete the job, or work which comes within the intent of these specifications, is to be included as though specified.

1.2 RELATED WORK

A. Section 01 35 26, SAFETY REQUIREMENTS: Activity Hazard Analysis.

B. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS: Sustainable Design Requirements.

C. Section 02 83 33.13, LEAD-BASED PAINT REMOVAL AND DISPOSAL: Lead Paint Removal.

D. Shop prime painting of steel and ferrous metals: Division 05 - METALS, Division 08 - OPENINGS; Division 10 - SPECIALTIES; Division 11 - EQUIPMENT; Division 12 - FURNISHINGS; Division 13 – SPECIAL CONSTRUCTION; Division 14 – CONVEYING EQUIPMENT; Division 21 – FIRE SUPPRESSION; Division 22 - PLUMBING; Division 23 – HEATING; VENTILATION AND AIR-CONDITIONING; Division 26 - ELECTRICAL; Division 27 - COMMUNICATIONS; and Division 28 – ELECTRONIC SAFETY AND SECURITY sections.

E. Prefinished flush doors with transparent finishes: Section 08 14 00, WOOD DOORS.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Sustainable Design Submittals as described below:
   1. Volatile organic compounds per volume as specified in PART 2 - PRODUCTS.

C. Painter qualifications.

D. Manufacturer's Literature and Data:
   1. Before work is started, or sample panels are prepared, submit manufacturer's literature and technical data, the current Master Painters Institute (MPI) "Approved Product List" indicating brand label, product name and product code as of the date of contract award, will be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use subsequent MPI "Approved Product List", however, only one (1) list may be used for the entire contract and each coating system is to be from a single manufacturer. All coats on a particular substrate must be from a single manufacturer. No variation from the MPI "Approved Product List" where applicable is acceptable.

E. Sample Panels:
   1. After painters' materials have been approved and before work is started, submit sample panels showing each type of finish and color specified.
   2. Panels to Show Color: Composition board, 100 x 250 mm (4 x 10 inch).
   3. Panel to Show Transparent Finishes: Wood of same species and grain pattern as wood approved for use, 100 x 250 mm (4 x 10 inch face) minimum, and where both flat and edge grain will be exposed, 250 mm (10 inches) long by sufficient size, 50 x 50 mm (2 x 2 inch) minimum or actual wood member to show complete finish.
   4. Attach labels to panel stating the following:
      a. Federal Specification Number or manufacturers name and product number of paints used.
      b. Specification code number specified in Construction Documents.
      c. Product type and color.
      d. Name of project.
   5. Strips showing not less than 50 mm (2 inch) wide strips of undercoats and 100 mm (4 inch) wide strip of finish coat.

F. Sample of identity markers if used.

G. Manufacturers' Certificates indicating compliance with specified requirements:
   1. Manufacturer's paint substituted for Federal Specification paints meets or exceeds performance of paint specified.
   2. High temperature aluminum paint.
   3. Epoxy coating.
      Intumescent clear coating or fire-retardant paint.
   4. Plastic floor coating.

1.4 DELIVERY AND STORAGE

A. Deliver materials to site in manufacturer's sealed container marked to show following:
   1. Name of manufacturer.
   2. Product type.
   3. Batch number.
   4. Instructions for use.
   5. Safety precautions.

B. In addition to manufacturer's label, provide a label legibly printed as following:
   1. Federal Specification Number, where applicable, and name of material.
   2. Surface upon which material is to be applied.
   3. Specify Coat Types: Prime; body; finish; etc.

C. Maintain space for storage, and handling of painting materials and equipment in a ventilated, neat and orderly condition to prevent spontaneous combustion from occurring or igniting adjacent items.

D. Store materials at site at least 24 hours before using, at a temperature between 7 and 30 degrees C (45 and 85 degrees F).

1.5 QUALITY ASSURANCE

A. Qualification of Painters: Use only qualified journeyman painters for the mixing and application of paint on exposed surfaces. Submit evidence that key personnel have successfully performed surface preparation and application of coating on a minimum of three (3) similar projects within the past three (3) years.

B. Paint Coordination: Provide finish coats which are compatible with the prime paints used. Review other Sections of these specifications in which prime paints are to be provided to ensure compatibility of the total coatings system for the various substrates. Upon request from other subcontractors, furnish information on the characteristics of the finish materials proposed to be used, to ensure that compatible prime coats are used. Provide barrier coats over incompatible primers or remove and re-prime as required. Notify the Contracting Officer Representative (COR) in writing of any anticipated problems using the coating systems as specified with substrates primed by others.

1.6 REGULATORY REQUIREMENTS

A. Paint materials are to conform to the restrictions of the local Environmental and Toxic Control jurisdiction.
   1. Volatile Organic Compounds (VOC) Emissions Requirements: Field-applied paints and coatings that are inside the waterproofing system to not exceed limits of authorities having jurisdiction.
   2. Lead-Base Paint:
      a. Comply with Section 410 of the Lead-Based Paint Poisoning Prevention Act, as amended, and with implementing regulations promulgated by Secretary of Housing and Urban Development.
      b. Regulations concerning prohibition against use of lead-based paint in federal and federally assisted construction, or rehabilitation of residential structures are set forth in Subpart F, Title 24, Code of Federal Regulations, Department of Housing and Urban Development.
      c. Do not use coatings having a lead content over 0.06 percent by weight of non-volatile content.
      d. For lead-paint removal, see Section 02 83 33.13, LEAD-BASED PAINT REMOVAL AND DISPOSAL.
   3. Asbestos: Provide materials that do not contain asbestos.
   4. Chromate, Cadmium, Mercury, and Silica: Provide materials that do not contain zinc-chromate, strontium-chromate, Cadmium, mercury or mercury compounds or free crystalline silica.
   5. Human Carcinogens: Provide materials that do not contain any of the ACGIH-BKLT and ACGHI-DOC confirmed or suspected human carcinogens.
   6. Use high performance acrylic paints in place of alkyd paints.

1.7 SAFETY AND HEALTH

A. Apply paint materials using safety methods and equipment in accordance with the following:
   1. Comply with applicable Federal, State, and local laws and regulations, and with the ACCIDENT PREVENTION PLAN, including the Activity Hazard Analysis (AHA) as specified in Section 01 35 26, SAFETY REQUIREMENTS. The AHA is to include analyses of the potential impact of painting operations on painting personnel and on others involved in and adjacent to the work zone.

B. Safety Methods Used During Paint Application: Comply with the requirements of SSPC PA Guide 10.

C. Toxic Materials: To protect personnel from overexposure to toxic materials, conform to the most stringent guidance of:
   1. The applicable manufacturer's Material Safety Data Sheets (MSDS) or local regulation.
   2. 29 CFR 1910.1000.
   3. ACHIH-BKLT and ACGHI-DOC, threshold limit values.

1.8 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.

B. American Conference of Governmental Industrial Hygienists (ACGIH):
ACGIH TLV-BKLT-2012 ..... Threshold Limit Values (TLV) for Chemical Substances and Physical Agents and Biological Exposure Indices (BEIs)

ACGIH TLV-DOC-2012 ..... Documentation of Threshold Limit Values and Biological Exposure Indices, (Seventh Edition)

C. ASME International (ASME):
A13.1-07(R2013) ..... Scheme for the Identification of Piping Systems

D. Code of Federal Regulation (CFR):
40 CFR 59 ..... Determination of Volatile Matter Content, Water Content, Density Volume Solids, and Weight Solids of Surface Coating

E. Commercial Item Description (CID):
A-A-1272A ..... Plaster Gypsum (Spackling Compound)

F. Federal Specifications (Fed Spec):
TT-P-1411A ..... Paint, Copolymer-Resin, Cementitious (For Waterproofing Concrete and Masonry Walls) (CEP)

G. Master Painters Institute (MPI):
1 ..... Aluminum Paint

3 ..... Primer, Alkali Resistant, Water Based

4 ..... Interior/ Exterior Latex Block Filler

5 ..... Exterior Alkyd Wood Primer

6 ..... Exterior, Latex for Exterior Wood Primer

7 ..... Exterior Oil Wood Primer

8 ..... Exterior Alkyd, Flat MPI Gloss Level 1

9 ..... Exterior Alkyd Enamel MPI Gloss Level 6

10 ..... Exterior Latex, Flat

11 ..... Exterior Latex, Semi-Gloss

15 ..... Exterior Latex, Low Sheen (MPI Gloss Level 3-4)

17 ..... Primer, Bonding, Waterbased

18 ..... Organic Zinc Rich Primer

22 ..... Aluminum Paint, High Heat (up to 590% - 1100F)

23 ..... Primer, Metal, Surface Tolerant

27 ..... Exterior / Interior Alkyd Floor Enamel, Gloss

31 ..... Polyurethane, Moisture Cured, Clear Gloss

36 ..... Knot Sealer

39 ..... Primer, Latex, for Interior Wood

40 ..... Exterior, Latex High Build

42 ..... Textured Coating, Latex, Flat

43 .....Interior Satin Latex, MPI Gloss Level 4
44 .....Interior Low Sheen Latex, MPI Gloss Level 2
45 .....Interior Primer Sealer
46 .....Interior Enamel Undercoat
47 .....Interior Alkyd, Semi-Gloss, MPI Gloss Level 5
48 .....Interior Alkyd, Gloss, MPI Gloss Level 6
50 .....Interior Latex Primer Sealer
51 .....Interior Alkyd, Eggshell, MPI Gloss Level 3
52 .....Interior Latex, MPI Gloss Level 3
53 .....Interior Latex, Flat, MPI Gloss Level 1
54 .....Interior Latex, Semi-Gloss, MPI Gloss Level 5
59 .....Interior/Exterior Alkyd Porch & Floor Enamel, Low Gloss
60 .....Interior/Exterior Latex Porch & Floor Paint, Low Gloss
66 .....Interior Alkyd Fire Retardant, Clear Top-Coat (ULC Approved)
67 .....Interior Latex Fire Retardant, Top-Coat (ULC Approved)
68 .....Interior/ Exterior Latex Porch & Floor Paint, Gloss
71 .....Polyurethane, Moisture Cured, Clear, Flat
77 .....Epoxy Cold Cured, Gloss
79 .....Marine Alkyd Metal Primer
90 .....Interior Wood Stain, Semi-Transparent
91 .....Wood Filler Paste
94 .....Exterior Alkyd, Semi-Gloss
95 .....Fast Drying Metal Primer
98 .....High Build Epoxy Coating
99 .....Sealer, Water-based, for Concrete Floors
101 .....Epoxy Anti-Corrosive Metal Primer
107 .....Primer, Rust-Inhibitive, Water-based

108 .....High Build Epoxy Coating, Low Gloss
113 .....Elastomeric, Pigmented, Exterior, Water-based, Flat
114 .....Interior Latex, Gloss
115 .....Epoxy-Modified Latex, Interior Gloss (MPI gloss level 6)
118 .....Dry Fall, Latex Flat
119 .....Exterior Latex, High Gloss (acrylic)
134 .....Galvanized Water Based Primer
135 .....Non-Cementitious Galvanized Primer
138 .....Interior High Performance Latex, MPI Gloss Level 2

139 .....Interior High Performance Latex, MPI Gloss Level 3

140 .....Interior High Performance Latex, MPI Gloss Level 4

141 .....Interior High Performance Latex (SG) MPI Gloss Level 5

144 .....Latex, Interior, Institutional Low Odor / VOC, (MPI Gloss Level 2)

145 .....Latex, Interior, Institutional Low Odor / VOC, (MPI Gloss Level 3)

146 .....Latex, Interior, Institutional Low Odor / VOC, (MPI Gloss Level 4)

151 .....Light Industrial Coating, Interior, Water-based, (MPI Gloss Level 3)

153 .....Light Industrial Coating, Interior, Water-based, (MPI Gloss Level 4)

163 .....Exterior Water Based Semi-Gloss Light Industrial Coating, MPI Gloss Level 5

164 .....Exterior, Water Based, Gloss, Light Industrial Coating, MPI Gloss Level 6

H. Society for Protective Coatings (SSPC):
SSPC SP 1-82(R2004) .....Solvent Cleaning

SSPC SP 2-82(R2004) .....Hand Tool Cleaning

SSPC SP 3-28(R2004) .....Power Tool Cleaning

SSPC SP 10/NACE No.2 .....Near-White Blast Cleaning

SSPC PA Guide 10 .....Guide to Safety and Health Requirements

I. Maple Flooring Manufacturer's Association (MFMA):

J. U.S. National Archives and Records Administration (NARA):
29 CFR 1910.1000 .....Air Contaminants

K. Underwriter's Laboratory (UL)

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Conform to the coating specifications and standards referenced in PART 3. Submit manufacturer's technical data sheets for specified coatings and solvents.

2.2 PAINT PROPERTIES:

A. Use ready-mixed (including colors), except two component epoxies, polyurethanes, polyesters, paints having metallic powders packaged separately and paints requiring specified additives.

B. Where no requirements are given in the referenced specifications for primers, use primers with pigment and vehicle, compatible with substrate and finish coats specified.

C. Provide undercoat paint produced by the same manufacturer as the finish coats. Use only thinners approved by the paint manufacturer and use only to recommended limits.

D. VOC Content: For field applications that are inside the weatherproofing system, paints and coating to comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:
1. Flat Paints and Coatings: 50 gram/liter.
2. Non-flat Paints and Coatings: 150 gram/liter.
3. Dry-Fog Coatings: 400 gram/liter.
4. Primers, Sealers, and Undercoaters: 200 gram/liter.

5. Anticorrosive and Antirust Paints applied to Ferrous Metals: 250 gram/liter.
6. Zinc-Rich Industrial Maintenance Primers: 340 gram/liter.
7. Pretreatment Wash Primers: 420 gram/liter.
8. Shellacs, Clear: 730 gram/liter.
9. Shellacs, Pigmented: 550 gram/liter.

E. VOC test method for paints and coatings is to be in accordance with 40 CFR 59 (EPA Method 24). Part 60, Appendix A with the exempt compounds' content determined by Method 303 (Determination of Exempt Compounds) in the South Coast Air Quality Management District's (SCAQMD) "Laboratory Methods of Analysis for Enforcement Samples" manual.

2.3 PLASTIC TAPE:

A. Pigmented vinyl plastic film in colors as specified in SCHEDULE FOR FINISHES or specified.

B. Pressure sensitive adhesive back.

C. Snap on coil plastic markers.

D. Widths as shown on construction documents.

2.4 BIOBASED CONTENT

A. Paint products shall comply with following bio-based standards for biobased materials:

Material Type	Percent by Weight
Interior Paint	20 percent biobased material
Interior Paint- Oil Based and Solvent Alkyd	67 percent biobased material
Exterior Paint	20 percent biobased material
Wood & Concrete Stain	39 percent biobased content
Polyurethane Coatings	25 percent biobased content
Water Tank Coatings	59 percent biobased content
Wood & Concrete Sealer- Membrane Concrete Sealers	11 percent biobased content
Wood & Concrete Sealer- Penetrating Liquid	79 percent biobased content

B. The minimum-content standards are based on the weight (not the volume) of the material.

PART 3 - EXECUTION

3.1 JOB CONDITIONS:

A. Safety: Observe required safety regulations and manufacturer's warning and instructions for storage, handling and application of painting materials.
   1. Take necessary precautions to protect personnel and property from hazards due to falls, injuries, toxic fumes, fire, explosion, or other harm.
   2. Deposit soiled cleaning rags and waste materials in metal containers approved for that purpose. Dispose of such items off the site at end of each day's work.

B. Atmospheric and Surface Conditions:
   1. Do not apply coating when air or substrate conditions are:
      a. Less than 3 degrees C (5 degrees F) above dew point.
      b. Below 10 degrees C (50 degrees F) or over 35 degrees C (95 degrees F), unless specifically pre-approved by the COR and the product manufacturer. Under no circumstances are application conditions to exceed manufacturer recommendations.

c. When the relative humidity exceeds 85 percent; or to damp or wet surfaces; unless otherwise permitted by the paint manufacturer's printed instructions.

2. Maintain interior temperatures until paint dries hard.
3. Do no exterior painting when it is windy and dusty.
4. Do not paint in direct sunlight or on surfaces that the sun will warm.
5. Apply only on clean, dry and frost-free surfaces except as follows:
   a. Apply water thinned acrylic and cementitious paints to damp (not wet) surfaces only when allowed by manufacturer's printed instructions.
   b. Concrete and masonry when permitted by manufacturer's recommendations, dampen surfaces to which water thinned acrylic and cementitious paints are applied with a fine mist of water on hot dry days to prevent excessive suction and to cool surface.
6. Varnishing:
   a. Apply in clean areas and in still air.
   b. Before varnishing vacuum and dust area.
   c. Immediately before varnishing wipe down surfaces with a tack rag.

3.2 INSPECTION:

A. Examine the areas and conditions where painting and finishing are to be applied and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.3 GENERAL WORKMANSHIP REQUIREMENTS:

A. Application may be by brush or roller. Spray application only upon acceptance from the COR in writing.

B. Furnish to the COR a painting schedule indicating when the respective coats of paint for the various areas and surfaces will be completed. This schedule is to be kept current as the job progresses.

C. Protect work at all times. Protect all adjacent work and materials by suitable covering or other method during progress of work. Upon completion of the work, remove all paint and varnish spots from floors, glass and other surfaces. Remove from the premises all rubbish and accumulated materials of whatever nature not caused by others and leave work in a clean condition.

D. Remove and protect hardware, accessories, device plates, lighting fixtures, and factory finished work, and similar items, or provide in place protection. Upon completion of each space, carefully replace all removed items by workmen skilled in the trades involved.

E. When indicated to be painted, remove electrical panel box covers and doors before painting walls. Paint separately and re-install after all paint is dry.

F. Materials are to be applied under adequate illumination, evenly spread and flowed on smoothly to avoid runs, sags, holidays, brush marks, air bubbles and excessive roller stipple.

G. Apply materials with a coverage to hide substrate completely. When color, stain, dirt or undercoats show through final coat of paint, the surface is to be covered by additional coats until the paint film is of uniform finish, color, appearance and coverage, at no additional cost to the Government.

H. All coats are to be dry to manufacturer's recommendations before applying succeeding coats.

I. All suction spots or "hot spots" in plaster after the application of the first coat are to be touched up before applying the second coat.

J. Do not apply paint behind frameless mirrors that use mastic for adhering to wall surface.

3.4 SURFACE PREPARATION:

A. General:

1. The Contractor shall be held wholly responsible for the finished appearance and satisfactory completion of painting work. Properly prepare all surfaces to receive paint, which includes cleaning, sanding, and touching-up of all prime coats applied under other Sections of the work. Broom clean all spaces before painting is started. All surfaces to be painted or finished are to be completely dry, clean and smooth.
2. See other sections of specifications for specified surface conditions and prime coat.
3. Perform preparation and cleaning procedures in strict accordance with the paint manufacturer's instructions and as herein specified, for each particular substrate condition.
4. Clean surfaces before applying paint or surface treatments with materials and methods compatible with substrate and specified finish. Remove any residue remaining from cleaning agents used. Do not use solvents, acid, or steam on concrete and masonry. Schedule the cleaning and painting so that dust and other contaminants from the cleaning process will not fall in wet, newly painted surfaces.
5. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
   a. Concrete: 12 percent.
   b. Fiber-Cement Board: 12 percent.
   c. Masonry (Clay and CMU's): 12 percent.
   d. Wood: 15 percent.
   e. Gypsum Board: 12 percent.
   f. Plaster: 12 percent.

B. Wood:
1. Sand to a smooth even surface and then dust off.
2. Sand surfaces showing raised grain smooth between each coat.
3. Wipe surface with a tack rag prior to applying finish.
4. Surface painted with an opaque finish:
   a. Coat knots, sap and pitch streaks with MPI 36 (Knot Sealer) before applying paint.
   b. Apply two coats of MPI 36 (Knot Sealer) over large knots.
5. After application of prime or first coat of stain, fill cracks, nail and screw holes, depressions and similar defects with wood filler paste. Sand the surface to make smooth and finish flush with adjacent surface.
6. Before applying finish coat, reapply wood filler paste if required, and sand surface to remove surface blemishes. Finish flush with adjacent surfaces.
7. Fill open grained wood such as oak, walnut, ash and mahogany with MPI 91 (Wood Filler Paste), colored to match wood color.
   a. Thin filler in accordance with manufacturer's instructions for application.
   b. Remove excess filler, wipe as clean as possible, dry, and sand as specified.

C. Ferrous Metals:
1. Remove oil, grease, soil, drawing and cutting compounds, flux and other detrimental foreign matter in accordance with SSPC-SP 1 (Solvent Cleaning).
2. Remove loose mill scale, rust, and paint, by hand or power tool cleaning, as defined in SSPC-SP 2 (Hand Tool Cleaning) and SSPC-SP 3 (Power Tool Cleaning).
3. Fill dents, holes and similar voids and depressions in flat exposed surfaces of hollow steel doors and frames, access panels, roll-up steel doors and similar items specified to have semi-gloss or gloss finish with TT-F-322D (Filler, Two-Component Type, For Dents, Small Holes and Blow-Holes). Finish flush with adjacent surfaces.
   a. Fill flat head countersunk screws used for permanent anchors.
   b. Do not fill screws of item intended for removal such as glazing beads.
4. Spot prime abraded and damaged areas in shop prime coat which expose bare metal with same type of paint used for prime coat. Feather edge of spot prime to produce smooth finish coat.
5. Spot prime abraded and damaged areas which expose bare metal of factory finished items with paint as recommended by manufacturer of item.

D. Gypsum Plaster and Gypsum Board:
   1. Remove efflorescence, loose and chalking plaster or finishing materials.
   2. Remove dust, dirt, and other deterrents to paint adhesion.
   3. Fill holes, cracks, and other depressions with CID-A-A-1272A finished flush with adjacent surface, with texture to match texture of adjacent surface. Patch holes over 25 mm (1-inch) in diameter as specified in Section for plaster or gypsum board.

3.5 PAINT PREPARATION:

A. Thoroughly mix painting materials to ensure uniformity of color, complete dispersion of pigment and uniform composition.

B. Do not thin unless necessary for application and when finish paint is used for body and prime coats. Use materials and quantities for thinning as specified in manufacturer's printed instructions.

C. Remove paint skins, then strain paint through commercial paint strainer to remove lumps and other particles.

D. Mix two (2) component and two (2) part paint and those requiring additives in such a manner as to uniformly blend as specified in manufacturer's printed instructions unless specified otherwise.

E. For tinting required to produce exact shades specified, use color pigment recommended by the paint manufacturer.

3.6 APPLICATION:

A. Start of surface preparation or painting will be construed as acceptance of the surface as satisfactory for the application of materials.

B. Unless otherwise specified, apply paint in three (3) coats; prime, body, and finish. When two (2) coats applied to prime coat are the same, first coat applied over primer is body coat and second coat is finish coat.

C. Apply each coat evenly and cover substrate completely.

D. Allow not less than 48 hours between application of succeeding coats, except as allowed by manufacturer's printed instructions, and approved by COR.

E. Apply by brush or roller. Spray application for new or existing occupied spaces only upon approval by acceptance from COR in writing.
   1. Apply painting materials specifically required by manufacturer to be applied by spraying.
   2. In new construction and in existing occupied spaces, where paint is applied by spray, mask or enclose with polyethylene, or similar air tight material with edges and seams continuously sealed including items specified in “Building and Structural Work Field Painting”; “Work not Painted”; motors, controls, telephone, and electrical equipment, fronts of sterilizes and other recessed equipment and similar prefinished items.

F. Do not paint in closed position operable items such as access doors and panels, window sashes, overhead doors, and similar items except overhead roll-up doors and shutters.

3.7 PRIME PAINTING:

A. After surface preparation, prime surfaces before application of body and finish coats, except as otherwise specified.

B. Spot prime and apply body coat to damaged and abraded painted surfaces before applying succeeding coats.

C. Additional field applied prime coats over shop or factory applied prime coats are not required except for exterior exposed steel apply an additional prime coat.

D. Prime rabbets for stop and face glazing of wood, and for face glazing of steel.

E. Gypsum Board

1. Surfaces scheduled to have MPI 52 (Interior Latex, MPI Gloss Level 3) respectively.
2. Primer: MPI 50 (Interior Latex Primer Sealer) except use MPI 45 (Interior Primer Sealer) in shower and bathrooms.
3. Surfaces scheduled to receive vinyl coated fabric wall covering:
4. Use MPI 45 (Interior Primer Sealer).

F. Gypsum Plaster and Veneer Plaster:
1. Surfaces scheduled to receive vinyl coated fabric wall covering: Use MPI 45 (Interior Primer Sealer).
2. MPI 45 (Interior Primer Sealer), except use MPI 50 (Interior Latex Primer Sealer) when an alkyd flat finish is specified.
3. Surfaces scheduled to MPI 52 (Interior Latex, MPI Gloss Level 3.

G. Concrete Masonry Units except glazed or integrally colored and decorative units:
1. MPI 4 (Block Filler) on interior surfaces.
2. Prime exterior surface as specified for exterior finishes.

H. Concrete Floors: MPI 99 (Water-based Acrylic Curing and Sealing Compound).

3.8 INTERIOR FINISHES:

A. Apply following finish coats over prime coats in spaces or on surfaces specified in SCHEDULE FOR FINISHES.

B. Metal Work:
1. Apply to exposed surfaces.
2. Omit body and finish coats on surfaces concealed after installation except electrical conduit containing conductors over 600 volts.
3. Ferrous Metal, Galvanized Metal, and Other Metals Scheduled:
   a. Apply two (2) coats of MPI 47 (Interior Alkyd, Semi-Gloss) unless specified otherwise.
   b. Two (2) coats of MPI 51 (Interior Alkyd, Eggshell) .
   c. Machinery: One (1) coat MPI 9 (Exterior Alkyd Enamel).

C. Gypsum Board:
1. One (1) coat of MPI 45 (Interior Primer Sealerplus one (1) coat of MPI 139 (Interior High Performance Latex, MPI Gloss level 3).
2. Two (2) coats of MPI 138 (Interior High Performance Latex, MPI Gloss Level 2).

D. Plaster:
1. One (1) coat of MPI 45 (Interior Primer Sealerplus one (1) coat of MPI 139 (Interior High Performance Latex, MPI Gloss level 3).
2. Two (2) coats of MPI 51 (Interior Alkyd, Eggshell).

E. Concrete Floors: One (1) coat of MPI 68 (Interior/ Exterior Latex Porch & Floor Paint, Gloss).

F. Miscellaneous:
1. Apply where specified in SCHEDULE FOR FINISHES.
2. MPI 1 (Aluminum Paint): Two (2) coats of aluminum paint.

3.9 REFINISHING EXISTING PAINTED SURFACES:

A. Clean, patch and repair existing surfaces as specified under “Surface Preparation”. No “telegraphing” of lines, ridges, flakes, etc., through new surfacing is permitted. Where this occurs, sand smooth and re-finish until surface meets with COR’s approval.

B. Remove and reinstall items as specified under “General Workmanship Requirements”.

C. Remove existing finishes or apply separation coats to prevent non compatible coatings from having contact.

D. Patched or Replaced Areas in Surfaces and Components: Apply spot prime and body coats as specified for new work to repaired areas or replaced components.

E. Except where scheduled for complete painting apply finish coat over plane surface to nearest break in plane, such as corner, reveal, or frame.

F. Refinish areas as specified for new work to match adjoining work unless specified or scheduled otherwise.

G. Sand or dull glossy surfaces prior to painting.

H. Sand existing coatings to a feather edge so that transition between new and existing finish will not show in finished work.

3.10 PAINT COLOR:

A. Color and gloss of finish coats is specified in SCHEDULE FOR FINISHES.

B. For additional requirements regarding color see Articles, “REFINISHING EXISTING PAINTED SURFACE” and “MECHANICAL AND ELECTRICAL FIELD PAINTING SCHEDULE”.

C. Coat Colors:
1. Color of priming coat: Lighter than body coat.
2. Color of body coat: Lighter than finish coat.
3. Color prime and body coats to not show through the finish coat and to mask surface imperfections or contrasts.

D. Painting, Caulking, Closures, and Fillers Adjacent to Casework:
1. Paint to match color of casework where casework has a paint finish.
2. Paint to match color of wall where casework is stainless steel, plastic laminate, or varnished wood.

3.11 MECHANICAL AND ELECTRICAL WORK FIELD PAINTING SCHEDULE:

A. Field painting of mechanical and electrical consists of cleaning, touching-up abraded shop prime coats, and applying prime, body and finish coats to materials and equipment if not factory finished in space scheduled to be finished.

B. In spaces not scheduled to be finish painted: paint as specified below.

C. Paint various systems specified in Division 02 – EXISTING CONDITIONS, Division 21 – FIRE SUPPRESSION, Division 22 - PLUMBING, Division 23 – HEATING, VENTILATION AND AIR-CONDITIONING, Division 26 - ELECTRICAL, Division 27 - COMMUNICATIONS, and Division 28 – ELECTRONIC SAFETY AND SECURITY.

D. Paint after tests have been completed.

E. Omit prime coat from factory prime-coated items.

F. Finish painting of mechanical and electrical equipment is not required when located in interstitial spaces, above suspended ceilings, in concealed areas such as pipe and electric closets, pipe basements, pipe tunnels, trenches, attics, roof spaces, shafts and furred spaces except on electrical conduit containing feeders 600 volts or more.

G. Omit field painting of items specified in “BUILDING AND STRUCTURAL WORK FIELD PAINTING”; “Building and Structural Work not Painted”.

H. Color:
1. Paint items having no color specified in SCHEDULE FOR FINISHES to match surrounding surfaces.
2. Paint colors as specified in SCHEDULE FOR FINISHES except for following:
   a. White: Exterior unfinished surfaces of enameled plumbing fixtures. Insulation coverings on breeching and uptake inside boiler house, drums and drum-heads, oil heaters, condensate tanks and condensate piping.
   b. Gray: Heating, ventilating, air conditioning and refrigeration equipment (except as required to match surrounding surfaces), and water and sewage treatment equipment and sewage ejection equipment.

c. Aluminum Color: Ferrous metal on outside of boilers and in connection with boiler settings including supporting doors and door frames and fuel oil burning equipment, and steam generation system (bare piping, fittings, hangers, supports, valves, traps and miscellaneous iron work in contact with pipe).
d. Federal Safety Red: Exposed fire protection piping hydrants, post indicators, electrical conducts containing fire alarm control wiring, and fire alarm equipment.
e. Federal Safety Orange: Entire lengths of electrical conduits containing feeders 600 volts or more.
f. Color to match brickwork sheet metal covering on breeching outside of exterior wall of boiler house.

I. Apply paint systems on properly prepared and primed surface as follows:
1. Interior Locations:
a. Apply two (2) coats of MPI 47 (Interior Alkyd, Semi-Gloss) to following items:
1) Metal under 94 degrees C (201 degrees F) of items such as bare piping, fittings, hangers and supports.
2) Equipment and systems such as hinged covers and frames for control cabinets and boxes, cast-iron radiators, electric conduits and panel boards.
3) Heating, ventilating, air conditioning, plumbing equipment, and machinery having shop prime coat and not factory finished.
b. Paint electrical conduits containing cables rated 600 volts or more using two (2) coats of MPI 8 (Exterior Alkyd, Flat) in the Federal Safety Orange color in exposed and concealed spaces full length of conduit.
2. Other exposed locations:
a. Metal surfaces, except aluminum, of cooling towers exposed to view, including connected pipes, rails, and ladders: Two (2) coats of MPI 1 (Aluminum Paint).
b. Cloth jackets of insulation of ducts and pipes in connection with plumbing, air conditioning, ventilating refrigeration and heating systems: One (1) coat of MPI 50 (Interior Latex Primer Sealer) and one (1) coat of MPI 10 (Exterior Latex, Flat).

3.12 BUILDING AND STRUCTURAL WORK FIELD PAINTING:

A. Painting and finishing of interior and exterior work except as specified here-in-after.
1. Painting and finishing of new and existingwork including colors and gloss of finish selected is specified in Finish Schedule, Section SCHEDULE FOR FINISHES.
2. Painting of disturbed, damaged and repaired or patched surfaces when entire space is not scheduled for complete repainting or refinishing.
3. Painting of ferrous metal and galvanized metal.
4. Painting of wood with fire retardant paint exposed in attics, when used as mechanical equipment space (except shingles).
5. Identity painting and safety painting.

B. Building and Structural Work not Painted:
1. Prefinished items:
a. Casework, doors, elevator entrances and cabs, metal panels, wall covering, and similar items specified factory finished under other sections.
b. Factory finished equipment and pre-engineered metal building components such as metal roof and wall panels.
2. Finished surfaces:
a. Hardware except ferrous metal.
b. Anodized aluminum, stainless steel, chromium plating, copper, and brass, except as otherwise specified.
c. Signs, fixtures, and other similar items integrally finished.
3. Concealed surfaces:
a. Inside dumbwaiter, elevator and duct shafts, interstitial spaces, pipe basements, crawl spaces, pipe tunnels, above ceilings, attics, except as otherwise specified.
b. Inside walls or other spaces behind access doors or panels.
c. Surfaces concealed behind permanently installed casework and equipment.

4. Moving and operating parts:
   a. Shafts, chains, gears, mechanical and electrical operators, linkages, and sprinkler heads, and sensing devices.
   b. Tracks for overhead or coiling doors, shutters, and grilles.
5. Labels:
   a. Code required label, such as Underwriters Laboratories Inc., Intertek Testing Service or Factory Mutual Research Corporation.
   b. Identification plates, instruction plates, performance rating, and nomenclature.
6. Galvanized metal:
   a. Exterior chain link fence and gates, corrugated metal areaways, and gratings.
   b. Gas Storage Racks.
   c. Except where specifically specified to be painted.
7. Metal safety treads and nosings.
8. Gaskets.
9. Concrete curbs, gutters, pavements, retaining walls, exterior exposed foundations walls and interior walls in pipe basements.
10. Face brick.
11. Structural steel encased in concrete, masonry, or other enclosure.
12. Structural steel to receive sprayed-on fire proofing.
13. Ceilings, walls, columns in interstitial spaces.
14. Ceilings, walls, and columns in pipe basements.
15. Wood Shingles.

3.13 IDENTITY PAINTING SCHEDULE:

A. Identify designated service in new buildings or projects with extensive remodeling in accordance with ASME A13.1, unless specified otherwise, on exposed piping, piping above removable ceilings, piping in accessible pipe spaces, interstitial spaces, and piping behind access panels. For existing spaces where work is minor match existing.
   1. Legend may be identified using snap-on coil plastic markers or by paint stencil applications.
   2. Apply legends adjacent to changes in direction, on branches, where pipes pass through walls or floors, adjacent to operating accessories such as valves, regulators, strainers and cleanouts a minimum of 12.2 M (40 feet) apart on straight runs of piping. Identification next to plumbing fixtures is not required.
   3. Locate Legends clearly visible from operating position.
   4. Use arrow to indicate direction of flow using black stencil paint.
   5. Identify pipe contents with sufficient additional details such as temperature, pressure, and contents to identify possible hazard. Insert working pressure shown on construction documents where asterisk appears for High, Medium, and Low Pressure designations as follows:
      a. High Pressure - 414 kPa (60 psig) and above.
      b. Medium Pressure - 104 to 413 kPa (15 to 59 psig).
      c. Low Pressure - 103 kPa (14 psig) and below.
      d. Add Fuel oil grade numbers.
   6. Legend name in full or in abbreviated form as follows:

PIPING	COLOR OF EXPOSED PIPING	COLOR OF BACKGROUND	COLOR OF LETTERS	LEGEND ABBREVIATIONS
Blow-off		Green	White	Blow-off
Boiler Feedwater		Green	White	Blr Feed
A/C Condenser Water Supply		Green	White	A/C Cond Wtr Sup
A/C Condenser Water Return		Green	White	A/C Cond Wtr Ret

PIPING	COLOR OF EXPOSED PIPING	COLOR OF BACKGROUND	COLOR OF LETTERS	LEGEND ABBREVIATIONS
Chilled Water Supply		Green	White	Ch. Wtr Sup
Chilled Water Return		Green	White	Ch. Wtr Ret
Shop Compressed Air		Blue	White	Shop Air
Air-Instrument Controls		Green	White	Air-Inst Cont
Drain Line		Green	White	Drain
Emergency Shower		Green	White	Emg Shower
High Pressure Steam		Green	White	H.P. _____*
High Pressure Condensate Return		Green	White	H.P. Ret ____*
Medium Pressure Steam		Green	White	M. P. Stm ____*
Medium Pressure Condensate Return		Green	White	M.P. Ret _____*
Low Pressure Steam		Green	White	L.P. Stm _____*
Low Pressure Condensate Return		Green	White	L.P. Ret _____*
High Temperature Water Supply		Green	White	H. Temp Wtr Sup
High Temperature Water Return		Green	White	H. Temp Wtr Ret
Hot Water Heating Supply		Green	White	H. W. Htg Sup
Hot Water Heating Return		Green	White	H. W. Htg Ret
Gravity Condensate Return		Green	White	Gravity Cond Ret
Pumped Condensate Return		Green	White	Pumped Cond Ret
Vacuum Condensate Return		Green	White	Vac Cond Ret
(Diesel Fuel included under Fuel Oil)				
Boiler Water Sampling		Green	White	Sample
Chemical Feed		Green	White	Chem Feed
Continuous Blow-Down		Green	White	Cont. B D
Pumped Condensate		Green	White	Pump Cond
Pump Recirculating		Green	White	Pump-Recirc.
Vent Line		Green	White	Vent
Alkali		Orange	Black	Alk
Bleach		Orange	Black	Bleach
Detergent		Yellow	Black	Det
Liquid Supply		Yellow	Black	Liq Sup
Reuse Water		Yellow	Black	Reuse Wtr
Cold Water (Domestic)	White	Green	White	C.W. Dom
Hot Water (Domestic)				
Supply	White	Yellow	Black	H.W. Dom

PIPING	COLOR OF EXPOSED PIPING	COLOR OF BACKGROUND	COLOR OF LETTERS	LEGEND ABBREVIATIONS
Return	White	Yellow	Black	H.W. Dom Ret
Tempered Water	White	Yellow	Black	Temp. Wtr
Ice Water				
Supply	White	Green	White	Ice Wtr
Return	White	Green	White	Ice Wtr Ret
Reagent Grade Water	Green	White	RG	
Reverse Osmosis	Green	White	RO	
Sanitary Waste		Green	White	San Waste
Sanitary Vent		Green	White	San Vent
Storm Drainage		Green	White	St Drain
Pump Drainage		Green	White	Pump Disch
Chemical Resistant Pipe				
Waste		Orange	Black	Acid Waste
Vent		Orange	Black	Acid Vent
Atmospheric Vent		Green	White	ATV
Silver Recovery		Green	White	Silver Rec
Oral Evacuation		Green	White	Oral Evac
Fuel Gas		Yellow	Black	Gas
Fire Protection Water				
Sprinkler	Red	Red	White	Auto Spr
Standpipe	Red	Red	White	Stand
Sprinkler	Red	Red	White	Drain

7. Electrical Conduits containing feeders over 600 volts, paint legends using 50 mm (2 inch) high black numbers and letters, showing the voltage class rating. Provide legends where conduits pass through walls and floors and at maximum 6096 mm (20 foot) intervals in between. Use labels with yellow background with black border and words Danger High Voltage Class, 5000, 15000,25000.
8. See Sections for methods of identification, legends, and abbreviations of the following:
   a. Conduits containing high voltage feeders over 600 volts: Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS / Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS / Section 28 05 28.33, CONDUITS AND BACKBOXES FOR ELECTRONIC SAFETY AND SECURITY.

B. Fire and Smoke Partitions:
1. Identify partitions above ceilings on both sides of partitions except within shafts in letters not less than 64 mm (2 1/2 inches) high.
2. Stenciled message: "SMOKE BARRIER" or, "FIRE BARRIER" as applicable.
3. Locate not more than 6096 mm (20 feet) on center on corridor sides of partitions, and with a least one (1) message per room on room side of partition.
4. Use semi-gloss paint of color that contrasts with color of substrate.

C. Identify columns in pipe basements and interstitial space:
1. Apply stenciled number and letters to correspond with grid numbering and lettering indicated on construction documents.

2. Paint numbers and letters 101 mm (4 inches) high, locate 45 mm (18 inches) below overhead structural slab.
3. Apply on four (4) sides of interior columns and on inside face only of exterior wall columns.
4. Color:
   a. Use black on concrete columns.
   b. Use white or contrasting color on steel columns.

3.14 PROTECTION CLEAN UP, AND TOUCH-UP:

A. Protect work from paint droppings and spattering by use of masking, drop cloths, removal of items or by other approved methods.

B. Upon completion, clean paint from hardware, glass and other surfaces and items not required to be painted of paint drops or smears.

C. Before final inspection, touch-up or refinished in a manner to produce solid even color and finish texture, free from defects in work which was damaged or discolored.

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Section 09 96 00

STATIC DISSIPATIVE SEALER FOR CONCRETE SUBSTRATES

PART ONE: GENERAL

1.1 SECTIONS

A. Static Dissipative floor coating system for interior concrete slabs.

1.2 RELATED SECTIONS

A. Section 03300 - Cast in place concrete.

1.3 REFERENCES

A. ANSI/ESD STM7.1-2020 - Flooring Systems Resistive Characterization.
B. ANSI/ESD S20.20-2021, ESD Control Program.
C. ANSI/ESD STM97.1, Flooring Footwear System
D. ESD TR53, Flooring Section
E. ASTM D-4623 - Concrete vapor emission test method.
F. ASTM D-968-17, abrasion resistance.

1.4 SUBMITTALS

A. Comply with Section 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES Submittal Procedures
B. Product Data: Submit manufacturer's product data including physical properties, electrical properties and application instructions.
C. Installer Qualifications: Submit letter stating installer's experience.

1.5 QUALITY ASSURANCE

A. Applicators Qualifications: Ensure applicators qualifications by one of the following:
1) Use applicator experienced in application of similar materials for a minimum of 5 years on projects of similar size and complexity. Submit list of completed projects including project name and location, name of Architect, name of material manufacturer and approximate quantity of materials applied.
2) Submit letter of approval from manufacturer stating applicator is qualified to apply the specified materials.
B: Applicators Personnel: Employ persons trained for application of specific materials.

C. Pre-application Meeting: Convene a pre-application meeting 6 weeks before start of application of static control flooring system. Require attendance of parties directly affecting work in this section, including Contractor, Architect and applicator. Review surface preparation, application,

application timeframe, curing, protection and coordination with other work. Contact manufacturer with questions pertaining to application and usage of these products.

1.16 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging with labels clearly identifying product name, manufacturer, batch or dye lot numbers and SDS sheets.
B. Storage: Store materials in accordance with manufacturer's instructions. Keep containers sealed until ready for use.
C. Handling: Protect materials during handling and application to prevent damage or contamination.

1.17 ENVIRONMENTAL CONDITIONS
A. Ensure environment is fully enclosed; weather tight, well lighted and air temperatures at time of installation are between 60 and 80 degrees F.

PART TWO: PRODUCTS

2.1 MANUFACTURER
A. Basis of Design: United SCP Incorporated, 2124 South Prairie Ave, Complex D, Pueblo, CO 81005. Phone (719) 676-3928 (option 3 for tech support during normal business hours, option 8 for afterhours tech support).

2.2 HEAVY DUTY STATIC CONTROL CONCRETE SEALER WITH ESD FLOOR FINISH
A. ElectraSeal hygroscopic static control concrete sealer followed by one coat of ElectraGlaze.
1) Enhanced urethane topical concrete sealer followed by ESD floor finish.
2) Available colors: Translucent

PART THREE: EXECUTION

3.1 EXAMINATION

A. Examine substrate to receive static control coating system. Notify Architect if substrate is unacceptable. Do not begin preparation or application until conditions are acceptable.
B. Pre-application Product Testing: Mask off a 36" x 36" test area. Apply three thin coats of ElectraSeal. Optional: Follow with one thin coat of ElectraGlaze Allow the coating (s) to cure for at least 24 hours. Pre-test material bond strength to substrate per ElectraSeal product instructions. Test Electrical conductivity to ANSI/ESD STM7.1-2020 - Point to Point Electrical Resistance, flooring. Contact manufacturer should results exceed >1.0E09 Ohms.

C. Moisture Testing of Concrete Slab: Prior to installation, test the concrete slab in accordance with ASTM D4263. This test involves taping an 18” x 18” polyethylene sheet to the concrete subfloor

and then waiting at least 16 hours prior to collecting the results. Visible condensation on the bottom of the sheet or darkening of the concrete indicates excessive moisture. Test the concrete's pH level in this area. The pH levels shall be between 7 and 10. Should testing indicate excessive vapor emissions or inappropriate pH levels contact United Static Control Products prior to proceeding with the application.

D. Ensure new concrete has the following properties:

1) Maximum water/cement ratio of 0.45
2) Cured 60 days at a minimum of 60 degrees F.
3) Minimum compressive strength of 3,500 PSI.
4) Minimum tensile strength of 200 PSI.

3.2 SURFACE PREPARATION

A. Prepare substrates in accordance with manufacturer's instructions.
B. Ensure substrate is clean, free of dirt, oil, grease, wax and other compounds which may inhibit bonding of ElectraSeal to substrate.
C. Repair cracked and eroded concrete in accordance with manufacturer's instructions. Remove and repair unsound substrates.

3.3 APPLICATION

A. Mask all encumbrances such as existing wall base and columns prior to application of coatings in accordance with manufacturer's instructions.
B. Install electrical grounding foil in accordance with manufacturer's recommended grounding methods as is shown here. Use two ground connections for smalls areas (<3,000 square feet) and one additional ground connection for every 3,000 square feet thereafter.
C. Ensure that concrete or other substrate is visibly dry.
D. ElectraSeal is designed for use as supplied. Do not add thinners to any component of this conductive floor coating system.
E. Apply 1st coat of ElectraSeal to prepared concrete per manufacturers recommended guidelines. Do not over apply - apply a thin even coat. Allow to cure for at least 2 hours prior to proceeding.

NOTE: When applied in environments with an ambient humidity in excess or 80% rH, increase the drying time between coats to at least 4 hours while maintaining the suggested ambient application temperature of 60 degrees F.

F. Apply 2nd coat of ElectraSeal per manufacturers recommended guidelines. Do not over apply - apply a thin even coat. Allow to cure at least 2 to 4 hours prior to proceeding.
F: Apply 3rd coat of ElectraSeal per manufacturers recommended guidelines. Do not over apply - apply a thin even coat. Allow to cure at least 4 hours prior to proceeding.
G. OPTIONAL: Apply one thin coat of ElectraGlaze per manufacturer's instructions. Allow coatings 1 hour to dry before subjecting to foot traffic and 24 hours prior to subjecting to moderate forklift traffic.

3.4 TESTING

A. Test the flooring for compliance to ANSI/ESD S20.20-2021 per test method ANSI/ESD STM7.1-2020, Flooring Systems Resistive Characterization, section 6.2 Product Acceptance of Installed or Applied Flooring Systems (electrical resistance point to point and electrical resistance to ground).
B. Optional: Compliance Verification per ESD TR53, Page 6, Table 2 Personnel Grounding Requirement per TR53 Footwear Section.

3.5 PROTECTION

A. The ElectraSeal system gains hardness and conductivity during a curing phase lasting 48 hours. Protect floor coating system while curing and especially during move in of heavy equipment.

3.6 SPECIFICATIONS

Nonvolatile Solids	25% +/- 0.6%
VOC Content	Meets CDHP V1.2 See Test Results
Total Active	30.1% +/- 1.6%
Typical resistivity as applied to in place concrete slabs per ANSI/ESD STM7.1-2020, Section 6.2 Product Acceptance of Installed or Applied Flooring Systems.	>1.0E04 and < 1.0E09 Ohms @ 40% relative humidity
ANSI/ESD S20.20-2021, Table 2, Page 6, ANSI/STM 97.1 and ANSI/STM 97.2, Product Qualification	PASSES
Static Dissipation	< 0.3 Second
pH	8.4 - 9.0
Gloss 60	85+ @ 3 coats
Color	Translucent
Weight Per Gallon	8.55 - 8.8
Slip Resistance (ASTM)	0.65 Minimum (excellent)
Stability	2 year minimum at room temperature and in unopened containers
Freeze/Thaw Stability	3 cycles minimum
Drying Time Between Coats	1 Hour
Water Resistance	Good
Gallon Coverage (Feet 2)	1500 - 2000 per gallon per coat
Abrasion Resistance, ASTM D968-17	6,480 grams

END OF SECTION

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SECTION 10 11 13

CHALKBOARDS AND MARKERBOARDS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies chalkboards, markerboards, and presentation boards.

1.2 RELATED WORK

A. Sustainable Design Requirements: Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

B. Manufacturer, Color, and Style of Chalkboards, Markerboards and Presentation Boards: SCHEDULE FOR FINISHES.

1.3 QUALITY ASSURANCE

A. Provide boards that are the products of a single manufacturer, who has provided units as specified for a minimum of three (3) years.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

B. Sustainable Design Submittals, as described below:
   1. Volatile organic compounds per volume as specified in PART 2 - PRODUCTS.

C. Shop Drawings: Identifying all parts by name and material and showing design, construction, installation, anchorage and relation to adjacent construction.

D. Manufacturer's Literature and Data:
   1. Chalkboard.
   2. Markerboard.
   3. Presentation Board.

E. Samples:
   1. Chalkboard and markerboard writing surface, 152 x 152 mm (6 x 6 inches), each color, and texture mounted on backing.
   2. Frame material, 305 mm (6 inch) length.

F. Manufacturer’s qualifications.

1.5 WARRANTY

A. Construction Warranty: Comply with FAR clause 52.246-21, “Warranty of Construction”.

1.6 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Architectural Manufacturers Association (AAMA):
   611-14 ..... Voluntary Specification for Anodized Architectural Aluminum

   2603-20 ..... Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coiling Coating Appendix)

C. American National Standards (ANSI):
   Z97.1-2015 ..... Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test

D. ASTM International (ASTM):
B221-14.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

B221M-13.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)

C1048-18.....Heat-Strengthened and Fully Tempered Flat Glass

E. Code of Federal Regulation (CFR):
40 CFR 59(2016) Subpart D . National Volatile Organic Compound Emission Standards for Architectural Coatings

F. Composite Panel Association (CPA):
A208.1-2016.....Particleboard

A135.4-12(R2020).....Basic Hardboard

G. National Association of Architectural Metal Manufacturers (NAAMM):
AMP 500-06 .....Metal Finishes Manual

H. Porcelain Enamel Institute (PEI)
1001 .....Manual of Architectural Porcelain Enamel

PART 2 - PRODUCTS

2.1 MARKERBOARD

A. Provide markerboard with porcelain enamel writing surface and chalktray.

B. Provide factory assembled unit complete in one (1) piece, without joints whenever possible. When markerboard dimensions require delivery in separate sections, prefit components at factory, disassembled for delivery and fit joints at site.

C. Frame: Aluminum.

D. Marker Tray: Same material as frameand extend full length of markerboard.

E. Map Rail: Not required.

F. Provide surface such that dry erase markings are removable with felt eraser or dry cloth without ghosting.

G. Provide face fabricated from ferromagnetic material.

2.2 ACCESSORIES:

A. Provide each markerboardwith an eraser and four (4) different color compatible dry erase markers.

2.3 MATERIALS

A. Writing Surface:
1. Provide markerboard writing surface composed of porcelain enamel fused to nominal 0.378 mm (28 gauge) thick steel. Laminate to a minimum 6 mm (1/4 inch) thick core material with a steel or foil backing sheet.

B. Aluminum:
1. Aluminum frame extrusions to be alloy 6063-T5 or 6063-T6, conform to ASTM B221M (B221). Minimum 1.5 mm (0.06 inches) thick.
2. Provide straight, single lengths wherever possible.
3. Miter corners to have hairline closure.

C. Hardwood Finish:
1. Provide hardwood with a durable factory-applied transparent finish.

D. Glass:
   1. Provide tempered glass in accordance with ANSI Z97.1 and conform to ASTM C1048, Kind FT (fully tempered), Condition A (uncoated), Type I, Class I (clear).

E. Adhesives:
   1. Adhesives for Field Application: Mildew-resistant, nonstaining adhesive for use with specific type of panels, sheets, or assemblies; and for substrate application; as recommended in writing by visual display unit manufacturer.
   2. Adhesives to have VOC content of 50 g/L or less when calculated according to 40 CFR 59, (EPA Method 24).

2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's AMP 500 Series for Architectural and Metal Products for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved samples and are assembled or installed to minimize contrast.

2.5 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm (.39 mil) or thicker.

B. Baked-Enamel or Powder-Coat Finish: AAMA 2603, except with a minimum dry film thickness of 0.04 mm (1.5 mil).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install units in accordance with the manufacturer's installation instructions with concealed fasteners.

B. Verify partitions have received blocking and reinforcement before installation of markerboards

C. Assemble units in accordance with manufacturer's written instructions.

D. Grounds Designed to Receive Clips for Snap-On Trim: Continuous and secured 305 mm (12 inches) on center.

E. Miter trim at corners, conceal fasteners. Modify trim as required to conform to surrounding construction details.

3.2 CLEANING

A. Clean in accordance with manufacturers' written instructions.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

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SECTION 10 14 00

SIGNAGE

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies interior signage for room numbers, directional signs exterior signage, code required signs and temporary signs.

B. This section specifies exterior signage.

1.2 RELATED WORK

A. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS: Sustainable Design Requirements.

B. Division 26, ELECTRICAL Lighted EXIT signs for egress purposes are specified under and Electrical Work.

C. Structural Steel Supports: Section 05 12 00, STRUCTURAL STEEL FRAMING.

1.3 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Provide signage that is the product of one manufacturer, who has provided signage as specified for a minimum of three (3) years. Submit manufacturer’s qualifications.

B. Installer’s Qualifications: Minimum three (3) years’ experience in the installation of signage of the type as specified in this Section. Submit installer’s qualifications.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

B. Sustainable Design Submittals, as described below:
   1. Volatile organic compounds per volume as specified in PART 2 - PRODUCTS.

C. Interior Sign Samples: Sign panels and frames, with letters and symbols, for each sign type.
   1. Sign Panel, 203 x 254 mm (8 x 10 inches), with letters.
   2. Color samples of each color, 152 x 152 mm (6 x 6 inches. Show anticipated range of color and texture.
   3. Sample of typeface, arrow and symbols in a typical full size layout.

D. Exterior Sign Samples: 152 x 152 mm (6 x 6 inches) samples of each color and material.

E. Manufacturer's Literature:
   1. Showing the methods and procedures proposed for the anchorage of the signage system to each surface type.
   2. Manufacturer’s printed specifications and maintenance instructions.

F. Sign Location Plan, showing location, type and total number of signs required.

G. Shop Drawings: Scaled for manufacture and fabrication of sign types. Identify materials, show joints, welds, anchorage, accessory items, mounting and finishes.

H. Full size layout patterns for dimensional letters.

I. Manufacturer’s qualifications.

J. Installer’s qualifications.

1.5 DELIVERY AND STORAGE

A. Deliver materials to job in manufacturer's original sealed containers with brand name marked thereon. Protect materials from damage.

B. Package to prevent damage or deterioration during shipment, handling, storage and installation. Maintain protective covering in place and in good repair until removal is necessary.

C. Deliver signs only when the site and mounting services are ready for installation work to proceed.

D. Store products in dry condition inside enclosed facilities.

1.6 WARRANTY

A. Construction Warranty: Comply with FAR clause 52.246-21, “Warranty of Construction”.

1.7 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Architectural Manufacturers Association (AAMA):
611-14 ..... Anodized Architectural Aluminum

2603-13 ..... Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels

C. American National Standards Institute (ANSI):
A117.1-09..... Accessible and Usable Buildings and Facilities

D. ASTM International (ASTM):
A36/A36M-19 ..... Carbon Structural Steel

A240/A240M-20 ..... Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

A666-15..... Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar

A1011/A1011M-18a ..... Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength

B36/B36M-18 ..... Brass Plate, Sheet, Strip, and Rolled Bar

B152/B152M-19 ..... Copper Sheet, Strip, Plate, and Rolled Bar

B209-14..... Aluminum and Aluminum-Alloy Sheet and Plate

B209M-14..... Aluminum and Aluminum-Alloy Sheet and Plate (Metric)

B221-14..... Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

B221M-13..... Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes (Metric)

C1036-16..... Flat Glass

C1048-18..... Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass

C1349-17..... Architectural Flat Glass Clad Polycarbonate

D1003-13..... Test Method for Haze and Luminous Transmittance of Transparent Plastics

D4802-16.....Poly(Methyl Methacrylate) Acrylic Plastic Sheet

E. Code of Federal Regulation (CFR):
40 CFR 59 .....Determination of Volatile Matter Content, Water Content, Density Volume Solids, and Weight Solids of Surface Coating

F. Federal Specifications (Fed Spec):
MIL-PRF-8184F.....Plastic Sheet, Acrylic, Modified.

MIL-P-46144C .....Plastic Sheet, Polycarbonate

G. National Fire Protection Association (NFPA):
70-20 .....National Electrical Code

PART 2 - PRODUCTS

2.1 SIGNAGE GENERAL

A. Provide signs of type, size and design shown on the construction documents.

B. Provide signs complete with lettering, framing and related components for a complete installation.

C. Provide graphics items as completed units produced by a single manufacturer, including necessary mounting accessories, fittings and fastenings.

D. Do not scale construction documents for dimensions. Verify dimensions and coordinate with field conditions. Notify Contracting Officer Representative (COR) of discrepancies or changes needed to satisfy the requirements of the construction documents.

2.2 INTERIOR SIGN MATERIALS

A. Aluminum:
1. Sheet and Plate: ASTM B209M (B209).
2. Extrusions and Tubing: ASTM B221M (B221).

B. Cast Acrylic Sheet: MIL-PRF-8184F; Type II, class 1, Water white non-glare optically clear. Matt finish water white clear acrylic shall not be acceptable.

C. Polycarbonate: MIL-P-46144C; Type I, class 1.

D. Vinyl: Premium grade 0.1 mm (0.004 inch) thick machine cut, having a pressure sensitive adhesive and integral colors.

E. Adhesives:
1. Adhesives for Field Application: Mildew-resistant, nonstaining adhesive for use with specific type of panels, sheets, or assemblies; and for substrate application; as recommended in writing by signage manufacturer.
2. Adhesives to have VOC content of g/L or less when calculated according to 40 CFR 59, (EPA Method 24).

F. Typography: Comply with VA Signage Design Manual.
1. Type Style: Helvetica Medium and Helvetica Medium Condensed. Initial caps or all caps, as indicated in Sign Message Schedule
2. Arrow: Comply with graphic standards in construction documents.
3. Letter spacing: Comply with graphic standards in construction documents.
4. Letter spacing: Comply with graphic standards in construction documents.
5. Provide text, arrows, and symbols in size, colors, typefaces and letter spacing shown in construction documents. Text shall be a true, clean, accurate reproduction of typeface(s). Text shown in construction documents is for layout purposes only; final text for signs is listed in Sign Message Schedule

2.3 INTERIOR SIGN TYPES

A. Conform to the VA Signage Design Manual.

B. Provide frame insert and frame component system.

C. Component System Signs:
   1. Provide interior sign system as follows:
      a. Interchangeable system that allows for changes of graphic components of the installed sign, without changing sign in its entirety.
         1) Provide sign system comprised of following primary components: Rail Back: Horizontal rails, spaced to allow for uniform, modular sizing of sign types.
         2) Rail Insert: Mount to back of Copy Panels to allow for attachment to Rail Back.
         3) Copy Panels: Fabricate of acrylic materials to allow for different graphic needs.
         4) End Caps: Interlock to Rail Back to enclose and secure changeable Copy Panels.
         5) Joiners and Accent Joiners: To connect separate Rail Backs together.
         6) Top Accent Bars: To provide decorative trim cap that encloses the top of sign.
      b. Provide rail back, rail insert and end caps in anodized extruded aluminum.
      c. Provide signs in system that are convertible in the field to allow for enlargement from one (1) size to another in height and width through use of joiners or accent joiners, which connect rail back panels together blindly, providing a butt joint between copy panels. Connect accent joiners to rail backs with a visible 3 mm (1/8") horizontal rib, flush to the adjacent copy insert surfaces.
      d. Provide sign configurations as indicated on construction documents that vary in width from 228 mm (9 inches) to 2032 mm (80 inches), and have height dimensions of 50 mm (2 inches), 76 mm (3 inches), 152 mm (6 inches), 228 mm (9 inches) and 305 mm (12 inches). Height that can be increased beyond 305 mm (12 inches), by repeating height module in full or in part.
   2. Provide rail back functions as internal structural member of sign. Fabricate of 6063T5-extruded aluminum, anodized black.
      a. Fabricate to accept an extruded aluminum or plastic insert on either side, depending upon sign type.
      b. Provide components that are convertible in field to allow for connection to other rail back panels.
      c. Provide mounting devices including wall mounting for screw-on applications, wall mounting with pressure sensitive tape, freestanding mount, ceiling mount and other mounting devices as needed.
   3. Provide rail insert functions as mounting device for copy panels on to the rail back. The rail insert mounts to the back of the copy panel with adhesive suitable for attaching particular copy insert material.
      a. Provide copy panels that slide or snap into the horizontal rail back.
   4. Provide copy panels that accept various forms of copy and graphics, and attach to the rail back with the rail insert. Provide copy panels fabricated of ABS plastic with integral color or an acrylic lacquer finish ,photopolymer ,acrylic.
      a. Provide copy panels that are interchangeable by sliding horizontally from either side of sign, and to other signs in system of equal or greater width or height.
      b. Provide materials that are cleanable without use of special chemicals or cleaning solutions.
      c. Copy Panel Materials.
         1) ABS Inserts: 2.3 mm (.090 inches) extruded ABS plastic core with .07 mm (.003 inches) acrylic cap bonded during extrusion/texturing process.
            a) Pressure bonded to extruded rail insert with adhesive.
            b) Background Color: Integral or painted in acrylic lacquer.

c) Finished: Texture pattern.

2) Photopolymer Inserts: 3.2 mm (.125 inches) phenolic photo polymer with raised copy etched to 2.3 mm (.0937 inches), bonded to an ABS plastic or extruded aluminum insert with adhesive.

a) Background Color: Painted, acrylic enamel.

3) Changeable Paper/ Insert Holder: Extruded insert holder with integral rail insert for connection with structural back panel in 6063T5 aluminum with a black anodized finish.

a) Inserts into holder are paper with a clear 0.76 mm (.030 inches) textured cover.

b) Background Color: Painted, acrylic lacquer.

5. Acrylic - 2 mm (.080 inches) non-glare acrylic.

a) Pressure bonded to extruded rail insert using adhesive.

b) Background Color: Painted in acrylic lacquer or acrylic enamel.

6. Extruded 6063T5 aluminum with a black anodized finish insert holder with integral rail insert for connection with structural back panel to hold 0.76 mm (.030 inches) textured polycarbonate insert and a sliding tile which mounts in the inset holder and slides horizontally.

7. End Caps: Extruded using 6063T5 aluminum with a black anodized finish. End caps interlock with rail back with clips to form an integral unit, enclosing and securing the changeable copy panels, without requiring tools for assembly.

a. Interchangeable to each end of sign and to other signs in signage system of equal height.

b. Provide mechanical fasteners that can be added to the end caps that will secure it to rail back to make sign tamper resistant.

8. Joiners: Extruded using 6063T5 aluminum with a black anodized finish. Rail joiners connect rail backs together blindly, providing a butt joint between copy inserts.

9. Accent Joiners: Extruded using 6063T5 aluminum with a mirror polished finish. Connect joiner and rail backs together with a visible 3 mm (.125 inches) horizontal rib, flush to the adjacent copy panel surfaces.

10. Top Accent Rail: Extruded rail using 6063T5 aluminum with a mirror polished finish that provides a 3.2 mm (.125 inches) high decorative trim cap. Cap butts flush to adjacent copy panel and encloses top of rail back and copy panel.

11. Typography:

a. Vinyl First Surface Copy (non-tactile): Applied vinyl copy.

b. Subsurface Copy Inserts: Textured 1 mm (.030 inches) clear polycarbonate face with subsurface applied vinyl copy.

1) Spray face back with paint and laminated to extruded aluminum carrier insert.

c. Integral Tactile Copy Inserts: Phenolic photopolymer etched with 2.3 mm (.0937 inches) raised copy.

d. Silk-screened First Surface Copy (non-tactile): Injection molded or extruded ABS plastic insert with first surface applied enamel silk-screened copy.

D. Tactile Sign:

1. Tactile sign made from a material that provides for letters, numbers and Braille to be integral with sign. Photopolymer etched metal, sandblasted phenolic or embossed material. Do not apply letters, numbers and Braille with adhesive.

2. Numbers, letters and Braille to be raised 0.8 mm (1/32 inches) from the background surface. The draft of the letters, numbers and Braille to be tapered, vertical and clean.

3. Braille Dots: Conform with ANSI A117.1 for Braille position and layout; (a) Dot base diameter: 1.5 mm (.059 inches) (b) Inter-dot spacing: 2.3 mm (.090 inches) (c) Horizontal separation between cells: 6.0 mm (.241 inches) (d) Vertical separation between cells: 10.0 mm (.395 inches)

4. Paint assembly specified color. After painting, apply white or other specified color to surface of the numbers and letters. Apply protective clear coat sealant to entire sign.

5. Finish: Eggshell, 11 to 19 degree on a 60 degree glossmeter.

E. Provide cork or felt on bottom or mounting bracket when sign is mounted on counter or desk.

F. For ceiling mounted signs, provide mounting hardware on the sign that allows for sign disconnection, removal, reinstallation, and reconnection.

G. Glass Door and Side Light Graphics:
1. Provide text and graphics as first surface applied stylus cut vinyl.
2. Provide typeface, color, and spacing, with each message or message group on a single quick release backing sheet.

H. Specialty Signs:
1. Small Freestanding Stanchion Sign: 57 mm (2.25 inches) polished aluminum tube mounted to weighted 356 mm (14 inches) diameter polished aluminum base. Sign bracket to hold a 6 mm (.25 inches)copy panel.
2. Freestanding Informational Sign: 57 mm (2.25 inches) polished aluminum tube vertical support mounted to a weighted 356 mm (14 inches) diameter 57 mm (2.25 inches) polished aluminum base. Provide rail back mechanically connected to vertical supports with copy panel attached to front and back.
3. Freestanding Informational Signs for Changeable Messages: 57 mm (2.25 inches) polished aluminum tube vertical support mounted to a weighted 365 mm (14 inches) 57 mm (2.25 inches) polished aluminum base. Provide rail back mechanically connected to vertical supports with hinged locking glass door. Provide interior surface with grooved felt covered changeable letter board or vinyl impregnated tackboard.
4. Card or Paper Holder: Extruded aluminum clip anodized black containing rollers to pinch and release paper.
   a. End caps are black plastic.

I. Temporary Interior Signs:
1. Fabricated from 50 kg (110 pound) matte finished white paper cut to 101 mm (4 inch) wide by 305 mm (12 inch) long.
   a. Punched 3.2 mm (.125 inch) hole with edge of hole spaced 13 mm (.5 inch) in from edge and centered on 101 mm (4 inch) side.
   b. Reinforce hole on both sides with suitable material that prevents tie from pulling through hole.
   c. Ties: Steel wire 0.3 mm (0.120 inch) thick attached to tag with twist leaving 152 mm (6 inch) long free ends.
2. Mark architectural room number on sign, with broad felt marker in clearly legible numbers or letters that identify room, corridor or space as shown on construction documents.
3. Install temporary signs to rooms that have a room, corridor or space number. Attach to door frame, door knob or door pull.
   a. Doors that do not require signs are: corridor doors in corridor with same number, folding doors or partitions, toilet doors, bathroom doors within and between rooms, closet doors within rooms, communicating doors in partitions between rooms with corridor entrance doors.
   b. Replace and missing, damaged or illegible signs.

2.4 FABRICATION

A. Design interior signage components to allow for expansion and contraction for a minimum material temperature range of 38 degrees C (100 degrees F), without causing buckling, excessive opening of joints or over stressing of adhesives, welds and fasteners.

B. Form work to required shapes and sizes, with true curve lines and angles. Provide necessary rebates, lugs and brackets for assembly of units. Provide concealed fasteners wherever possible.

C. Shop fabricate so far as practicable. Fasten joints flush to conceal reinforcement, or weld joints, where thickness or section permits.

D. Level and assemble contract surfaces of connected members so joints will be tight and practically unnoticeable, without applying filling compound.

E. Signs: Fabricate with fine, even texture to be flat and sound.
   1. Maintain lines and miters sharp, arises unbroken, profiles accurate and ornament true to pattern.
   2. Plane surfaces to be smooth, flat and without oil-canning, free of rack and twist.
   3. Maximum variation from plane of surface plus or minus 0.3 mm (0.015 inches). Restore texture to filed or cut areas.

F. Finish extruded members to be free from extrusion marks. Fabricate square turns, sharp corners, and true curves.

G. Finish hollow signs with matching material on all faces, tops, bottoms and ends. Miter edge joints to give appearance of solid material.

H. Do not manufacture signs until final sign message schedule and location review has been completed by the COR and forwarded to contractor.

I. Drill holes for bolts and screws. Mill smooth exposed ends and edges with corners slightly rounded.

J. Form joints exposed to weather to exclude water.

K. Movable Parts, Including Hardware: Cleaned and adjusted to operate as designed without binding or deformation of members. Center doors and covers in opening or frame.
   1. Align contact surfaces fit tight and even without forcing or warping components.

L. Pre-assemble items in shop to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for re-assembly and coordinated installation.

M. Prime painted surfaces as required. Apply finish coating of paint for complete coverage with no light or thin applications allowing substrate or primer to show.
   1. Finish surface smooth, free of scratches, gouges, drips, bubbles, thickness variations, foreign matter and other imperfections.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Locate signs as shown on the construction documents .

B. Conform to the VA Signage Design Guide for installation requirements.

C. At each sign location there are no utility lines behind each sign location that will be affected by installation of signs.
   1. Correct and repair damage done to utilities during installation of signs at no additional cost to Government.

D. Provide inserts and anchoring devices which must be set in concrete or other material for installation of signs. Submit setting drawings, templates, instructions and directions for installation of anchorage devices, which may involve other trades.

E. Refer to Sign Message Schedule for mounting method. Mount signs in proper alignment, level and plumb according to the Sign Location Plan and the dimensions given on elevation and Sign Location Plans. When exact position, angle, height or location is not clear, contact COR for resolution.

F. When signs are installed on glass, provide blank glass back up to be placed on opposite side of glass exactly behind sign being installed. Provide blank glass back that is the same size as sign being installed.

G. Touch up exposed fasteners and connecting hardware to match color and finish of surrounding surface.

H. At completion of sign installation, clean exposed sign surfaces. Clean and repair adjoining or adjacent surfaces that became soiled or damaged as a result of installation of signs.

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SECTION 10 21 23

CUBICLE CURTAIN TRACKS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies cubicle curtain track (C.C.T.), shower curtain tracks.

1.2 RELATED WORK

A. Section 05 50 00, METAL FABRICATIONS: Steel shapes for suspending track assembly: Section 05 50 00, METAL FABRICATIONS.

B. Section 09 51 00, ACOUSTICAL CEILINGS: Acoustical ceiling tile and suspension systems Section 09 51 00, ACOUSTICAL CEILINGS.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Samples:
1. 305 mm (12 inch) long piece of cubicle curtain track with carrier access and end stop.
2. Clip anchor for fastening track to grid system of acoustical ceilings.
3. Curtain carrier for attaching curtain to track.

C. Shop Drawings: Showing layout of tracks and method of anchorage.

D. Manufacturer's Literature and Data:
1. Cubicle curtain track.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver material in original package marked to identify the contents, brand name, and the name of the manufacturer or supplier.

B. Store in dry and protected location. Store so as to not bend or warp the tracks.

C. Do not open packages until contents are needed for installation, unless verification inspection is required.

1.5 WARRANTY

A. Construction Warranty: Cubicle curtain tracks are subject to the terms of the Article “Warranty of Construction,” FAR clause 52.246-21.

1.6 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. ASTM International (ASTM):

B221-14 ..... Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

B221M-13 ..... Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)

B456-17 ..... Electrodeposited Coatings for Copper Plus Nickel Plus Chromium and Nickel Plus Chromium

C. Aluminum Association (AA):

DAF 45-09 ..... Designation System for Aluminum Finishes

D. American Architectural Manufacturers Association (AAMA):
2603-20 ..... Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix)

E. The National Association of Architectural Metal Manufacturers (NAAMM):
AMP 500-06 Series ..... Metal Finishes Manual

PART 2 - PRODUCTS

2.1 CUBICLE CURTAIN TRACKS

A. Channel Tracks (Surface Mounted Type): Extruded aluminum, ASTM B221M (B221), alloy 6063, temper T5 or T6, channel shaped, with smooth inside raceway for curtain carriers.

B. Surface mounted hookless curtain track.

C. Curtain Carriers: Nylon carriers, with nylon wheels on metal or nylon axles.
1. Equip each carrier with either stainless steel, chromium plated brass or steel hooks with swivel, or nickel chromium plated brass or stainless steel bead chain
2. Hook for bead chain may be the same material and finish as the bead chain or may be chromium plated steel.
3. Provide 2.2 carriers for every 305 mm (1 foot) of each section of each track length, plus one (1) additional carrier.

D. End Stop Connectors, Ceiling Flanges and Other Accessories: Fabricate from the same material with the same finish as the tracks or from nylon.

E. Hangers and Fittings: Fabricate from the same material with the same finish as the tracks. Hangers may be round or square for channel tracks and round for tubular tracks. Design fittings to be compatible with design of tracks and to safely transmit the track load to the hangers.

F. At end of each section of track, make provision for insertion and removal of carriers. Design to prevent accidental removal of carrier. Provide operating mechanism shall be removable with common tools.

2.2 SHOWER CURTAIN TRACK

A. Provide water/corrosion resistant aluminum surface mounted track system and glider hooks at 10 per meter (3.28 feet).

2.3 FASTENERS

A. Exposed Fasteners, Screws and Bolts: Stainless steel or chromium/nickel plated brass.

B. Concealed Fasteners, Screws and Bolts: Stainless steel.

C. Metal Clips: Anchor curtain tracks to exposed grid of lay-in acoustical tile ceilings, with concealed metal (butterfly) type or two piece snap locking type ceiling clip of high strength spring steel.
1. When it is not possible to install the metal ceiling clip, the cubicle curtain track may be screwed to the ceiling grid.

2.4 FINISHES

A. Aluminum: Finish numbers for aluminum specified are in accordance with AA DAF 45. AA-C22A31 finish, chemically etched medium matte with clear anodic coating, Class II Architectural, .01 mm (0.4 mils) thick.

B. Chrome/Nickel Plating: Satin or polished finish, ASTM B546, minimum thickness of chromium plate as follows:
   1. 0.005 mm (0.2 mil) on copper alloys.
   2. 0.01 mm (0.4 mil) on steel.

C. Stainless Steel: No. 4 in accordance with NAAMM AMP 500.

D. Baked Enamel or Powder Coat Finish: AAMA 2603.

2.5 FABRICATION

A. Weld and grind smooth joints of fabricated components.

B. Form tracks and bends of lengths that will produce the minimum number of joints. Make track sections up to 4877 mm (16 feet) without joints. Form corner bend on a 305 mm (12 inch) radius.

C. Provide steel anchor plates, supports, and anchors for securing components to building construction.

D. Form flat surface without distortion.

E. Shop assemble components and package complete with anchors and fittings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install tracks after finish painting and ceiling finishing operations are complete.

B. Install track level and hangers plumb and securely anchor to the ceiling or suspend from above to form a rigid installation.

C. Anchor surface mounted curtain tracks directly to exposed grid of lay-in acoustical tile ceilings with suitable fasteners, spaced approximately 610 mm (24 inches) on center.

D. Anchor surface mounted curtain tracks to concrete, plaster and gypsum board ceilings with a minimum of 3 mm (1/8-inch) diameter fastenings or concealed clips spaced not more than 914 mm (3 feet) on center.

E. Install suspended track 2210 mm (87 inches) above the finished floor, with hangers spaced no more than 1219 mm (4 feet) on center. At ceiling line, provide flange fittings secured to hangers with set screws. Secure track to walls with flanged fittings and to hangers with special fittings.

F. Fasten end stop caps to prevent them from being forced out by the striking weight of carriers.

G. Remove damaged or defective components and replace with new components or repair to the original condition.

H. Install track rigid, plumb, level and true, and securely anchored to the overhead construction.

I. Verify that carrier units operate smoothly and easily over the full range of travel.

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SECTION 10 26 00

WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies wall guards, handrail/wall guard combinations, corner guards and door/door frame protectors and high impact wall covering.

1.2 RELATED WORK

A. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS: Sustainable Design Requirements.

B. Section 05 50 00, METAL FABRICATIONS: Structural Steel Corner Guards.

C. Section 08 71 00, DOOR HARDWARE: Armor plates and kick plates not specified in this section.

D. See Construction Documents: Color and texture of aluminum and resilient material.

1.3 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Manufacturer with a minimum of three (3) years’ experience in providing items of type specified.
   1. Obtain wall and door protection from single manufacturer.

B. Installer’s Qualifications: Installers are to have a minimum of three (3) years’ experience in the installation of units required for this project.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Sustainable Design Submittals, as described below:
   1. Volatile organic compounds per volume as specified in PART 2 - PRODUCTS.
   2. For composite wood products, submit documentation indicating product contains no added urea formaldehyde.

C. Shop Drawings: Show design and installation details.

D. Manufacturer's Literature and Data:
   1. Handrail/Wall Guard Combinations.
   2. Wall Guards.
   3. Corner Guards.
   4. Door/Door Frame Protectors.
   5. High Impact Wall covering.

E. Test Report: Showing that resilient material complies with specified fire and safety code requirements.

F. Manufacturer’s qualifications.

G. Installer’s qualifications.

H. Manufacturer’s warranty.

1.5 DELIVERY AND STORAGE

A. Deliver materials to the site in original sealed packages or containers marked with the name and brand, or trademark of the manufacturer.

B. Protect from damage from handling and construction operations before, during and after installation.

C. Store in a dry environment of approximately 21 degrees C (70 degrees F) for at least 48 hours prior to installation.

1.6 WARRANTY

A. Construction Warranty: Comply with FAR clause 52.246-21 “Warranty of Construction”.

B. Manufacturer Warranty: Manufacturer shall warranty their wall and door protection for a minimum of five (5) years from date of installation and final acceptance by the Government. Submit manufacturer warranty.

1.7 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

B. ASTM International (ASTM):
A240/A240M-20 ..... Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and For General Applications

B221-14 ..... Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

B221M-13 ..... Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)

D256-10(2018) ..... Determining the Izod Pendulum Impact Resistance of Plastics

D635-18 ..... Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position

E84-20 ..... Surface Burning Characteristics of Building Materials

C. Aluminum Association (AA):
DAF 45-09 ..... Designation System for Aluminum Finishes

D. American Architectural Manufacturers Association (AAMA):
611-14 ..... Voluntary Specification for Anodized Architectural Aluminum

E. Code of Federal Regulation (CFR):
40 CFR 59(2020) Subpart D . National Volatile Organic Compound Emission Standards for Architectural Coatings

F. The National Association of Architectural Metal Manufacturers (NAAMM):
AMP 500-06 ..... Metal Finishes Manual

G. National Fire Protection Association (NFPA):
80-2019 ..... Standard for Fire Doors and Other Opening Protectives

H. SAE International (SAE):
J 1545-2014-10 ..... Instrumental Color Difference Measurement for Exterior Finishes, Textiles and Colored Trim.

I. Underwriters Laboratories Inc. (UL):
Annual Issue..... Building Materials Directory

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel: A240/A240M, Type 304.

B. Aluminum Extruded: ASTM B221M (B221), Alloy 6063, Temper T5 or T6.

C. Resilient Material:
1. Provide resilient material consisting of high impact resistant extruded acrylic vinyl, polyvinyl chloride, or injection molded thermal plastic conforming to the following:
   a. Minimum impact resistance of 960.8 N-m/m (18 feet-pounds/square inch) when tested in accordance with ASTM D256 (Izod impact, feet-pounds per inch notched).
   b. Class 1 fire rating when tested in accordance with ASTM E84, having a maximum flame spread of 25 and a smoke developed rating of 450 or less.
   c. Rated self-extinguishing when tested in accordance with ASTM D635.
   d. Provide material labeled and tested by Underwriters Laboratories or other approved independent testing laboratory.
   e. Provide resilient material for protection on fire rated doors and frames assemblies that is listed by the testing laboratory performing the tests.
   f. Provide resilient material installed on fire rated wood/steel door and frame assemblies that have been tested on similar type assemblies. Test results of material tested on any other combination of door and frame assembly are not acceptable.
   g. Provide integral color with colored components matched in accordance with SAE J 1545 to within plus or minus 1.0 on the CIE-LCH scales.

2.2 CORNER GUARDS

A. Resilient, Shock-Absorbing Corner Guards: Surface mounted type.
1. Snap-on corner guard formed from resilient material, minimum 1.98 mm (0.078-inch) thick, free floating on a continuous 1.52 mm (0.060-inch) thick extruded aluminum retainer. Provide appropriate mounting hardware, cushions and base plates as required.
2. Profile: Minimum 76 mm (3 inch) long leg and 6 mm (1/4 inch) corner radius.
3. Height: 1.22 m (4 feet) .
4. Retainer Clips: Provide manufacturer's standard impact-absorbing clips.
5. Provide factory fabricated end closure caps at top and bottom of surface mounted corner guards.
6. Flush mounted corner guards installed on any fire rated wall to be installed in a manner that maintains the fire rating of the wall. Provide fire test of proposed corner guard system to verify compliance.
   a. Where insulating materials are an integral part of the corner guard system, provide insulating materials furnished by the manufacturer of the corner guard system.

B. Fabricate stainless steel corner guards of 1.27 mm (.05 inch) thick material conforming to ASTM A240/A240M, Type 304. Install corner guards as indicated on construction documents. Form corner guard to dimensions shown on construction documents.

2.3 WALL GUARDS AND HANDRAILS

A. Resilient Wall Guards and Handrails:
1. Handrail/Wall Guard Combination:
   a. Snap-on covers of resilient material, minimum 2 mm (0.078-inch) thick.
   b. Free-floating on a continuous, extruded aluminum retainer, minimum 1.82 mm (0.072-inch) thick.
   c. Anchor to wall at maximum 762 mm (30 inches) on center.
2. Wall Guards:
   a. Snap-on covers of resilient material, minimum 2.54 mm (0.100-inch) thick. free-floated over a continuous extruded aluminum retainer, minimum 2.03 mm (0.080-inch) thick anchored to wall at maximum 610 mm (24 inches) on center.
3. Provide handrails and wall guards with prefabricated end closure caps, inside and outside corners, concealed splices, cushions, mounting hardware and other accessories as required. End caps and corners to be field adjustable to assure close alignment with handrails and wall guards. Screw or bolt closure caps to aluminum retainer in a concealed manner.

B. Aluminum Wall Guards: Extruded aluminum, closed tubular bumper assembly mounted on wall brackets.
   1. Provide wall bumper with factory fabricated end closure caps, and inside and outside corner assemblies, concealed splice plates, and other accessories standard with the manufacturer.
   2. Fabricate tubular wall guards from material with a nominal wall thickness of 6.35 mm (0.250-inch), form grooves for and provide two (2) strips of continuous polyvinyl chloride cushion bumper inserts.
   3. Fabricate adjustable wall brackets from aluminum having a nominal wall thickness of 5.08 mm (0.20-inch). Fasten bumper to brackets with 6.35 mm (1/4-inch) diameter aluminum or stainless steel bolts with locknuts.

C. Stainless Steel Wall Guards: Construct wall guard, including brackets, of minimum 4.76 mm (0.1875-inch) thick stainless steel.

2.4 DOOR AND DOOR FRAME PROTECTION

A. Fabricate door and door frame protection items from vinyl acrylic or polyvinyl chloride resilient material, minimum 1.52 mm (0.060-inch) thick, for doors and 0.89 mm (0.035-inch) thick for door frame.

B. Provide adhesive as recommended by resilient material manufacturer.

2.5 HIGH IMPACT WALL COVERING

A. Provide wall covering/panels consisting of high impact rigid acrylic vinyl or polyvinyl chloride resilient material.

B. Panel sizes to be 0.61 x 1.21 meter (2 x 4 feet).

C. Submit fire rating and extinguishing test results for resilient material.

D. Submit statements attesting that the items comply with specified fire and safety code requirements.

E. Rigid Vinyl Acrylic Wall Covering: Wall covering thickness to be 1.02 mm (0.040 inch)

F. Provide adhesive as recommended by the wall covering manufacturer. Provide adhesive with VOC content of 250g/L or less when calculated according to 40 CFR 59, (EPA Method 24).

2.6 FASTENERS AND ANCHORS

A. Provide fasteners and anchors as required for each specific type of installation.

B. Where type, size, spacing or method of fastening is not shown or specified in construction documents, submit shop drawings showing proposed installation details.

2.7 FINISH

A. Aluminum: In accordance with AA DAF-45.
   1. Exposed aluminum: AAMA 611 AA-M12C22A31 chemically etched medium matte, with clear anodic coating, Class II Architectural, .01 mm (0.4 mil) thick
   2. Concealed aluminum: Mill finish as fabricated, uniform in color and free from surface blemishes.

B. Stainless Steel: In accordance with NAAMM AMP 500 finish Number 4.

C. Resilient Material: Embossed textures and color in accordance with SAE J1545.

PART 3 - INSTALLATION

3.1 RESILIENT CORNER GUARDS

A. Install corner guards on walls in accordance with manufacturer's instructions.

3.2 STAINLESS STEEL CORNER GUARDS

A. Mount guards on external corners of interior walls, partitions and columns as shown on construction documents.

B. Where corner guards are installed on walls, partitions or columns finished with plaster or ceramic tile, anchor corner guards as shown on construction documents. Expansion bolt to concrete or masonry with four 9.52 mm (3/8-inch) diameter bolts, spaced 406 mm (16 inches) on centers . Coat back surfaces of corner guards, where shown on construction documents, with a non-flammable, sound deadening material. Corner guards to overlap finish plaster surfaces.

C. Where corner guards are installed on gypsum board, clean surface and anchor guards with a neoprene solvent-type contact adhesive specifically manufactured for use on gypsum board construction. Remove excess adhesive from around edge of guard and allow curing undisturbed for 24 hours.

3.3 RESILIENT WALL GUARDS, / HANDRAILS, / WALL GUARD HANDRAIL COMBINATION

A. Secure guards to walls with mounting cushions, brackets, and fasteners in accordance with manufacturer's details and instructions.

3.4 ALUMINUM WALL GUARDS

A. Secure brackets to walls with fasteners, spaced in accordance with manufacturer's installation instructions.

3.5 STAINLESS STEEL WALL GUARDS

A. Space brackets at not more than 914 mm (3 feet) on centers and anchor to the wall in accordance with manufacturer's installation instructions.

3.6 DOOR, DOOR FRAME PROTECTION AND HIGH IMPACT WALL COVERING

A. Surfaces to receive protection to be clean, smooth and free of obstructions.

B. Install protectors after frames are in place but preceding installation of doors in accordance with approved shop drawings and manufacturer’s specific instructions.

C. Apply with adhesive in controlled environment according to manufacturer’s recommendations.

D. Protection installed on fire rated doors and frames to be installed according to NFPA 80 and installation procedures listed in UL Building Materials Directory; or, equal listing by other approved independent testing laboratory establishing the procedures.

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SECTION 10 28 00

TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. SUMMARY:
1. Section Includes: Toilet and bath accessories at dressing rooms, toilets, baths, locker rooms and other areas indicated on drawings.

1.2 RELATED WORK

A.

B. Section 09 30 13, CERAMIC/PORCELAIN TILING: Ceramic Toilet and Bath Accessories.

C. Section 10 21 23, CUBICLE CURTAIN TRACKS: Shower Curtain Break Away Pendant Chain Hooks.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. American Society of Mechanical Engineers (ASME):
1. B18.6.4-98(R2005) Thread Forming and Thread Cutting Tapping Screws and Metallic Drive Screws inch.

C. American Welding Society (AWS):
1. D10.4-86(2000) Welding Austenitic Chromium-Nickle Stainless Steel Piping and Tubing.

D. ASTM International (ASTM):
1. A269/A269M-15a(2019) Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
2. A312/A312M-19 Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
3. A653/A653M-20 Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
4. A666-15 Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
5. A1011/A1011M-18a Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
6. B30-20 Copper Alloys in Ingot Form.
7. B75/B75M-20 Seamless Copper Tube.
8. B221-14 Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
9. B221M-13 Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
10. B456-17 Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
11. B824-17 General Requirements for Copper Alloy Castings.
12. C1036-16 Flat Glass.
13. C1048-18 Heat-Strengthened and Fully Tempered Flat Glass.
14. D635-18 Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.
15. F446-19 Grab Bars and Accessories Installed in the Bathing Area.

E. Federal Specifications (Fed. Spec.):

1. A-A-3002 Mirror, Glass.
2. FF-S-107C(2) Screws, Tapping and Drive.
3. WW-P-541/8B(1) Plumbing Fixtures (Accessories, Land Use).

F. National Architectural Metal Manufacturers(NAAMM):
1. AMP 500-06 Metal Finishes Manual.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:
1. Show size, configuration, and fabrication, anchorage and installation details.
2. Show mounting locations and heights.

C. Manufacturer's Literature and Data:
1. Description of each product.
2. Installation instructions.

D. Samples:
1. Full sized, complete assembly of each product specified.
2. Approved samples may be incorporated into project.

E. Certificates: Certify each product complies with specifications.
1. Soap dispensers: Certify soap dispensers are fabricated of material that will not be affected by liquid soap, aseptic detergents, and hexachlorophene solutions.

F. Qualifications: Substantiate qualifications comply with specifications.
1. Manufacturer with project experience list.

G. Operation and Maintenance Data:
1. Care instructions for each exposed finish product.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications:
1. Regularly manufactures specified products.

1.6 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.

B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.

C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

A. Store products indoors in dry, weathertight facility.

B. Protect products from damage during handling and construction operations.

1.8 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum: ASTM B221M (ASTM B221), Alloy 6063-T5 and Alloy 6463-T5.

B. Stainless Steel:

1. Plate or Sheet: ASTM A666, Type 304, 0.8 mm (0.031 inch) thick unless otherwise specified.
2. Tubing: ASTM A269/A269M, Grade TP 304, seamless or welded.
3. Pipe: ASTM A312/A312M; Grade TP 304.

C. Steel Sheet: ASTM A653/A653M, zinc-coated (galvanized) coating designation G90.

D. Chrome Plating (Service Condition Number SC 2): ASTM B456.

E. Brass Castings: ASTM B30.

F. Copper:
1. Tubing: ASTM B75/B75M.
2. Castings: ASTM B824.

G. Glass:
1. ASTM C1036, Type 1, Class 1, Quality q2, for mirrors, and for mirror doors in medicine cabinets.
2. ASTM C1036, Type 1 Class 1 Quality q3, for shelves in medicine cabinets.
3. ASTM C1048, Kind FT, Condition A, Type 1, Class 1 for glass and mirrors in Mental Health and Behavior Patient Care Units, and Security Examination Rooms.

2.2 PRODUCTS - GENERAL

A. Provide each product from one manufacturer.

B. Products Used Within Mental Health and Behavioral Patient Care Units:
1. Provide accessories free of anchor points.
2. Design accessories for attachment with tamper resistant hardware.

2.3 PAPER TOWEL DISPENSERS

A. Surface mounted type with sloping top.

B. Dispensing capacity for 300 sheets of any type of paper toweling.

C. Fabricate of stainless steel.

D. Provide door with continuous hinge at bottom, and spring tension cam lock or tumbler lock, keyed alike, at top, and refill sight slot in front.

2.4 WASTE RECEPTACLES

A. Semi-recessed type, without doors. Fed. Spec. WW-P-541, Type II.

B. Fabricate of stainless steel.

C. Form face frame from one piece.

D. Provide removable waste receptacle of approximately 45 L (12 gal.) capacity, fabricated of stainless steel.

E. Waste receptacle key locked in place.

2.5 TOILET TISSUE DISPENSERS

A. Double roll surface mounted type.

B. Mount on continuous backplate.

C. Removable spindle ABS plastic or chrome plated plastic.

D. Wood rollers are not acceptable.

E. Toilet Tissue Dispensers Used In Mental Health And Behavioral Patient Care Units: Soft plastic rod incapable of supporting load greater than 22.6 kg (50 pounds) with concealed or tamper resistant fasteners.

2.6 GRAB BARS

A. Fed. Spec. WW-P-541/8B, Type IV, bars, surface mounted, Class 2, grab bars and complying with ASTM F446.

B. Fabricate from stainless steel or nylon coated steel, use one type throughout project:
   1. Stainless steel: Grab bars, flanges, mounting plates, supports, screws, bolts, and exposed nuts and washers.

C. Mounting:
   1. Other Types and Locations: Concealed type.

D. Bars:
   1. Fabricate to 38 mm (1-1/2 inch) outside diameter.
      a. Stainless steel, minimum 1.2 mm (0.05 inch) thick.
      b. Nylon coated bars, minimum 1.5 mm (0.06 inch) thick.
   2. Fabricate in one continuous piece with ends turned toward walls.
      a. Swing up grab bars and grab bars continuous around three sides of showers may be fabricated in two sections, with concealed slip joint between.
   3. Continuously weld intermediate support to grab bar.
   4. Swing Up Bars: Manually operated; designed to prevent bar from falling when in raised position.

E. Flange for Concealed Mounting:
   1. Minimum 2.65 mm (0.1 inch) thick, maximum 79 mm (3-1/8 inch) diameter by 13 mm (1/2 inch) deep, with minimum three set screws for securing flange to back plate.
   2. Insert grab bar through center of flange and continuously weld perimeter of grab bar flush to back side of flange.
   3. In lieu of providing flange for concealed mounting, and back plate as specified, grab bar may be welded to back plate covered with flange.

F. Back Plates:
   1. Minimum 2.65 mm (0.1046 inch) thick metal.
   2. Fabricate in one piece, maximum 6 mm (1/4 inch) deep, with diameter sized to fit flange. Provide slotted holes to accommodate anchor bolts.
   3. Provide spreaders, through bolt fasteners, and cap nuts, where grab bars are mounted on partitions.

G. Grab bars in Mental Health and Behavioral Patient Care Units: Provide units complying with accessibility standards, but preventing materials from being threaded between bar and wall as possible anchor point.

2.7 SHOWER CURTAIN RODS

A. Stainless steel tubing, minimum 1.27 mm (0.050 inch) wall thickness, 32 mm (1-1/4 inch) outside diameter.

B. Flanges, stainless steel rings, 66 mm (2.6 inch) minimum outside diameter, with 2 holes opposite each other for 6 mm (1/4 inch) stainless steel fastening bolts. Provide set screw within curvature of each flange for securing rod.

C. Intermediate Support: For rods over 1800 mm (72 inches) long. Provide adjustable ceiling flanges with set screws, tubular hangers and stirrups.

D. Shower curtain rods in Mental Health and Behavioral Nursing Units:
   1. Ceiling mounted hospital cubicle curtain tracks as specified in Section 10 21 23, CUBICLE CURTAIN TRACKS, with break-away pendant chain hooks. Chain hooks located at 2000 mm (79 inches) above floor.

2.8 CLOTHES HOOKS, ROBE OR COAT

A. Fabricate hook units from chromium plated brass with satin finish, or stainless steel, using 6 mm (1/4 inch) minimum thick stock, with edges and corners rounded smooth to thickness of metal, or 3 mm (1/8 inch) minimum radius.

B. Fabricate each unit as a double hook on a single shaft, integral with or permanently fastened to wall flange, provided with concealed fastenings.

C. Clothes Hooks Used In Mental Health And Behavioral Patient Care Units: Provide units free of anchor points and secured to the wall using tamper resistant hardware.

2.9 TOWEL BARS

A. Fed. Spec. WW-P-541/8B, Type IV, Bar, Surface mounted; Class 1, towel.

B. Stainless steel, or chromium plated copper alloy.

C. Bar Length: 450 and 600 mm (18 and 24 inches) as shown.

D. Finish brackets and supports to match bar.

E. Towel Bars Used in Mental Health and Behavioral Patient Care Units: Design units to support maximum 1 kg (2 lbs.).

2.10 METAL FRAMED MIRRORS

A. Fed. Spec. A-A-3002 metal frame; stainless steel.

B. Mirror Glass:
   1. Minimum 6 mm (1/4 inch) thick.
   2. Set mirror in a protective vinyl glazing tape.

C. Frames:
   1. Channel or angle shaped section with face of frame minimum 9 mm (3/8 inch) wide. Fabricate with square corners.
   2. Metal Thickness 0.9 mm (0.035 inch).
   3. Filler:
      a. Where mirrors are mounted on walls having ceramic tile wainscots not flush with wall above, provide fillers contoured to conceal void between back of mirror and wall surface.
      b. Fabricate fillers from same material and finish as mirror frame.
   4. Attached Shelf for Mirrors:
      a. Fabricate shelf of same material and finish as mirror frame.
      b. Make shelf maximum 150 mm (6 inches) in depth, and extend full width of mirror.
      c. Close ends and front edge of shelf to same thickness as mirror frame width.
      d. Form shelf for aluminum framed mirror as integral part of bottom frame member.
      e. Form stainless steel shelf with concealed brackets to attach to mirror frame.

D. Back Plate:
   1. Fabricate backplate for concealed wall hanging from zinc-coated, or cadmium plated 0.9 mm (0.036 inch) thick sheet steel, die cut to fit face of mirror frame.
   2. Provide set screw type theft resistant concealed fastening system for mounting mirrors.

E. Mounting Bracket:
   1. Designed to support mirror tight to wall.
   2. Designed to retain mirror with concealed set screw fastenings.

F. Metal Framed Mirrors used in Resident Unit Bathrooms: Provide shatter proof glass or polished stainless steel units to meet ASTM C1048.

2.11 MEDICINE CABINETS

A. Fed. Spec. WW-P-541/8B, Type III Medicine cabinets, Style R, Recessed.

1. Mirror Glass: Minimum 5 mm (3/16 inch) thick. Set mirror in protective vinyl glazing tape.
2. Glass Shelves: Minimum 6 mm (1/4 inch) thick, with bulb-edges at front. Support shelves on adjustable aluminum brackets. Provide three shelves for each cabinet.
3. Cabinet Body: Fabricate from 0.9 mm (0.036 inch) thick sheet steel, with baked enamel finish, or 0.9 mm (0.036 inch) thick stainless steel. Form body in one piece, without seams, and with rounded inside corners.

B. Hinged Door:
1. Swing door.
2. Fabricate mirror door approximately 400 by 560 mm (16 by 22 inches).
3. Cabinet concealed when doors are closed.
4. Mirror Door Frame: Channel shape, 15 mm (0.060 inch) thick chromium plated brass, or 0.9 mm (0.036 inch) thick stainless steel.
5. Provide door with full length stainless steel piano hinge, magnetic or friction catches, rubber bumpers, and 90 degree restraining arm with spring type stop.

C. Sliding Door:
1. Slide door.
2. Fabricate sliding doors for approximately 660 by 560 mm (26 by 22 inch) opening.
3. Provide nylon glides in stainless steel tracks, door pulls and rubber bumpers.
4. Entire contents of cabinet concealed when doors closed.

D. Medicine Cabinets in Mental Health and Behavioral Patient Care Units: Provide shatter proof glass or polished stainless steel units.

2.12 SOAP DISHES

A. Fed. Spec. WW-P-541/8B, Type VI, Holder.

B. Soap, Recessed:
1. One piece seamless shell and flange with provisions for concealed fasteners.
2. Fabricate from 0.8 mm (0.031 inch) thick stainless steel or chromium plated brass.
3. Form surface of soap tray with raised ridges or patterned dimples to provide gripping surface for soap bar, or provide flush soap tray with a retaining lip. Plastic soap trays or tray inserts are not acceptable.

C. Soap Dishes in Mental Health and Behavioral Patient Care Units: Provide recessed units.

2.13 PAPER CUP DISPENSER

A. Fabricate of stainless steel.

B. Provide door with concealed stainless steel pivoting rod or piano hinge, and spring tension cam lock, or tumbler lock, keyed alike when more than one accessory unit is provided, and with cup level refill sight slot in door front.

C. Fabricate for flat bottom cups.

D. 90 Milliliters (3 ounce) Dispenser Unit:
1. Surface mounted single stack dispenser unit having a capacity of maximum one hundred fifty cups.
2. Form door from one piece to cover front and sides warp free.

E. 120 Milliliters (4 ounce) Dispenser Unit:
1. Recessed type single stack dispenser unit having a capacity of Maximum one hundred cups.
2. Form face frame in one piece.
3. Fabricate door double-pan warp free.

F. Combination 90 to 180 Milliliters (3 to 6 ounce) Dispenser and Disposal Unit:
1. Recessed type, having a capacity of Maximum 170 cups.
2. Fabricate as twin stack dispenser unit with adjustable dispensing mechanism to dispense any size cup.

3. Fabricate face frames in one piece and doors double pan warp free.
4. Fabricate recessed disposal unit with removable waste receptacle having a capacity of minimum 11 L (3.1 gallons).

2.14 MOP RACKS

A. Minimum 1016 mm (40 inches) long with five holders.

B. Clamps:
1. Minimum of 1.3 mm (0.05 inch) thick stainless steel bracket retaining channel with hard rubber serrated cam; pivot mounted to channel.
2. Clamps to hold handles from 13 mm (1/2 inch) minimum to 32 mm (1-1/4 inch) maximum diameter.

C. Support:
1. Minimum 1 mm (0.04 inch) thick stainless steel hat shape channel to hold clamps away from wall as indicated.
2. Drill wall flange for 3 mm (1/8 inch) fasteners above and below clamp locations.

D. Secure clamps to support with oval head machine screws or rivets into continuous reinforcing back of clamps.

2.15 STAINLESS STEEL SHELVES (TYPE 44)

A. Shelves:
1. Fabricate shelves of 1.2 mm (0.0478 inch) thick sheet to size and design indicated on Drawings.
2. Fabricate shelves of hollow metal type construction, forming a depressions indicated, with closed fronts, backs, ends and bottoms. Reinforce shelves with 1.2 mm (0.05 inch) thick sheet steel hat channel stiffeners, full depth, welded to underside of top at bracket locations.
3. Miter cuts, where made at corners of shelves, continuously welding.

B. Form brackets of 3 mm (1/8 inch) thick steel as shown. Drill brackets for 6 mm (1/4 inch) anchor bolts.

C. Weld or Screw brackets to shelves.

2.16 STAINLESS STEEL SHELVES(TYPES 45, 45C)

A. Fabricate shelves and brackets to design shown of 1.2 mm (0.05 inch) thick stainless steel.

B. Round and finish smooth projecting corners of shelves and edge corners of brackets. Drill brackets for 6 mm (1/4 inch) anchor bolts.

C. Screw or weld brackets to shelves.

2.17 STAINLESS STEEL SHELVES AT WHEELCHAIR LAVATORY

A. Side wall mounted:
1. Fabricate to size and shape indicated of 1.2 mm (0.05 inch) thick sheet.
2. Turn up edges and weld corners closed.
3. Fabricate brackets and weld to shelf. Drill brackets for 6 mm (1/4 inch) anchor bolts.

B. Back wall mounted:
1. Fabricate to size and shape shown of plate and tube.
2. Turn up edges and weld corners of shelf.
3. Weld tube to back plate and shelf, weld back plate to shelf, filler plate to tube, and corners of shelf with continuous welds.
4. Drill back plate for 6 mm (1/4 inch) anchor bolts.

2.18 FABRICATION - GENERAL

A. Welding, AWS D10.4.

B. Grind, dress, and finish welded joints to match finish of adjacent surface.

C. Form exposed surfaces from one sheet of stock, free of joints.

D. Provide steel anchors and components required for secure installation.

E. Form flat surfaces without distortion. Keep exposed surfaces free from scratches and dents. Reinforce doors to prevent warp or twist.

F. Isolate aluminum from dissimilar metals and from contact with building materials as required to prevent electrolysis and corrosion.

G. Hot-dip galvanized steel or stainless steel, anchors and fastening devices.

H. Shop assemble accessories and package with components, anchors, fittings, fasteners and keys.

I. Key items alike.

J. Provide templates and rough-in measurements.

K. Round and deburr edges of sheets to remove sharp edges.

2.19 FINISH

A. Steel Paint Finish:
   1. Powder-Coat Finish: Manufacturer's standard two-coat finish system consisting of the following:
      a. One coat primer.
      b. One coat thermosetting topcoat.
      c. Dry-film Thickness: 0.05 mm (2 mils) minimum.

B. Stainless Steel: NAAMM AMP 500; No. 4 polished finish.

C. Aluminum Anodized Finish: NAAMM AMP 500.
   1. Clear Anodized Finish: AA-C22A41; Class I Architectural, 0.018 mm (0.7 mil) thick.
   2. Color Anodized Finish: AA-C22A42 or AA-C22A44; Class I Architectural, 0.018 mm (0.7 mil) thick.

D. Chromium Plating: ASTM B456, satin or bright as specified, Service Condition No. SC2.

2.20 ACCESSORIES

A. Fasteners:
   1. Fasteners in Mental Health and Behavioral Patient Care Units: Tamper resistant hot-dipped galvanized or stainless steel.
   2. Exposed Fasteners: Stainless steel or chromium plated brass, finish to match adjacent surface.
   3. Concealed Fasteners:
      a. Shower, Bath Tubs, and High Moisture Areas: Stainless steel.
      b. Other Locations: Steel, hot-dipped galvanized.
   4. Toggle Bolts: For use in hollow masonry or frame construction.
   5. Sex bolts: For through bolting on thin panels.
   6. Expansion Shields: Lead or plastic for solid masonry and concrete substrate as recommended by accessory manufacturer to suit application.
   7. Screws:
      a. ASME B18.6.4.
      b. Fed. Spec. FF-S-107, Stainless steel Type A.

B. Adhesive: As recommended by manufacturer to suit application.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.
   1. Verify blocking to support accessories is installed and located correctly.

B. Verify location of accessories with Contracting Officer's Representative.

3.2 INSTALLATION

A. Install products according to manufacturer's instructions and approved submittal drawings.
   1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

B. Install grab bars according to ASTM F446.

C. Set work accurately, in alignment and where indicated, parallel or perpendicular as required to line and plane of surface. Install accessories plumb, level, free of rack and twist.

D. Toggle bolt to steel anchorage plates in frame partitions and hollow masonry. Expansion bolt to concrete or solid masonry.

E. Install accessories to function as designed. Perform maintenance service without interference with performance of other devices.

F. Position and install dispensers, and other devices in countertops, clear of drawers, permitting ample clearance below countertop between devices, and ready access for maintenance.

G. Align mirrors, dispensers and other accessories even and level, when installed in battery.

H. Install accessories to prevent striking by other moving, items or interference with accessibility.

I. Install accessories in Mental Health and Behavioral Units with tamper resistant screws that are flush mounted so that they will not support a rope or material for hanging.

3.3 CLEANING

A. After installation, clean toilet accessories according to manufacturer’s instructions.

3.4 PROTECTION

A. Protect accessories from damage until project completion.

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SECTION 10 44 13

FIRE EXTINGUISHER CABINETS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section covers recessed fire extinguisher cabinets.

1.2 RELATED WORK

A. Acrylic glazing: Section 08 80 00, GLAZING.

B. Field Painting: Section 09 91 00, PAINTING.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data: Fire extinguisher cabinet including installation instruction and rough opening required.

1.4 APPLICATION PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society of Testing and Materials (ASTM):
D4802-15.....Poly (Methyl Methacrylate) Acrylic Plastic Sheet

PART 2 - PRODUCTS

2.1 FIRE EXTINGUISHER CABINET

A. Recessed type with flat trim of size and design shown.

Selection Table - Fire Extinguisher Cabinets			
Mark	Material	Mounting	Usage / Condition
FEC-0	Carbon Steel	Recessed	Recessed for 2 ½ gallon fire extinguisher
FEC-3	Carbon Steel	Surface-mounted Cabinet	For economy or for walls which are not conducive to recessed mounting (i.e. CMU & CIP)
FE	Wall Bracket and exposed Fire Extinguisher – NO Cabinet	Surface-mounted FE w/ Wall Brackets	FE mounted to wall with manufacturer’s standard Wall Bracket (utilitarian). Appropriate for Mechanical Rooms and similar non-public areas.

B. Fire Extinguisher Cabinets (FEC):
   1. Provide FIRE EXTINGUISHER decal for each cabinet. Orient letters vertically.
   2. Provide standard fixed door pull at each cabinet.

C. FEC-0: Recessed, Steel, Fire Extinguisher Cabinet:
   1. Cold rolled steel tub with 1-1/4 IN wide recessed flange and flush cabinet door.
      a. Fire-rated Cabinets: Provide fire-rated cabinets where FEC is indicated to be installed in fire-rated walls.
      b. Maximum projection from wall surface: 1-1/2 IN.
   2. Cabinet Construction:
      a. Non-fire rated Cabinets: Single-wall, 0.026 IN (26 GA) steel.
      b. Fire Rated Cabinets: Double-wall construction fabricated from 0.043 IN (18 GA) steel lined with minimum 5/8 IN thick, fire-barrier material.

D. Finish:
   1. Finish interior of cabinet body with baked-on semigloss white enamel.
   2. Finish door, frame with manufacturer's standard baked-on prime coat suitable for field painting.
   3. Powder coated.
      a. Color: White.
   4. Tub Size, inside clear (WxHxD): 12 x 27 x 7-3/4 IN.
   5. Door Style: Full Glazing; Clear acrylic.
      a. Door Style: Vertical strip Glazing; Clear acrylic.
   6. Lock: None.

E. FEC-3: Surface-mounted, carbon steel, Fire Extinguisher Cabinet:
   1. Description: Steel cabinet box fully exposed and mounted directly on wall with no trim.
      a. Material: 0.026 IN (26 GA) cold-rolled steel.
   2. Finish:
      a. Finish interior of cabinet body with baked-on semigloss white enamel.
      b. Finish door, frame with manufacturer's standard baked-on prime coat suitable for field painting.
      c. Powder coated.
         1) Color: White.
   3.
   4. Tub Size, inside clear (WxHxD): 15-13/16 x 30-3/16 x 8-1/4 IN.
   5. Door Style: Full Glazing; Clear acrylic.
   6. Lock: None.

F. Wall Brackets:
   1. Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated
   2. Finish: Baked-enamel or powder coat.
   3. Include mounting accessories suitable for substrate wall type.
   4. Locations: Install wall brackets for each fire extinguisher (FE) not indicated to be installed in a cabinet.

2.2 FABRICATION

A. Form body of cabinet from 0.9 mm (0.0359 inch) thick sheet steel.

B. Fabricate door and trim from 1.2 mm (0.0478 inch) thick sheet steel with all face joints fully welded and ground smooth.
   1. Glaze doors with 6 mm (1/4 inch) thick ASTM D4802, clear acrylic sheet, Category B-1, Finish 1.
   2. Design doors to open 180 degrees.
   3. Provide continuous hinge, pull handle, and adjustable roller catch.

2.3 FINISH

A. Finish interior of cabinet body with baked-on semigloss white enamel.

B. Finish door, frame with manufacturer's standard baked-on prime coat suitable for field painting.

C. Comply with NAAMM's Metal Finishes Manual for Architectural and Metal Products.

D. Protect mechanical finishes on exposed surfaces of fire protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

E. Finish fire protection cabinets after assembly.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify suitability of substrates to accept installation.

B. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

A. Install fire extinguisher cabinets in prepared openings and secure in accordance with manufacturer's instructions.

B. Install cabinet so that the extinguisher height within meets the requirements of NFPA 10, ABAAS, and VA Barrier Free Guide.

C. Fasten mounting brackets and cabinets to structure, square and plumb, to comply with manufacturer’s instructions.

D. Provide unistrut or welded steel support where needed to mount cabinets or brackets in mechanical rooms and similar locations.

E. Provide required closures.

F. Mounting Height:
   1. Fire Extinguisher Cabinets (FEC):
      a. Locate with centerline of cabinet door handle not more than 48 IN AFF.
      b. Exception: Extinguishers with at gross weight > 40 LBS: Locate with centerline of cabinet door handle not higher than 24 IN AFF.
   2. Fire Extinguishers (FE) not contained in a cabinet:
      a. Locate wall brackets such that extinguisher release mechanism will not be higher 48 IN AFF.
      b. Exception: Extinguishers with at gross weight greater than 40 LBS: Install with extinguisher top not more than 36 IN above floor.

3.3 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films.

B. Adjust fire protection cabinet doors to operate easily without binding.
   1. Verify that integral locking devices operate properly.

C. Clean interior and exterior surfaces.

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SECTION 11 05 12

GENERAL MOTOR REQUIREMENTS FOR EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies the furnishing, installation and connection of motors.

1.2 RELATED WORK:

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one Section of Division 26.

B. Divisions 11 and 14: Other sections specifying motor driven equipment in.

1.3 SUBMITTALS:

A. In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:

B. Shop Drawings:
1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
2. Include electrical ratings, dimensions, mounting details, materials, horsepower, RPM, enclosure, starting characteristics, torque characteristics, code letter, full load and locked rotor current, service factor, and lubrication method.

C. Manuals:
1. Submit simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals, including technical data sheets and application data.

D. Certification: Two weeks prior to final inspection, unless otherwise noted, submit four copies of the following certification to the Resident Engineer:
1. Certification that the motors have been properly applied, installed, adjusted, lubricated, and tested.

1.4 APPLICABLE PUBLICATIONS:

A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. National Electrical Manufacturers Association (NEMA):
MG 1-2016 ..... Motors and Generators

MG 2-2014 ..... Safety Standard and Guide for Selection, Installation and Use of Electric Motors and Generators

C. National Fire Protection Association (NFPA):
70-2020 ..... National Electrical Code (NEC)

PART 2 - PRODUCTS

2.1 MOTORS:

A. For alternating current, fractional and integral horsepower motors, NEMA Publications MG 1 and MG 2 shall apply.

B. Minimum voltage ratings shall be as follows:
   1. Single phase:
      a. Motors connected to 120-volt systems: 115 volts.
      b. Motors connected to 208-volt systems: 200 volts.
      c. Motors connected to 240 volt or 480 volt systems: 230/460 volts, dual connection.
   2. Three phase:
      a. Motors connected to 208-volt systems: 200 volts.
      b. Motors, less than 74.6 kW (100 HP), connected to 240 volt or 480 volt systems: 230/460 volts, dual connection.
      c. Motors, 74.6 kW (100 HP) or larger, connected to 240-volt systems: 230 volts.
      d. Motors, 74.6 kW (100 HP) or larger, connected to 480-volt systems: 460 volts.
      e. Motors connected to high voltage systems: Shall conform to NEMA Standards for connection to the nominal system voltage shown on the drawings.

C. Number of phases shall be as follows:
   1. Motors, less than 373 W (1/2 HP): Single phase.
   2. Motors, 373 W (1/2 HP) and larger: Three phase.
   3. Exceptions:
      a. Hermetically sealed motors.
      b. Motors for equipment assemblies, less than 746 W (one HP), may be single phase provided the manufacturer of the proposed assemblies cannot supply the assemblies with three phase motors.

D. Horsepower ratings shall be adequate for operating the connected loads continuously in the prevailing ambient temperatures in areas where the motors are installed, without exceeding the NEMA standard temperature rises for the motor insulation.

E. Motor designs, as indicated by the NEMA code letters, shall be coordinated with the connected loads to assure adequate starting and running torque.

F. Motor Enclosures:
   1. Shall be the NEMA types shown on the drawings for the motors.
   2. Where the types of motor enclosures are not shown on the drawings, they shall be the NEMA types, which are most suitable for the environmental conditions where the motors are being installed.
   3. Enclosures shall be primed and finish coated at the factory with manufacturer's prime coat and standard finish.

G. Additional requirements for specific motors, as indicated in other sections, shall also apply.

H. Energy-Efficient Motors (Motor Efficiencies): All permanently wired polyphase motors of 746 Watts or more shall meet the minimum full-load efficiencies as indicated in the following table, and as specified in this specification. Motors of 746 Watts or more with open, drip-proof or totally enclosed fan-cooled enclosures shall be NEMA premium efficiency type, unless otherwise indicated. Motors provided as an integral part of motor driven equipment are excluded from this requirement if a minimum seasonal or overall efficiency requirement is indicated for that equipment by the provisions of another section.

Minimum Efficiencies Open Drip-Proof				Minimum Efficiencies Totally Enclosed Fan-Cooled			
Rating	1200	1800	3600	Rating	1200	1800	3600

General Motor Requirements for Equipment

kW (HP)	RPM	RPM	RPM	kW (HP)	RPM	RPM	RPM
0.746 (1)	82.5%	85.5%	77.0%	0.746 (1)	82.5%	85.5%	77.0%
1.12 (1.5)	86.5%	86.5%	84.0%	1.12 (1.5)	87.5%	86.5%	84.0%
1.49 (2)	87.5%	86.5%	85.5%	1.49 (2)	88.5%	86.5%	85.5%
2.24 (3)	88.5%	89.5%	85.5%	2.24 (3)	89.5%	89.5%	86.5%
3.73 (5)	89.5%	89.5%	86.5%	3.73 (5)	89.5%	89.5%	88.5%
5.60 (7.5)	90.2%	91.0%	88.5%	5.60 (7.5)	91.0%	91.7%	89.5%
7.46 (10)	91.7%	91.7%	89.5%	7.46 (10)	91.0%	91.7%	90.2%
11.2 (15)	91.7%	93.0%	90.2%	11.2 (15)	91.7%	92.4%	91.0%
14.9 (20)	92.4%	93.0%	91.0%	14.9 (20)	91.7%	93.0%	91.0%
18.7 (25)	93.0%	93.6%	91.7%	18.7 (25)	93.0%	93.6%	91.7%
22.4 (30)	93.6%	94.1%	91.7%	22.4 (30)	93.0%	93.6%	91.7%
29.8 (40)	94.1%	94.1%	92.4%	29.8 (40)	94.1%	94.1%	92.4%
37.3 (50)	94.1%	94.5%	93.0%	37.3 (50)	94.1%	94.5%	93.0%
44.8 (60)	94.5%	95.0%	93.6%	44.8 (60)	94.5%	95.0%	93.6%
56.9 (75)	94.5%	95.0%	93.6%	56.9 (75)	94.5%	95.4%	93.6%
74.6 (100)	95.0%	95.4%	93.6%	74.6 (100)	95.0%	95.4%	94.1%
93.3 (125)	95.0%	95.4%	94.1%	93.3 (125)	95.0%	95.4%	95.0%
112 (150)	95.4%	95.8%	94.1%	112 (150)	95.8%	95.8%	95.0%
149.2 (200)	95.4%	95.8%	95.0%	149.2 (200)	95.8%	96.2%	95.4%

I. Minimum Power Factor at Full Load and Rated Voltage: 90 percent at 1200 RPM, 1800 RPM and 3600 RPM.

J. Premium efficiency motors shall be used where energy cost/kW x (hours use/year) > 50.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Install motors in accordance with manufacturer's recommendations, the NEC, NEMA, as shown on the drawings and/or as required by other sections of these specifications.

3.2 FIELD TESTS

A. Conductor insulation resistance testing shall be performed using a megohmmeter (megger) for all motors after installation and before start-up. Results of tests shall be published for engineer and authority having jurisdiction review. All motor conductor tests shall show ungrounded.

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SECTION 11 44 00

FOOD COOKING EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies food service cooking equipment as follows:
   1. Cooktops, electric.
   2. Ovens, electric

1.2 RELATED WORK

A. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Seismic Restraint of Equipment.

B. Section 23 38 13, COMMERCIAL-KITCHEN HOODS

C. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Electrical Connections.

D. Section 26 29 21, DISCONNECT SWITCHES: Electrical Disconnect Switches.

1.3 QUALITY CONTROL

A. Installer Qualifications: Experienced in food service equipment installation or supervised by an experienced food service equipment installer:
   1. Where required to complete equipment installation, electrician and plumber shall be licensed in jurisdiction where project is located.

B. NSF Compliance: Equipment bears NSF Certification Mark or UL Classification Mark indicating compliance with NSF/ANSI 4E.

C. UL Listing: Equipment is listed in UL "Heating, Cooling, Ventilating and Cooking Equipment Directory" and is labeled for intended use.
   1. Electric Cooking Equipment: Evaluated according to UL 197.

D. Seismic Restraint:
   1. Comply with requirements in Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.
   2. Comply with applicable guidelines for seismic restraint of kitchen equipment contained in SMACNA's "Kitchen Ventilation Systems and Food Service Equipment Guidelines," Publication 1767, Appendix A.

E. In-Use Service: At least one factory-authorized service agency for equipment shall be located in the geographical area of the installation and shall have the ability to provide service within 24 hours after receiving a service call.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer’s Literature and Data:
   1. Include manufacturer's address and telephone number.
   2. Include catalog or model numbers and illustrations and descriptions of cooking equipment.
   3. Proof of appliances being Energy Star qualified where applicable.

C. Installation Drawings: Show dimensions, details of installation, coordination with plumbing and electrical work, and other work required for a complete installation.

D. Operating Instructions: In accordance with requirements in Section 01 00 00, GENERAL REQUIREMENTS.

1.5 WARRANTY

A. Warrant food service equipment to be free from defects in materials and workmanship in accordance with requirements of "Warranty of Construction", FAR clause 52.246-21.

1.6 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. ASME International (ASME):
BPVC-11 ..... Boiler and Pressure Vessel Code

C. NSF International/American National Standards Institute (NSF/ANSI):
4E-09 ..... Commercial Cooking, Rethermalization, and Powered Hot Food Holding and Trans Equipment

D. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA): Publication 1767 Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines, 2001

E. Underwriters Laboratories Inc. (UL):
197-10 ..... Commercial Electric Cooking Appliances UL Heating, Cooling, Ventilating and Cooking Equipment Directory

PART 2 - PRODUCTS

2.1 COOKTOPS, ELECTRIC

A. General Requirements: electric ranges as follows K4501HVAC
1. Five (or 6) burner induction cooktop – design to drop into countertop
   a. ADA compliant
   b. UL listed
2. Connect to master switch and timer per code requirements.

2.2 OVENS, CONVECTION

A. General Requirements: Convection ovens as follows:
1. Stainless-steel door, cavity, and exterior.
2. Manual controls, for hot air, cool down, and off.
3. Timer.
4. Accessories:
   a. Wall (cabinet) mounting accessories.
   b. .
   c. Wire racks.
      1) ADA compliant
      2) Quantity: 1

B. Convection Oven Units:

SYMBOL	CAPACITY	HEAT SOURCE	SPECIAL ACCESSORIES

K4502m	Single compartment, full size	Electric	-

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cooking equipment level and plumb; arranged for safe and convenient operation; with access clearances required for maintenance and cleaning; and according to manufacturer's written instructions.

B. Interconnect cooking equipment to service utilities.

C. Install seismic restraints for equipment.

3.2 CLEAN-UP

A. At completion of the installation, clean and adjust cooking equipment as required to produce ready-for-use condition.

B. Where stainless-steel surfaces are damaged during installation procedures, repair finishes to match adjoining undamaged surfaces.

3.3 INSTRUCTIONS

A. Instruct personnel and transmit operating instructions in accordance with requirements in Section 01 00 00, GENERAL REQUIREMENTS.

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SECTION 12 24 00

WINDOW SHADES

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section includes cloth shades, vertical blinds and venetian blinds. Provide window shades complete, including brackets, fittings and hardware.

1.2 RELATED WORK:

A. Color of shade cloth and color of exposed parts of venetian blinds, (including tapes and cords) : See Construction Documents.

1.3 QUALITY ASSURANCE:

A. Manufacturer's Qualification: Submit evidence that the manufacture has a minimum of three (3) years' experience in providing item of type specified, and that the blinds have performed satisfactorily on similar installations. Submit qualifications.

B. Submit qualifications for installers who are trained and approved by manufacturer for installation of units provided.

C. Electrical Requirements:
1. NFPA 70 Article 100.
2. Listed and labeled in accordance with UL 325.
3. Marked for intended use, and tested as a system.
4. Individual testing of components is not acceptable in lieu of system testing.

1.4 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Samples:
1. Shade cloth, each type, 610 mm (24 inch) square, including cord and ring, showing color, finish and texture.

C. Manufacturer's literature and data; showing details of construction and hardware for:
1. Cloth and window shades
2. \
3. \

D. Shop Drawings: Provide fabrication and installation details for cloth shades, including shade cloth materials, their orientation to rollers, and their seam and batten locations.

E. Fire Testing: Submit report of flame spread and smoke developed during product material tests by independent testing laboratory.

F. Manufacturer's warranty.

1.5 WARRANTY:

A. Construction Warranty: Comply with FAR clause 52.246-21, "Warranty of Construction".

B. Manufacturer Warranty: Manufacturer shall warranty their window shades for a minimum of five (5) years from date of installation and final acceptance by the Government. Submit manufacturer's warranty.

1.6 APPLICABLE PUBLICATIONS:

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced to in the text by the basic designation only.

B. Federal Specifications (Fed. Spec.):
AA-V-00200B ..... Venetian Blinds, Shade, Roller, Window, Roller, Slat, Cord, and Accessories

C. ASTM International (ASTM):
A240/A240M-14 ..... Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

B221-14 ..... Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

B221M-13 ..... Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes (Metric)

G21-13 ..... Determining Resistance of Synthetic Polymeric Materials to Fungi

D. National Electric Manufacturer's Association (NEMA):
ICS 6-93(R2006) ..... Industrial Control and Systems Closures

E. National Fire Protection Association (NFPA):
70-14 ..... National Electrical Code (NEC)

701-15 ..... Fire Tests for Flame Propagation of Textiles and Films

F. Underwriters Laboratories Inc. (UL):
325-06(R2013) ..... Door, Drapery, Gate, Louver, and Window Operators and Systems

PART 2 - PRODUCTS

2.1 CLOTH SHADES:

A. Light-Filtering Shade Cloth: Woven fabric, stain and fade resistant.
1. Weave: Basketweave.
2. Thickness: 0.9144 mm (0.036 inch)
3. Weight: 678.1 grams per square meter (20 ounces per square yard).
4. Orientation on Shadeband: Up the bolt .
5. Openness Factor: 3 percent.
6. Fire-Test-Response Characteristics: Passes NFPA 701 small and large-scale vertical burn. Submit report for testing of shade cloth materials identical to products provided.
7. Drive-End Location: As indicated on construction documents.
8. Shade Cloth Anti-Microbial Characteristics: 'No Growth' per ASTM G21 results for fungi ATCC9642, ATCC9677, and ATCC9645.

2.2 MATERIALS:

A. Stainless Steel: ASTM A240/A240M.

B. Extruded Aluminum: ASTM B221M (B221).

C. Cords for Cloth roller shades : #10 stainless steel chain having not less than 80 kg (175 pounds) breaking strength.

2.3 FASTENINGS:

A. Zinc-coated or cadmium plated steel or stainless steel fastenings of length and type recommended by manufacturer. Except as otherwise specified, provide fastenings for installation with various structural materials as follows:

Type of Fastening	Structural Material
Wood screw	Wood
Tap screw	Metal
Case-hardened, self-tapping screw in pre-drilled hole	Solid masonry, concrete
Screw or bolt in expansion shields	Solid masonry, concrete
Toggle bolts	Hollow blocks, gypsum wallboard, plaster

2.4 FABRICATION:

A. Fabricate cloth shades to fit measurements of finished openings obtained at site.

B. Cloth Shades: Rolling type, constructed of shade cloth mounted on rollers. Provide shade cloth with plain sides, and with hem at bottom to accommodate weight bar.
   1. Provide separate shades for each individual sash within opening. Provide shade length that exceeds height of window by 305 mm (12 inches) measured from head to sill, in addition to material required to make-up hem:
      a. Provide rollers with spindles, nylon bearings, tempered steel springs, and other related accessories required for positive action.
      b. Provide rollers of diameter and wall thicknesses required to accommodate operating mechanisms, weights, and widths of shadebands indicated without deflection.
      c. Provide rollers with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
      d. Secure shade cloth to rollers to prevent wrinkling or folding, and on line parallel to axis of rollers so that shade hangs plumb.
      e. Secure shade cloth with zinc-coated steel or stainless steel machine screws spaced not over 228 mm (9 inches) on centers.
      f. Do not attach shade cloth to rollers with tacks.
      g. Provide hem bar of extruded aluminum for entire width of shade band. Heat seal hem bar on all sides to prevent removal.
      h. Provide eyelets with clear openings large enough to accommodate cords, without cutting into cloth when set.
      i. Provide cords of sufficient length to permit shades to be drawn to bottom of opening with ends looped and held with cord rings. Attach cords to hems through metal eyelets in center of slats in bottom hems.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Measure openings before fabrication. Do not scale construction documents.

B. Cloth Shades: Mount window shades on end of face brackets, set on metal gussets, or casing of windows as required. Provide extension face brackets where necessary at mullions.
   1. Locate rollers in level position as high as practicable at heads of windows.
   2. Install shades to prevent infiltration of light over rollers.
   3. Where extension brackets are necessary for alignment of shades, provide metal lugs, and rigidly anchor lugs and brackets.
   4. Place brackets and rollers so that shades do not interfere with window and screen hardware.
   5. Mount shade to allow clearances for window operation hardware.

6. Shade installation methods not specifically described, are subject to approval of Contracting Officer Representative (COR).

3.2 ADJUSTING:

A. Adjust and shades to operate smoothly, free from binding or malfunction throughout entire operational range.

3.3 CLEANING AND PROTECTION:

A. Clean shade surfaces after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions that ensure that shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged shades that cannot be repaired, in a manner approved by COR before time of Substantial Completion.

3.4 DEMONSTRATION:

A. Furnish services of factory-authorized service representative to train maintenance personnel to adjust, operate, and maintain motorized shade operation systems.

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SECTION 12 32 00

MANUFACTURED WOOD CASEWORK

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies plastic laminate casework as detailed on the construction documents, including related components and accessories required to form integral units. Wood casework items shown on the construction documents, but not specified below are to be included as part of the work under this section, and applicable portions of the specification are to apply to these items.

1.2 RELATED WORK

A. Section 07 92 00, JOINT SEALANTS: Sealants.

B. SCHEDULE OF FINISHES: Color of Casework Finish.

C. Section 09 22 16, NON-STRUCTURAL METAL FRAMING: Backing Plates for Wall Mounted Casework.

D. Section 09 65 13, RESILIENT BASE AND ACCESSORIES: Resilient Base.

E. Backing Plates for Wall Mounted Casework: Section 09 22 16, NON-STRUCTURAL METAL FRAMING.

F. Section 12 36 00, COUNTERTOPS: Countertop Construction and Materials and Items Installed in Countertops: Section 12 36 00, COUNTERTOPS.

G. Division 22, PLUMBING: Plumbing Requirements Related to Casework.

H. Division 26, ELECTRICAL: Electrical Lighting and Power Requirements Related to Casework.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:
   1. Locks for doors and drawers.
   2. Adhesive cements.
   3. Casework hardware.

C. Samples:
   1. Plastic laminate.

D. Shop Drawings (1/2 full size):
   1. Each casework type, showing details of construction, including materials, hardware and accessories.
   2. Fastenings and method of installation.

E. Certification:
   1. Manufacturer’s qualifications specified.
   2. Installer’s qualifications specified.

1.4 QUALITY ASSURANCE

A. Approval by COR is required of manufacturer and installer based upon certification of qualifications specified.

B. Manufacturer’s qualifications:

1. Manufacturer is regularly engaged in design and manufacture of modular plastic laminate casework, casework components and accessories of scope and type similar to indicated requirements for a period of not less than five (5) years.
2. Manufacturer has successfully completed at least three (3) projects of scope and type similar to indicated requirements.
3. Submit manufacturer's qualifications and list of projects, including owner contact information.

C. Installer Qualifications:
1. Installer has completed at least three (3) projects in last five (5) years in which these products were installed.
2. Submit installer qualifications.

1.5 WARRANTY

A. Construction Warranty: Comply with FAR clause 52.246-21 "Warranty of Construction".

B. Manufacturer Warranty: Manufacturer shall warranty their wood casework for a minimum of five (5) years from date of installation and final acceptance by the Government. Submit manufacturer warranty.

1.6 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.

B. ASTM International (ASTM):
a. A240/A240M-20 Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
b. A1008/A1008M-18 Steel, Sheet, Cold-Rolled, Carbon, Structural, High Strength Low Alloy
c. C1036-16 Flat Glass

C. Builders Hardware Manufacturers Association (BHMA):
a. A156.1-16 Butts and Hinges
b. A156.5-20 Auxiliary Locks and Associated Products
A156.9-15.....Cabinet Hardware
c. A156.11-19 Cabinet Locks
A156.16-18.....Auxiliary Hardware

D. Composite Panel Association (CPA):
a. A208.1-09 Particleboard
b. A208.2-09 Medium Density Fiberboard (MDF) for Interior Applications

E. U.S. Department of Commerce Product Standards (Prod. Std):
a. PS 1-09 Construction and Industrial Plywood

F. Hardwood, Plywood and Veneer Association (HPVA):
a. HP-1-16 Hardwood and Decorative Plywood

G. Architectural Woodwork Institute (AWI):
a. Architectural Woodwork Standards, Edition 2 Certification Program - 2014

H. American Society of Mechanical Engineers (ASME):
a. A112.18.1-18 Plumbing Fixture Fittings

I. National Electrical Manufacturers Association (NEMA):
a. LD 3-05 High Pressure Decorative Laminates

J. Scientific Equipment and Furniture Association (SEFA):
a. 2.3-10 Installation of Scientific Laboratory Furniture and Equipment

K. Underwriters Laboratories Inc. (UL):

437-13 .....Key Locks

PART 2 - PRODUCTS

2.1 PLASTIC LAMINATE

A. NEMA LD 3.

B. Exposed decorative surfaces, both sides of cabinet doors, and for items having plastic laminate finish. General purpose Type HGL.

C. Cabinet Interiors Including Shelving: Both of following options to comply with NEMA LD 3 as a minimum.
   1. Plastic laminate clad plywood or particleboard, MDF (excluding shelves).
   2. Thermafoil.
   3. Low pressure laminate (LPL).

D. Backing sheet on bottom of plastic laminate covered wood tops. Backer Type BKL.

E. Post Forming Fabrication, Decorative Surface: Post forming Type HGP.

2.2 PLYWOOD, SOFTWOOD

A. Prod. Std. PS1, five (5) ply construction from 13 mm to 28 mm (1/2 inch to 1-1/8 inch) thickness, and seven (7) ply for 31 mm (1 1/4 inch) thickness.

2.3 PARTICLEBOARD

A. CPA A208.1, Type 1, Grade M or medium density.

2.4 MEDIUM DENSITY FIBERBOARD (MDF)

A. Fully waterproof bond conforming to CPA A208.1 and CPA A208.2.

2.5 GLASS

A. ASTM C1048 Kind FT Type I, Class 1, Quality q3.

B. For Doors: 6 mm (1/4 inch) thick; except where laminated glass is shown on construction documents.

C. For Shelves: 9 mm (3/8 inch) thick.

D. Laminated Glass: Fabricate of two (2) sheets of 3 mm (1/8 inch) thick clear ASTM C1172 Kind LT glass, laminated together with a 1.5 mm (0.060 inch) thick vinyl interlayer, to a total overall thickness of 8 mm (5/16 inch).

2.6 HARDWARE

A. Cabinet Locks:
   1. Provide where locks are indicated on construction documents.
   2. Locked pair of hinged doors over 915 mm (36 inches) high:
      a. ANSI/BHMA A156.5, key one side.
      b. On active leaf use three (3) point locking device, consisting of two (2) steel rods and lever controlled cam at lock, to operate by lever having lock cylinder housed therein.
      c. On inactive leaf provide dummy lever of same design.
      d. Provide keeper holes for locking device rods and cam.
   3. Door and Drawer: ANSI/BHMA A156.11 cam locks. Provide one (1) type for each condition as follows:
      a. Drawer and Hinged Door up to 915 mm (36 inches) high: E07261.
      b. Drawer and Hinged Door: Pin-tumbler, cylinder type lock with not less than four (4) pins or a UL 437 rated wafer lock with brass working parts and case.
      c. Sliding Door: E07161.

4. Key locks differently for each type casework and master key for each service, such as Nursing Units, Administrative, Pharmacy.
   a. Key drug locker inner door different from outer door.
   b. Furnish two (2) keys per lock.
   c. Furnish six (6) master keys per service or Nursing Unit.
5. Marking of Locks and Keys:
   a. Name of manufacturer, or trademark which can readily be identified legibly marked on each lock and key change number marked on exposed face of lock.
   b. Key change numbers stamped on keys.
   c. Key change numbers to provide sufficient information for manufacturer to replace key.

B. Hinged Doors:
1. Provide doors 915 mm (36 inches) and more in height with three (3) hinges and doors less than 915 mm (36 inches) in height is to have two (2) hinges. Each door is to close against two (2) rubber bumpers.
2. Concealed Hinges: BHMA A156.9, Type B01602, 170 degrees of opening, self-closing.
3. Fasteners: Provide full thread wood screws to fasten hinge leaves to door and cabinet frame. Finish screws to match finish of hinges.

C. Door Catches:
1. Friction or Magnetic type fabricated with metal housing.
2. Provide one (1) catch for cabinet doors 1220 mm (48 inches) high and under, and two (2) for doors over 1220 mm (48 inches) high.

D. Drawer and Door Pulls:
1. Doors and drawers to have flush pulls, fabricated of either chromium-plated brass, chromium plated steel, stainless steel, or anodized aluminum. Drawer and door pulls to be of a design that can be operated with a force of 22.2 N (5 pounds) or less, with one (1) hand and not require tight grasping, pinching or twisting of the wrist.

E. Drawer Slides:
1. Full extension steel slides with nylon ball-bearing rollers.
2. Slides to have positive stop.
3. Equip drawers with rubber bumpers.

F. Sliding Doors:
1. Each door to be supported by two ball bearing bronze or nylon rollers, or sheaves riding on a stainless steel track at top or bottom, and to be restrained by a nylon or stainless steel guide at the opposite end.
2. Plastic guides are not acceptable.
3. Each door to have rubber silencers set near top and bottom of each jamb.

G. Shelf Standards (Except For Fixed Shelves):
1. Bright zinc-plated steel for recessed mounting with screws, 16 mm (5/8 inch) wide by 5 mm (3/16 inch) high providing 13 mm (1/2 inch) adjustment, complete with shelf supports.

H. Gate Bolt:
1. Surface mounted barrel type with strike.

I. Hinged Gates:
1. Gates to have two (2) double-acting pivots, size as required for gate size and weight.

2.7 MANUFACTURED PRODUCTS

A. When two (2) or more units are required, use products of one (1) manufacturer.

B. Manufacturer of casework assemblies is to assume complete responsibility for the final assembled unit.

C. Provide products of a single manufacturer for parts which are alike.

2.8 FABRICATION

A. Casework to be of the flush overlay design and, except as otherwise specified, be of Premium Grade construction and of component thickness in conformance with AWI Quality Standards.

B. Fabricate casework of plastic laminated covered plywood as follows:
   1. Where shown, gates, doors, drawers, shelves, all semi-concealed surfaces to be plastic laminated.

C. Provide plastic laminated covered plywood sloping tops for casework where shown on construction drawings. Fasten sloping tops with oval-head screws inserted from interior. Exposed ends of sloping tops to have plastic laminated covered plywood closures fastened as recommended by manufacturer.

D. Support Members for Tops of Tables and Countertops:
   1. Construct as detailed on construction documents.
   2. Provide miscellaneous steel members and anchor as shown on construction drawings.

E. Legs for Counters:
   1. Fabricate legs for counters of 1.6 mm (0.0635 inch) thick, 38 mm (1-1/2 inch) square tubular steel.
   2. Secure legs to counter tops and provide legs at bottom with shoes not less than 25 mm (1 inch) in height.
   3. Fabricate shoes of stainless steel, aluminum or chromium plated brass.

F. Cantilever Table Supports:
   1. Wall mounted steel supports to carry 635 mm (25 inch) wide table and supported load of 136 kg (300pounds).

2.9 PRODUCTS OF OTHER COMPONENTS DIRECTLY RELATED TO CASEWORK

A. Refer to Section 07 92 00, JOINT SEALANTS for work related to sealants used in conjunction with joints of countertops, casework systems, and adjacent materials.

B. Refer to Section 09 65 13, RESILIENT BASE AND ACCESSORIES for work related to rubber base adhered to casework systems.

C. Refer to Section 09 22 16, NON-STRUCTURAL METAL FRAMING for backing plates used in conjunction with wall assemblies for the attachment of casework systems.

D. Refer to Section 12 36 00, COUNTERTOPS for work related to plastic laminate, acid-resistant plastic laminate, metal, molded resin, wood, and methyl methacrylic polymer countertops and/or shelving used in conjunction with casework systems. When countertop materials are provided by the casework manufacturer, they are to include the following features:
   1. Capable of being suspended from vertical support rails or horizontal wall strips or service modules.
   2. Provided with rounded corners and impact resistant material on exposed edges.
   3. Capable of being easily relocated and installed without tools.
   4. Capable of being suspended and easily changed under counter mounted storage units.
   5. Provide leveling adjustment capability so units can be brought into a level position.
   6. Secured using fasteners. Show detail on shop drawings.

E. Refer to Section 12 36 00, COUNTERTOPS for work related to and integral with countertop systems such as pegboards, funnel and graduate racks.

F. Refer to Division 22, PLUMBING for the following work related to casework systems:
   1. Sinks, faucets and other plumbing service fixtures, venting, and piping systems.
   2. Compressed air, gas, vacuum and piping systems.

G. Refer to Division 26, ELECTRICAL for the following work related to casework systems:
   1. Connections and wiring devices.
   2. Connections and lighting fixtures except when factory installed by the manufacturer.

PART 3 - EXECUTION

3.1 COORDINATION

A. Begin only after work of other trades is complete, including wall and floor finish completed, ceilings installed, light fixtures and diffusers installed and connected and area free of trash and debris.

B. Verify location and size of mechanical and electrical services as required and perform cutting of components of work installed by other trades.

C. Verify reinforcement of walls and partitions for support and anchorage of casework.

D. Coordinate with other Divisions and Sections of the specification for work related to installation of casework systems to avoid interference and completion of service connections.

3.2 INSTALLATION

A. Install casework in accordance with manufacturer's written instructions and per recommendations.
   1. Install in available space; arranged for safe and convenient operation and maintenance.
   2. Align cabinets for flush joints except where shown otherwise.
   3. Install with bottom of wall cabinets in alignment and tops of base cabinets aligned level, plumb, true, and straight to a tolerance of 3.2 mm in 2438 mm (1/8 inch in 96 inches).
   4. Install corner cabinets with hinges on corner side with filler or spacers sufficient to allow opening of drawers.

B. Support Rails:
   1. Install true to horizontal at heights shown on construction documents; maximum tolerance for uneven floors is plus or minus 13 mm (1/2 inch).
   2. Shim as necessary to accommodate variations in wall surface not exceeding 5 mm (3/16 inch) at fastener.

C. Wall Strips:
   1. Install true to vertical and spaced as shown on construction documents.
   2. Align slots to assure that hanging units will be level.

D. Plug Buttons:
   1. Install plug buttons in predrilled or prepunched perforations not used.
   2. Use chromium plate plug buttons or buttons finish to match adjacent surfaces.

E. Seal junctures of casework systems with mildew-resistant silicone sealants as specified in Section 07 92 00, JOINT SEALANTS.

3.3 CLOSURES AND FILLER PLATES

A. Close openings larger than 6 mm (1/4 inch) wide between cabinets and adjacent walls with flat, steel closure strips, scribed to required contours, or machined formed steel fillers with returns, and secured with sheet metal screws to tubular or channel members of units, or bolts where exposed on inside.

B. Where ceilings interfere with installation of sloping tops, omit sloping tops and provide flat steel filler plates.

C. Secure filler plates to casework top members, unless shown otherwise on construction documents.

D. Secure filler plates more than 152 mm (6 inches) in width top edge to a continuous 25 x 25 mm (1 x 1 inch) 0.889 mm (1/16 inch) thick steel formed steel angle with screws.

E. Anchor angle to ceiling with toggle bolts.

F. Install closure strips at exposed ends of pipe space and offset opening into concealed space.

G. Finish closure strips and fillers with same finishes as cabinets.

3.4 FASTENINGS AND ANCHORAGE

A. Do not anchor to wood ground strips.

B. Provide hat shape metal spacers where fasteners span gaps or spaces.

C. Use 6 mm (1/4 inch) diameter toggle or expansion bolts, or other appropriate size and type fastening device for securing casework to walls or floor. Use expansion bolts shields having holding power beyond tensile and shear strength of bolt and breaking strength of bolt head.

D. Use 6 mm (1/4 inch) diameter hex bolts for securing cabinets together.

E. Use 6 mm (1/4 inch) by minimum 38 mm (1-1/2 inch) length lag bolt anchorage to wood blocking for concealed fasteners.

F. Use not less than No. 12 or 14 wood screws with not less than 38 mm (1-1/2 inch) penetration into wood blocking.

G. Space fastening devices 305 mm (12 inches) on center with minimum of three (3) fasteners in 915 or 1220 mm (3 or 4 foot) unit width.

H. Anchor floor mounted cabinets with a minimum of four (4) bolts through corner gussets. Anchor bolts may be combined with or separate from leveling device.

I. Secure cabinets in alignment with hex bolts or other internal fastener devices removable from interior of cabinets without special tools. Do not use fastener devices which require removal of tops for access.

J. Where units abut end to end, anchor together at top and bottom of sides at front and back. Where units are back to back, anchor backs together at corners with hex bolts placed inconspicuously inside casework.

K. Where type, size, or spacing of fastenings is not shown on construction documents or specified, show on shop drawings proposed fastenings and method of installation.

3.5 ADJUSTMENTS

A. Adjust equipment to insure proper alignment and operation.

B. Replace or repair damaged or improperly operating materials, components or equipment.

3.6 CLEANING

A. Immediately following installation, clean each item, removing finger marks, soil and foreign matter.

B. Remove from job site trash, debris and packing materials.

C. Leave installed areas clean of dust and debris.

3.7 INSTRUCTIONS

A. Provide operational and cleaning manuals and verbal instructions in accordance with Article INSTRUCTIONS, SECTION 01 00 00, GENERAL REQUIREMENTS.

B. Provide in service training both prior to and after facility opening. Coordinate in service activities with COR.

C. Commencing at least seven (7) days prior to opening of facility, provide one (1) four (4) hour day of on-site orientation and technical instruction on use and cleaning procedures application to products and systems specified herein.

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SECTION 12 36 00

COUNTERTOPS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies casework countertops with integral accessories.

B. Integral accessories include:
1. Sinks with traps and drains.
2. Eye and Face Wash Units.
3. Mechanical Service fixtures.
4. Electrical Receptacles.
5. Hot Plates (Range)
6. Pegboards

1.2 RELATED WORK

A. DIVISION 22, PLUMBING.

B. DIVISION 26, ELECTRICAL.

C. Equipment Reference Manual for SECTION 12 36 00, COUNTERTOPS.

1.3 SUBMITTALS

A. Submit in accordance with SECTION 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings
1. Show dimensions of section and method of assembly.
2. Show details of construction at a scale of ½ inch to a foot.

C. Samples:
1. 150 mm (6 inch) square samples each top.
2. Front edge, back splash, end splash and core with surface material and booking.

1.4 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. American Hardboard Association (AHA):
A135.4-95.....Basic Hardboard

C. Composite Panel Association (CPA):
A208.1-09.....Particleboard

D. American Society of Mechanical Engineers (ASME):
A112.18.1-12.....Plumbing Supply Fittings

A112.1.2-12.....Air Gaps in Plumbing System

A112.19.3-08(R2004).....Stainless Steel Plumbing Fixtures (Designed for Residential Use)

E. American Society for Testing and Materials (ASTM):
A167-99 (R2009).....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip

A1008-10.....Steel, Sheet, Cold-Rolled, Carbon, Structural, High Strength, Low Alloy

D256-10.....Pendulum Impact Resistance of Plastic

D570-98(R2005) .....Water Absorption of Plastics

D638-10.....Tensile Properties of Plastics

D785-08.....Rockwell Hardness of Plastics and Electrical Insulating Materials

D790-10.....Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

D4690-99(2005) .....Urea-Formaldehyde Resin Adhesives

F. Federal Specifications (FS):
A-A-1936 .....Adhesive, Contact, Neoprene Rubber

G. U.S. Department of Commerce, Product Standards (PS):
PS 1-95 .....Construction and Industrial Plywood

H. National Electrical Manufacturers Association (NEMA):
LD 3-05.....High Pressure Decorative Laminates

PART 2 - PRODUCTS

2.1 MATERIALS

A. Plastic Laminate: NEMA LD 3.
1. Concealed backing sheet Type BKL.
2. Decorative surfaces:
   a. Flat components: Type GP-HGL.
   b. Post forming: Type PF-HGP.
3. Chemical Resistant Surfaces
   a. Flat components: Type GP-HGL.
   b. Post forming: Type PF-HGP.
   c. Resistance to reagents:
      1) Test with five 0.25 mil drops remaining on surface for 16 hours followed by washing off with tap water, then cleaned with liquid soap and water, dried with soft cotton cloth and then cleaned with naphtha.
      2) No change in color, surface texture, and original protectability remaining from test results of following reagents:

98% Acetic Acid	Butyl Alcohol	Acetone
90% Formic Acid--	Benzine	Chloroform
28% Ammonium Hydroxide	Xylene	Carbon Tetrachloride
Zinc Chloride (Sat.)	Toluene	Cresol
Sodium Carbonate (Sat.)	Gasoline	Ether
Calcium Hypochlorite (Sat.)	Kerosene	Cottonseed Oil
Sodium Chloride (Sat.)	Mineral Oil	40% Formaldehyde
Methyl Alcohol	Ethyl Acetate	Trichlorethylene
Ethyl Alcohol	Amyl Acetate	Monochlorobenzine

      3) Superficial effects only: Slight color change, spot, or residue only with original protectability remaining from test results of following reagents:

77% Sulfuric Acid	37% Hydrochloric Acid	85% Phenol
33% Sulfuric Acid	20% Nitric Acid	Furfural
85% Phosphoric Acid	30% Nitric Acid	Dioxane

      4) Minimum height of impact resistance: 300 mm (12 inches).

B. Molded Resin:
1. Non-glare epoxy resin or furan resin compounded and cured for minimum physical properties specified:

Flexural strength	70 MPa (10,000 psi)	ASTM D790
Rockwell hardness	105	ASTM D785
Water absorption, 14 hours (weight)	.01%	ASTM D570

2. Material of uniform mixture throughout.

C. Stainless Steel: ASTM A167, Type 304.

D. Sheet Steel: ASTM A1008, cold rolled, Class 1 finish, stretcher leveled.

E. Particleboard: CPA A208.1, Grade 2-M-2.

F. Plywood: PS 1, Exterior type, veneer grade AC not less than five ply construction.

G. Hardwood Countertop: Solid maple, clear grade except where otherwise specified.

H. Hardboard: ANSI/AHA A135.4, Type I, tempered, fire retardant treated, smooth surface one side.

I. Adhesive
1. For plastic laminate FS A-A-1936.
2. For wood products: ASTM D4690, unextended urea resin or unextended melamine resin, phenol resin, or resorcinol resin.
3. For Field Joints:
   a. Epoxy type, resistant to chemicals as specified for plastic laminate laboratory surfaces.
   b. Fungi resistant: ASTM G-21, rating of 0.

J. Fasteners:
1. Metals used for welding same metal as materials joined.
2. Use studs, bolts, spaces, threaded rods with nuts or screws suitable for materials being joined with metal splice plates, channels or other supporting shape.

K. Solid Polymer Material:
1. Filled Methyl Methacrylic Polymer.
2. Performance properties required:

Property	Result	Test
Elongation	0.3% min.	ASTM D638
Hardness	90 Rockwell M	ASTM D785
Gloss (60^0 Gordon)	5-20	NEMA LD3.1
Color stability	No change	NEMA LD3 except 200 hour
Abrasion resistance	No loss of pattern Max wear depth 0.0762 mm (0.003 in) - 10000 cycles	NEMA LD3
Water absorption weight (5 max)	24 hours 0.9	ASTM D-570
Izod impact	14 N·m/m (0.25 ft-lb/in)	ASTM D256 (Method A)

Property	Result	Test
Impact resistance	No fracture	NEMA LD-3 900 mm (36") drop 1 kg (2 lb.) ball
Boiling water surface resistance	No visible change	NEMA LD3
High temperature resistance	Slight surface dulling	NEMA LD3

3. Cast into sheet form and bowl form.
4. Color throughout with subtle veining through thickness.
5. Joint adhesive and sealer: Manufacturers silicone adhesive and sealant for joining methyl methacrylic polymer sheet.
6. Bio-based products will be preferred.

L. Laminar Flow Control Device
1. Smooth bright stainless steel or satin finish, chrome plated metal laminar flow device shall provide non-aeration, clear, coherent laminar flow that will not splash in basin. Device shall also have a flow control restrictor and have vandal resistant housing.
2. Flow Control Restrictor:
   a. Capable of restricting flow of 7.5 to 8.5 Lpm (2.0 to 2.2 gpm) for sinks provided in paragraph 2.2D.
   b. Compensates for pressure fluctuation maintaining flow rate specified above within 10 percent between 175 and 550 kPa (25 and 80 psi).
   c. Operates by expansion and contraction, eliminates mineral/sediment building up with self clearing action, and is capable of easy manual cleaning.

2.2 SINKS

A. Molded Resin:
1. Cast or molded in one piece with interior corners 25 mm (one inch) minimum radius.
2. Minimum thickness of sides and ends 13 mm (1/2 inch), bottom 16 mm (5/8 inch).
3. Molded resin outlet for drain and standpipe overflow.
4. Provide clamping collar permitting connection to 38 mm (1-1/2 inch) or 50 mm (2 inch) waste outlet and trap, making sealed but not permanent connection.

B. Stainless Steel:
1. ANSI/ASME A112.19.3, Type 304.
2. Self rim for plastic laminate or similar tops with concealed fasteners.
3. Flat rim for welded into stainless steel tops.
4. Ledge back or ledge sides with holes to receive required fixtures when mounted on countertop.
5. Apply fire resistant sound deadening material to underside.

C. Stainless steel circular or oval shaped bowl.

D. Sinks of Methyl Methacrylic Polymer:
1. Minimum 19 mm (3/4 inch) thick, cast into bowl shape with overflow to drain.
2. 2Provide for underhung installation to countertop.
3. Provide openings for drain.

2.3 TRAPS AND FITTINGS

A. Material as specified in DIVISION 22, PLUMBING.

B. For Molded Resin Sinks:
1. Chemical resisting P-traps and fittings for chemical waste service.
2. Provide traps with cleanout plug easily removable without tools.

C. For Stainless Steel Sinks:
   1. Either cast or wrought brass or stainless steel P-traps and drain fittings; ASME A112.18.1
   2. Flat strainer, except where cup strainer or overflow standpipe specified.
      a. Provide cup strainer in cabinet type 1B.
      b. Provide stainless steel overflow stand pipe to within 38 mm (1-1/2 inches) of sink rim.
   3. Exposed surface chromium plated finish.

D. Plaster traps:
   1. Cast iron body with porcelain enamel exterior finish.
   2. 50 mm (2 inch) female threaded side inlet and outlet.
   3. Removable galvanized cage having integral baffles and replaceable brass screens.
   4. Removable gasketed cover.
   5. Minimum overall dimensions: 350 x 350 x 400 mm high (14 x 14 x 16 inches) with 175 mm (7 inch) water seal.
   6. Non-siphoning and easily accessible for cleaning.

E. Air Gap Fittings: ASME A112.1.2.

F. Methyl Methacrylic Polymer Sink Traps:
   1. Cast or wrought brass with flat grid strainer, off-set tail piece, adjustable 38 x 32 mm (1-1/2 x 1 1/4-inch) P trap.
   2. Chromium plated finish.

2.4 WATER FAUCETS

A. ASME A112.18.1.
   1. Cast or forged brass, compression type with replaceable seat and stem assembly or replaceable cartridge.
   2. Indexed lever handles either with or without head.
   3. Gooseneck minimum clearance above countertop of 190 mm (7-1/2 inches), bent 180 degrees for vertical discharge.
   4. Swing spouts elevated to clear handles.
   5. Exposed brass surfaces chromium plated.
   6. Cast combination hot and cold fixture with one piece body for multiple outlets.
   7. Adapter type connection which will permit field conversion of swing spouts to fixed or gooseneck grouts or vice versa.
   8. Pedestals Top for Laboratory or Pharmacy:
      a. Modern design tapered to a round base, factory assembled and tested.
      b. Brass shanks, locknuts and washers for attaching to top or curbs.

B. Laminar flow control device on spouts.

C. Automatic Controlled Faucets.
   1. Infra-red photocell sensor and a solenoid valve to control water flow automatically.
   2. Breaking light beam activates water flow.
   3. Water stops when user moves away from light beam.

D. Laboratory and Pharmacy Faucets:
   1. Female 9 mm (3/8 inch) IPS threaded outlet for attachment of filter pumps, hose connectors, anti-hose nozzle, or laminar flow control device on spout end.
   2. Provide angle type vacuum breaker for fixture, designed for low flow, with built-in floating disk and renewable seat in vacuum breaker body.

E. Eye and Face Wash Unit Pull-Out-Type:
   1. Deck mounted.
   2. Designed for vandal resistant push-down control valve and 6 foot hose.
   3. Eye and face wash head, provide a soft stream for flushing action.
   4. Valve, when opened; remain open until manually closed.

F. Eye and Face Bath, Counter Mounted:

1. Stainless Steel circular or oval shaped self rimmed sink, as shown on drawings.
2. Two fully enclosed rubber bound spray heads to provide an aerated flow of water simultaneously into both eyes and across face.
3. Push-pull hand operated valve.
4. Volume regulator for each spray.

G. Manifold, Tube-Washing:
1. Deck mounted
2. Three valved outlet, plus one bleeder outlet.
3. Vacuum breaker, and loose key stops with integral check valve.

H. Vanity or Lavatory Faucets in Methyl Methacrylic Polymer tops:
1. Extra long center set single lever handle control.
2. Cast or wrought copper alloy, vandal resistant.
3. Stainless steel ball type with replaceable non-metallic seats, stainless steel lined sockets.
4. Handle always returning to the neutral position or cartridge body construction.
5. Provide laminar flow control device.

2.5 FIXTURE IDENTIFICATION

A. Code fixtures with full view plastic index buttons.

B. Use following colors and codes:

SERVICE	COLOR	CODE	COLOR OF LETTERS
Cold Water	Dark Green	CW	White
Hot Water	Red	HW	White
Laboratory Air	Orange	AIR	Black
Fuel Gas	Dark Blue	GAS	White
Laboratory Vacuum	Yellow	VAC	Black
Distilled Water	White	DW	Black
Deionized Water	White	DI	Black
Oxygen	Light Green	OXY	White
Hydrogen	Pink	H	Black
Nitrogen	Gray	N	Black
All Other Gases	Light Blue	CHEM.SYM.	Black

2.6 ELECTRICAL RECEPTACLES

A. Hospital grade per electrical specifications.

B. Curb Mounted Receptacles:
1. NEMA 5-20R duplex in galvanized steel box.
2. Chromium plated brass or steel face plate.

C. Pedestal Mounted Receptacles:
1. NEMA 5-20R duplex installed in double faces.
2. Polished stainless steel or aluminum, or chromium plated brass pedestal.

2.7 ELECTRIC DROP-IN HOTPLATE (RANGE) UNITS

A. Built-in type units in stainless steel exposed surfaces.

B. Service -per drawings

C. Smooth flat cooking surfaces.

D. Metal sheath type heating units having removable heating elements and drip pans, protected terminals or lead wires with protected splices for connections and means for positive grounding.
   1. No open seams or holes in metal sheath and made of material that will not scale or crack at temperatures reached in service.
   2. Resistance wire: Uniformly spaced coil of nickel chromium alloy wire insulated from sheath by dense compaction of insulating material.
   3. Terminals or lead wires suitable for rating of units.

E. Heating Units:
   1. Double units rated not less than 2600 watts per unit.
   2. Not more than 200 mm (8 inches) in diameter.
   3. Capable of bringing four quarts of cold water to boil in six minutes.

F. Separate Control Unit:
   1. Suitably attached and prewired to range unit.
   2. Separate switch for each heating unit.
      a. Commercial quality, rotatable in either direction through 360 degrees.
      b. At least three heat levels.
   3. Operating dials for switches clearly marked to indicate control positions and easily visible in ordinary light.
   4. Control unit front removable.

G. Indicating light assembly
   1. Mounted on the Control Unit Front.
   2. Red lens and high brightness neon glow type lamp with resistor suitably for 25,000 hours average life.

H. Fuses and Circuit Breakers:
   1. Easily accessible from front of cabinet.
   2. Do not locate at back of storage or where articles can be stored in the front.

I. Range and Control Units Concealed Surfaces:
   1. Made of materials suitable for the intended use.
   2. Low carbon steel galvanized or other suitable corrosion resistant finish.
   3. Provide a solid 1.5 mm (0.0598 inch) thick sheet steel barrier below the unit, located a minimum of nine inches below the unit top.

2.8 COUNTERTOPS

A. Fabricate in largest sections practicable.

B. Fabricate with joints flush on top surface.

C. Fabricate countertops to overhang front of cabinets and end of assemblies 25 mm (one inch) except where against walls or cabinets.

D. Provide 1 mm (0.039 inch) thick metal plate connectors or fastening devices (except epoxy resin tops).

E. Join edges in a chemical resistant waterproof cement or epoxy cement, except weld metal tops.

F. Fabricate with end splashes where against walls or cabinets.

G. Splash Backs and End Splashes:
   1. Not less than 19 mm (3/4 inch) thick.
   2. Height 100 mm (4 inches) unless noted otherwise.
   3. Laboratories and pharmacy heights or where fixtures or outlets occur: Not less than 150 mm (6 inches) unless noted otherwise.
   4. Fabricate epoxy splash back in maximum lengths practical of the same material.

H. Drill or cutout for sinks, and penetrations.
   1. Accurately cut for size of penetration.
   2. Cutout for VL 81 photographic enlarger cabinet.

a. Finish cutout to fit flush with vertical side of cabinet, allowing adjustable shelf to fit into cutout space of cabinet at counter top level. Finish cutout surface as an exposed edge.
b. Provide braces under enlarger space to support not less than 45 kg (100 pounds) centered on opening side along backsplash.

I. Plastic Laminate Countertops:
1. Fabricate plastic laminate on five-ply plywood or particleboard core 19 mm (3/4 inch) thick with plastic laminate backing sheet.
2. Front edge over cabinets not less than 38 mm (1-1/2 inches) thick except where plastic "T" insert is used, not less than 19 mm (3/4 inch) thick.
3. Exposed Surfaces and edges of decorative laminated plastic or laboratory chemical resistant surfaces shall be finished with the material of the chosen countertop finish. Where countertops overhang over the edge of a cabinet without a bullnose edge wrap the countertop finish to cover the exposed under side of the overhang.

J. Metal Counter Tops:
1. Fabricate up to 3600 mm (12 feet) long in one piece, including nosing, backs and ends.
2. When counter tops exceed 3600 mm (12 feet) in length accurately fitted field joints are acceptable.
3. Finish thickness at edges 32 mm (1-1/4 inch).
4. Reinforced with minimum 1.5 mm (0.0598 inch) thick hat channel stiffeners, minimum of two stiffeners for units without sinks and three stiffeners for units with sinks welded or soldered to underside of top full length, except at sink openings.
5. Apply sound deadening material on underside.
6. Flange edges of tops down 32 mm (1-1/4 inch) and reinforce with concealed hardwood or with a steel frame.
7. Grind welds smooth and finished on exposed surfaces to match finish specified.
8. Stainless Steel Counter or Sink Tops:
a. Where noted stainless steel except where specified for nourishment unit, unit kitchen, and medicine cabinet.
b. Use 1.5 mm (0.0598 inch) thick stainless steel.
c. Depth of splash backs and splash ends 25 mm (one inch) and turned down at least 13 mm (1/2 inch) at wall. Where faucets are located in splash backs, fabricate depth of splash backs 50 mm (2 inches) with provision made to receive required fixture.
d. Where sinks occur fabricate top with 5 mm (3/16 inch) marine edge and fit flush with adjacent tops of other materials.
e. Weld sink flush to counter top and finish to appear seamless.

K. Counter Tops for Interchangeable Furniture: Counter tops, unless otherwise shown, are to be capable of vertical adjustment of 150 mm (6 inches). Fabricate tops, except CRS, in increments of units over which they fit with maximum length not to exceed 1950 mm (78 inches). Top section shall cover as many cabinet units as possible. Horizontal joints in counter tops at service strip and across depth of counter are be watertight when in place but of a type that can be easily separated and reset when counter top is moved up or down. Fabricate CRS tops in maximum lengths practicable, with field joints welded and ground smooth to match adjacent surfaces. Securely fasten to supporting rails with heavy metal fastening devices, or with screws, through pierced slots in such rails. Fabricate vertical splash back and reagent shelf in maximum length practicable of same material as working surface, except finish thickness shall be 19 mm (3/4 inch).

S. Countertop products shall comply with following standards for biobased materials:

Material Type	Percent by Weight
Composite Panel	89 percent biobased material
Hardwood	89 percent biobased material

Particleboard	89 percent biobased material
Plywood	89 percent biobased material

The minimum-content standards are based on the weight (not the volume)

of the material in the insulating core only.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Before installing countertops verify that wall surfaces have been finished as specified and that mechanical and electrical service locations are as required.

B. Secure countertops to supporting rails of cabinets with metal fastening devices, or screws through pierced slots in rails.
   1. Where type, size or spacing of fastenings is not shown or specified, submit shop drawings showing proposed fastenings and method of installation.
   2. Use round head bolts or screws.
   3. Use epoxy or silicone to fasten the epoxy resin countertops to the cabinets.
   4. Use wood or sheet metal screws for wood or plastic laminate tops; minimum penetration into top 16 mm (5/8 inch), screw size No 8, or 10.

C. Rubber Moldings:
   1. Where shown install molding with butt joints in horizontal runs and mitered joints at corners where ceramic tile occurs omit molding.
   2. Fasten molding to wall and to splashbacks and splashends with adhesive.

D. Sinks
   1. Install stainless steel sink in plastic laminate tops with epoxy compound to form watertight seal under shelf rim.
      a. In laboratory and pharmacy fit stainless steel sink with overflow standpipe.
      b. Install faucets and fittings on sink ledges with watertight seals where shown.
   2. Install molded resin sinks with epoxy compound to form watertight seal with underside of molded resin top.
      a. Install sink with not less than two channel supports with threaded rods and nuts at each end, expansion bolted to molded resin top.
      b. Design support for a twice the full sink weight.
      c. Install with overflow standpipes.
   3. Install methyl methacrylic polymer sinks in manufacturers recommended adhesive sealer or epoxy compound to underside of methyl methacrylic polymer countertop.
      a. Bolt or screw to countertop to prevent separation of bowl and fracture of adhesive sealant joint.
      b. Install drain and traps to sink.

E. Faucets, Fixtures, and Outlets:
   1. Seal opening between fixture and top.
   2. Secure to top with manufacturers standard fittings.

F. Range Tops, Electrical Outlets, Film Viewer:
   1. Set in cutouts with manufacturers gasket sealing joint with top to prevent water leakage.
   2. Install control unit and electric outlets where shown. Seal escutcheon plate at lap if on counter or top to prevent water leakage.

3.2 PROTECTION AND CLEANING

A. Tightly cover and protect against dirt, water, and chemical or mechanical injury.

B. Clean at completion of work.

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SECTION 13 05 41

SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS

PART 1 - GENERAL

1.1 DESCRIPTION:

A. Provide seismic restraint in accordance with the requirements of the drawings, VA Handbook H18-8: Seismic Design Requirements and this specification in order to maintain the integrity of non-structural components and equipment of the building so that they remain safe and functional in case of seismic event.

B. The design of seismic restraints of non-structural components to resist seismic load shall be based on Seismic Design parameters indicated below in accordance with VA H-18-8 in conjunction with ASCE 7, as specified in H-18-8 Section 4.0, for existing building retrofit projects. Specific requirements for Critical and Essential facilities are covered in Section 4.0 of H-18-8, including applying Ip = 1.5 for all nonstructural components in Critical facilities.) dated October 2016, http://www.cfm.va.gov/til/etc/seismic.pdf.
   1. International Building Code 2018Edition
   2. Building Seismic Design Category: B
      a. Per ASCE 7, the seismic design category of B exempts Seismic design requirements for mechanical and electrical components, and for architectural components with importance factors of 1.0

C. Definitions: Non-structural building components are components or systems that are not part of the building's structural system whether inside or outside, above or below grade. Non-structural components of buildings include but are not limited to (Refer to VA H-18-8, ASCE 7 and ASCE 41 for additional examples):
   1. Architectural Elements: Facades that are not part of the structural system and its shear resistant elements; cornices and other architectural projections and parapets that do not function structurally; glazing; nonbearing partitions; suspended ceilings; stairs isolated from the basic structure; cabinets; bookshelves; medical equipment; and storage racks, etc.
   2. Electrical Elements: Power and lighting systems; substations; switchgear and switchboards; auxiliary engine-generator sets; transfer switches; motor control centers; motor generators; selector and controller panels; fire protection and alarm systems; special life support systems; and telephone and communication systems, etc.
   3. Mechanical Elements: Heating, ventilating, and air-conditioning systems; medical gas systems; plumbing systems; sprinkler systems; pneumatic systems; boiler/chiller/utility plant/other equipment and components, etc.
   4. Transportation Elements: Mechanical, electrical and structural elements for transport systems, i.e., elevators and dumbwaiters, including hoisting equipment and counterweights.

1.2 RELATED WORK:

A. Acoustical Ceilings: Section 09 51 00 ACOUSTICAL CEILINGS

B. Interior Lighting: Section 26 51 00, INTERIOR LIGHTING

C. Division 21, FIRE SUPPRESSION

D. Division 22, Plumbing

E. Division 23, HEATING VENTILATING AND AIR CONDITIONING.

F. Division 26, ELECTRICAL

G. Division 27 COMMUNICATIONS

H. Division 28 ELECTRONIC SAFETY AND SECURITY
1.

1.3 QUALITY CONTROL:

A. Shop-Drawing Preparation:
1. Non-structural seismic restraint systems shop drawings and delegated design calculations shall be prepared by a professional structural engineer with a minimum of 5 years' experience in the design and detailing of seismic force restraints. The professional structural engineer shall be registered in the state where the project is located and submit qualifications with list of projects illustrating compliance with the experience requirement of this section.
2. Submit design tables and information used for the design-force levels, stamped and signed by a professional structural engineer registered in the State where project is located.

B. Coordination:
1. Do not install seismic restraints until seismic restraint submittals are approved by the Contracting Officers Representative (COR).
2. Coordinate trapezes or other multi-pipe hanger systems prior to submission of shop drawings for review.

C. Seismic Certification:
1. In structures assigned to Seismic Design Category C, D, E, or F, permanent equipment and components are to have Special Seismic Certification in accordance with requirements of section 13.2.2 of ASCE 7, including those required in existing buildings within Section 13.7.1.3.3, 13.7.7.3.3 and 13.7.8.3.3 of ASCE 41, except for equipment and components that are considered inherently rugged as listed in Section 4.2.2 of VA H18-8, and shall comply with section 13.2.6 of ASCE 7.

1.4 SUBMITTALS:

A. Submit a complete and coordinated set of bracing and signed and sealed anchorage drawings and calculations for all non-structural elements requiring seismic restraint by the delegated professional structural engineer mentioned in Section 1.3.A.1 for review prior to installation including:
1. Description, layout, and location of all items to be anchored or braced with anchorage or brace points noted and dimensioned.
2. Details of all anchorage and bracing at large scale with all members, parts brackets shown, together with all connections, bolts, welds etc. clearly identified and specified. Details shall be coordinated with all project conditions and trades prior to shop drawing submission for review.
3. Complete calculations including but not limited to seismic design criteria, computer model input and output, seismic design forces and capacities, design tables and information used for all proprietary design elements such as post installed anchors, stamped and signed by a professional structural engineer specified in section 1.3 A.1.
4. For all post installed anchorages submit the appropriate International Code Council Engineering Service (ICC-ES) evaluation reports, California's Office of Statewide Health Planning and Development(OSHPD) pre-approvals, or lab test reports verifying compliance with OSHPD Interpretation of Regulations 28-6.
5. Delegated professional structural engineer qualifications.

B. Submit for review prior to installation, the following for seismic protection of piping in addition to items noted in Section 1.4.A:
1. Single-line piping diagrams on a floor-by-floor basis. Show all suspended piping for a given floor on the same plain.
2. Type of pipe (Copper, steel, cast iron, insulated, non-insulated, etc.).

3. Pipe contents.
4. Structural framing for the seismic and gravity support and the main superstructure for which the bracing and or anchorage is attached.
5. Location of all gravity load pipe supports and spacing requirements.
6. Numerical value of gravity load reactions.
7. Location of all seismic bracing.
8. Numerical value of applied seismic brace loads.
9. Type of connection (Vertical support, vertical support with seismic brace etc.).
10. Seismic brace reaction type (tension or compression): Details illustrating all support and bracing components, methods of connections, and specific anchors to be used.

C. Submit for review prior to installation, the following items for seismic protection of suspended ductwork and suspended electrical and communication cables, in addition to items noted in Section 1.4.A:
1. Details illustrating all support and bracing components, methods of connection, and specific anchors to be used.
2. Numerical value of applied gravity and seismic loads and seismic loads acting on support and bracing components.
3. Maximum spacing of hangers and bracing.

1.5 APPLICABLE PUBLICATIONS:

A. The Publications listed below (including amendments, addenda revisions, supplements and errata) form a part of this specification to the extent referenced. The publications are referenced in text by basic designation only.

B. American Concrete Institute (ACI):
355.2-19 ..... Qualification for Post-Installed Mechanical Anchors in Concrete and Commentary

C. American Institute of Steel Construction (AISC):
Load and Resistance Factor Design, Volume 1, Second Edition

D. ASTM International (ASTM):
A36/A36M-19 ..... Standard Specification for Carbon Structural Steel

A53/A53M-18 ..... Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

A307-14e1 ..... Standard Specifications for Carbon Steel Bolts, and Studs, and Threaded Rod 60,000 PSIpsi Tensile Strength

A500/A500M-18 ..... Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

A501/A501M-14 ..... Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing

A615/A615M-20 ..... Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement

A992/A992M-11(2015)..... Standard Specification for Steel for Structural Shapes for Use in Building Framing

A996/A996M-16 ..... Standard Specification for Rail Steel and Axle Steel Deformed Bars for Concrete Reinforcement

E488/E488M-18 ..... Standard Test Methods for Strength of Anchors in Concrete Elements

F3125/F3125M ..... Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch

Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength

E. American Society of Civil Engineers
   1. Minimum Design Loads and Associated Criteria for Buildings and Other Structures (ASCE 7) Edition as indicated in section 1.1 B of this specification. Associated Criteria for Buildings and Other Structures (ASCE 7): 7-16

F. International Building Code (IBC) Edition as indicated in Section 1.1 B of this specification.

G. VA Handbook H18-8 Seismic Design Requirements, VA H-18-8, November 2019 (REVISED MAY 1,2020)

H. National Uniform Seismic Installation Guidelines (NUSIG)

I. Sheet Metal and Air Conditioning Contractors National Association

J. (SMACNA): Seismic Restraint Manual - Guidelines for Mechanical Systems, 3RD EDITION 2008 and Addendum

1.6 REGULATORY REQUIREMENT:

A. IBC as shown in Section 1.1 B of this specification.
   1. Exceptions: The omission of seismic restraints shall be allowed only in accordance with VA H18-8, ASCE 7.

PART 2 - PRODUCTS

2.1 STEEL:

A. Structural Steel: ASTM A36 and/or A992.

B. Structural Tubing: ASTM A500, Grade B.

C. Structural Tubing: ASTM A501.

D. Steel Pipe: ASTM A53/A53M, Grade B.

E. Bolts & Nuts: ASTM .A307.

2.2 CAST-IN-PLACE CONCRETE:

A. Concrete: 28 day strength, f'c = 27.5 MPa (4,000 psi)

B. Reinforcing Steel: ASTM A615/615M or ASTM A996/A996M deformed.

PART 3 - EXECUTION

3.1 CONSTRUCTION, GENERAL:

A. Provide equipment supports and anchoring devices to withstand the seismic design forces, so that when seismic design forces are applied, the equipment cannot displace, overturn, or become inoperable.

B. Provide anchorages in conformance with recommendations of the equipment manufacturer and as shown on approved shop drawings and calculations.

C. Construct seismic restraints and anchorage to allow for thermal expansion.

D. Testing Before Final Inspection:

1. Test 10-percent of anchors in masonry and concrete per ASTM E488, and ACI 355.2 to determine that they meet the required load capacity. If any anchor fails to meet the required load, test the next 20 consecutive anchors, which are required to have zero failure, before resuming the 10-percent testing frequency.
2. Before scheduling Final Inspection, submit a report on this testing indicating the number and location of testing, and what anchor-loads were obtained.
3. Construct seismic restraints and anchorages to not interfere with other trades or damage existing or in-situ elements of the constructed building.

3.2 EQUIPMENT RESTRAINT AND BRACING:

A. See drawings for equipment to be restrained or braced.

3.3 MECHANICAL DUCTWORK AND PIPING; BOILER PLANT STACKS AND BREACHING; ELECTRICAL BUSWAYS, CONDUITS, AND CABLE TRAYS; AND TELECOMMUNICATION WIRES AND CABLE TRAYS

A. Support and brace mechanical ductwork and piping; electrical busways, conduits and cable trays; and telecommunication wires and cable trays including boiler plant stacks and breeching to resist directional forces (lateral, longitudinal and vertical).

B. Brace duct and breeching branches with a minimum of 1 brace per branch.

C. Provide supports and anchoring so that, upon application of seismic forces, piping remains fully connected as operable systems which will not displace sufficiently to damage adjacent or connecting equipment, or building members.

D. Piping Connections: Provide flexible connections where pipes connect to equipment. Make the connections capable of accommodating relative differential movements between the pipe and equipment under conditions of earthquake shaking.

3.4 PARTITIONS

A. In buildings with flexible structural frames, anchor partitions to only structural element, such as a floor slab, and separate such partition by a physical gap from all other structural elements.

B. Properly anchor masonry walls to the structure for restraint, so as to carry lateral loads imposed due to earthquake along with their own weight and other lateral forces.

3.5 CEILINGS AND LIGHTING FIXTURES

A. At intervals required to meet the seismic demand forces, laterally brace suspended ceilings against lateral and vertical movements, and provide with a physical separation at the walls.

B. Independently support and laterally brace all lighting fixtures. Refer to applicable portion of lighting specification, Section 26 51 00, INTERIOR LIGHTING.

3.6 FACADES AND GLAZING

A. Do not install concrete masonry unit filler walls in a manner that can restrain the lateral deflection of the building frame. Provide a gap with adequately sized resilient filler to separate the structural frame from the non-structural filler wall.

B. Tie brick veneers to a separate wall that is independent of the steel frame as shown on construction drawings to ensure strength against applicable seismic forces at the project location.

C. Install attachments to structure for all façade materials as shown on construction drawings to ensure strength against applicable seismic forces at the project location.

3.7 STORAGE RACKS, CABINETS, AND BOOKCASES

A. Install storage racks to withstand earthquake forces and anchored to the floor or laterally braced from the top to the structural elements.

B. Anchor medical supply cabinets to the floor or walls and equip them with properly engaged, lockable latches.

C. Anchor filing cabinets that are more than 2 drawers high to the floor or walls, and equip all drawers with properly engaged, lockable latches.

D. Anchor bookcases that are more than 30 inches high to the floor or walls, and equip any doors with properly engaged, lockable latches.

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SECTION 21 08 00

COMMISSIONING OF FIRE SUPPRESSION SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. The requirements of this Section apply to all sections of Division 21.

B. This project will have selected building systems commissioned. The complete list of equipment and systems to be commissioned is specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS. The commissioning process, which the Contractor is responsible to execute, is defined in Section 01 91 00 GENERAL COMMISSIONING REQUIRMENTS. A Commissioning Agent (CxA) appointed by the VA will manage the commissioning process.

1.2 RELATED WORK

A. Section 01 00 00 GENERAL REQUIREMENTS.

B. Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

C. Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

1.3 SUMMARY

A. This Section includes requirements for commissioning the Fire Suppression systems, subsystems and equipment. This Section supplements the general requirements specified in Section 01 91 00 General Commissioning Requirements.

B. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for more details regarding processes and procedures as well as roles and responsibilities for all Commissioning Team members.

1.4 DEFINITIONS

A. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for definitions.

1.5 COMMISSIONED SYSTEMS

A. Commissioning of a system or systems specified in Division 21 is part of the construction process. Documentation and testing of these systems, as well as training of the VA's Operation and Maintenance personnel in accordance with the requirements of Section 01 91 00 and of Division 21, is required in cooperation with the VA and the Commissioning Agent.

B. The Fire Suppression systems commissioning will include the systems listed in Section 01 91 00 General Commissioning Requirements:

1.6 SUBMITTALS

A. The commissioning process requires review of selected Submittals. The Commissioning Agent will provide a list of submittals that will be reviewed by the Commissioning Agent. This list will be reviewed and approved by the VA prior to forwarding to the Contractor. Refer to Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, and SAMPLES for further details.

B. The commissioning process requires Submittal review simultaneously with engineering review. Specific submittal requirements related to the commissioning process are specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 CONSTRUCTION INSPECTIONS

A. Commissioning of the building fire suppression systems will require inspection of individual elements of the fire suppression construction throughout the construction period. The Contractor shall coordinate with the Commissioning Agent in accordance with Section 01 91 00 and the Commissioning plan to schedule inspections as required to support the Commissioning Process.

3.2 PRE-FUNCTIONAL CHECKLISTS

A. The Contractor shall complete Pre-Functional Checklists to verify systems, subsystems, and equipment installation is complete and systems are ready for Systems Functional Performance Testing. The Commissioning Agent will prepare Pre-Functional Checklists to be used to document equipment installation. The Contractor shall complete the checklists. Completed checklists shall be submitted to the VA and to the Commissioning Agent for review. The Commissioning Agent may spot check a sample of completed checklists. If the Commissioning Agent determines that the information provided on the checklist is not accurate, the Commissioning Agent will return the marked-up checklist to the Contractor for correction and resubmission. If the Commissioning Agent determines that a significant number of completed checklists for similar equipment are not accurate, the Commissioning Agent will select a broader sample of checklists for review. If the Commissioning Agent determines that a significant number of the broader sample of checklists is also inaccurate, all the checklists for the type of equipment will be returned to the Contractor for correction and resubmission. Refer to SECTION 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for submittal requirements for Pre-Functional Checklists, Equipment Startup Reports, and other commissioning documents.

3.3 CONTRACTORS TESTS

A. Contractor tests as required by other sections of Division 21 shall be scheduled and documented in accordance with Section 01 00 00 GENERAL REQUIREMENTS. All testing shall be incorporated into the project schedule. Contractor shall provide no less than 7 calendar days' notice of testing. The Commissioning Agent will witness selected Contractor tests at the sole discretion of the Commissioning Agent. Contractor tests shall be completed prior to scheduling Systems Functional Performance Testing.

3.4 SYSTEMS FUNCTIONAL PERFORMANCE TESTING

A. The Commissioning Process includes Systems Functional Performance Testing that is intended to test systems functional performance under steady state conditions, to test system reaction to changes in operating conditions, and system performance under emergency conditions. The Commissioning Agent will prepare detailed Systems Functional Performance Test procedures for review and approval by the COR. The Contractor shall review and comment on the tests prior to approval. The Contractor shall provide the required labor, materials, and test equipment identified in the test procedure to perform the tests. The Commissioning Agent will witness and document the testing. The Contractor shall sign the test reports to verify tests were performed. See Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS, for additional details.

3.5 TRAINING OF VA PERSONNEL

A. Training of the VA operation and maintenance personnel is required in cooperation with the COR and Commissioning Agent. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems. Contractor shall submit training agendas and trainer resumes in accordance with the requirements of Section 01 91 00. The instruction shall be scheduled in coordination with the COR after submission and approval of formal training plans.

Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS and Division 21 Sections for additional Contractor training requirements.

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SECTION 21 13 13

WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Design, installation and testing shall be in accordance with NFPA 13.

B. The design and installation of a hydraulically calculated automatic wet-pipe system complete and ready for operation, for the AB (First Floor) and CD (Second Floor).

C. Modification of the existing sprinkler system as indicated on the drawings and as further required by these specifications.

1.2 RELATED WORK

A. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Section 07 84 00, FIRESTOPPING.

C. Section 09 91 00, PAINTING.

D. Section 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING.

E. Section 28 31 00, FIRE DETECTION AND ALARM.

1.3 DESIGN CRITERIA

A. Design Basis Information: Provide design, materials, equipment, installation, inspection, and testing of the automatic sprinkler system in accordance with the requirements of NFPA 13.

1. Perform hydraulic calculations in accordance with NFPA 13 utilizing the Area/Density method. Do not restrict design area reductions permitted for using quick response sprinklers throughout by the required use of standard response sprinklers in the areas identified in this section.
2. Sprinkler Protection: Sprinkler hazard classifications shall be in accordance with NFPA 13. The hazard classification examples of uses and conditions identified in the Annex of NFPA 13 shall be mandatory for areas not listed below. Request clarification from the Government for any hazard classification not identified. To determining spacing and sizing, apply the following coverage classifications:
   a. Light Hazard Occupancies: Patient care, treatment, and customary access areas.
   b. Ordinary Hazard Group 1 Occupancies: Laboratories, Mechanical Equipment Rooms, Transformer Rooms, Electrical Switchgear Rooms, Electric Closets, and Repair Shops.
   c. Ordinary Hazard Group 2 Occupancies: Storage rooms, trash rooms, clean and soiled linen rooms, pharmacy and associated storage, laundry, kitchens, kitchen storage areas, retail stores, retail store storage rooms, storage areas, building management storage, boiler plants, energy centers, warehouse spaces, file storage areas for the entire area of the space up to 140 square meters (1500 square feet) and Supply Processing and Distribution (SPD).
3. Hydraulic Calculations: Calculated demand including hose stream requirements shall fall no less than 10 percent below the available water supply curve.
4. Water Supply: Contractor shall perform a flow test and design the new system based on the following information:
   a. Location _____
   b. Elevation Static Test Gauge _____ m (_____ ft)
   c. Elevation Residual Test Gauge _____ m (_____ ft)
   d. Static pressure: _____ kPa (_____ psi)
   e. Residual pressure: _____ kPa (_____ psi)

f. Flow: _____ L/s (_____ gpm)
g. Date: _____ Time _____

5. Zoning:
   a. For each sprinkler zone provide a control valve, flow switch, and a test and drain assembly with pressure gauge. For buildings greater than two stories, provide a check valve at each control valve.
   b. Sprinkler zones shall conform to the smoke barrier zones shown on the drawings.
6. Provide seismic protection in accordance with NFPA 13. Contractor shall submit load calculations for sizing of sway bracing for systems that are required to be protected against damage from earthquakes.

1.4 SUBMITTALS

A. Submit as one package in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Prepare detailed working drawings that are signed by a NICET Level III or Level IV Sprinkler Technician or stamped by a Registered Professional Engineer licensed in the field of Fire Protection Engineering. As the Government review is for technical adequacy only, the installer remains responsible for correcting any conflicts with other trades and building construction that arise during installation. Partial submittals will not be accepted. Material submittals shall be approved prior to the purchase or delivery to the job site. Suitably bind submittals in notebooks or binders and provide an index referencing the appropriate specification section. In addition to the hard copies, provide submittal items in Paragraphs 1.4(A)1 through 1.4(A)5 electronically in pdf format on a compact disc or as directed by the COR. Submittals shall include, but not be limited to, the following:

1. Qualifications:
   a. Provide a copy of the installing contractors fire sprinkler and state contractor's license.
   b. Provide a copy of the NICET certification for the NICET Level III or Level IV Sprinkler Technician who prepared and signed the detailed working drawings unless the drawings are stamped by a Registered Professional Engineer licensed in the field of Fire Protection Engineering.
   c. Provide documentation showing that the installer has been actively and successfully engaged in the installation of commercial automatic sprinkler systems for the past ten years.
2. Drawings: Submit detailed 1:100 (1/8 inch) scale (minimum) working drawings conforming to the Plans and Calculations chapter of NFPA 13. Drawings shall include graphical scales that allow the user to determine lengths when the drawings are reduced in size. Include a plan showing the piping to the water supply test location.
3. Manufacturer's Data Sheets: Provide data sheets for all materials and equipment proposed for use on the system. Include listing information and installation instructions in data sheets. Where data sheets describe items in addition to those proposed to be used for the system, clearly identify the proposed items on the sheet.
4. Calculation Sheets:
   a. Submit hydraulic calculation sheets in tabular form conforming to the requirements and recommendations of the Plans and Calculations chapter of NFPA 13.
   b. Submit calculations of loads for sizing of sway bracing in accordance with NFPA 13.
5. Valve Charts: Provide a valve chart that identifies the location of each control valve. Coordinate nomenclature and identification of control valves with COR. Where existing nomenclature does not exist, the chart shall include no less than the following: Tag ID No., Valve Size, Service (control valve, main drain, aux. drain, inspectors test valve, etc.), and Location.
6. Final Document Submittals: Provide as-built drawings, testing and maintenance instructions in accordance with the requirements in Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. In addition, submittals shall include, but not be limited to, the following:

a. A complete set of as-built drawings showing the installed system with the specific interconnections between the system switches and the fire alarm equipment. Provide a complete set in the formats as follows. Submit items 2 and 3 below on a compact disc or as directed by the COR.
   1) One full size (or size as directed by the COR) printed copy.
   2) One complete set in electronic pdf format.
   3) One complete set in AutoCAD format or a format as directed by the COR.
b. Material and Testing Certificate: Upon completion of the sprinkler system installation or any partial section of the system, including testing and flushing, provide a copy of a completed Material and Testing Certificate as indicated in NFPA 13. Certificates shall be provided to document all parts of the installation.
c. Operations and Maintenance Manuals that include step-by-step procedures required for system startup, operation, shutdown, and routine maintenance and testing. The manuals shall include the manufacturer's name, model number, parts list, and tools that should be kept in stock by the owner for routine maintenance, including the name of a local supplier, simplified wiring and controls diagrams, troubleshooting guide, and recommended service organization, including address and telephone number, for each item of equipment.
d. One paper copy of the Material and Testing Certificates and the Operations and Maintenance Manuals above shall be provided in a binder. In addition, these materials shall be provided in pdf format on a compact disc or as directed by the COR.
e. Provide one additional copy of the Operations and Maintenance Manual covering the system in a flexible protective cover and mount in an accessible location adjacent to the riser or as directed by the COR.

1.5 QUALITY ASSURANCE

A. Installer Reliability: The installer shall possess a valid State of New York fire sprinkler contractor's license. The installer shall have been actively and successfully engaged in the installation of commercial automatic sprinkler systems for the past ten years.

B. Materials and Equipment: All equipment and devices shall be of a make and type listed by UL or approved by FM, or other nationally recognized testing laboratory for the specific purpose for which it is used. All materials, devices, and equipment shall be approved by the VA. All materials and equipment shall be free from defect. All materials and equipment shall be new unless specifically indicated otherwise on the contract drawings.

1.6 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. National Fire Protection Association (NFPA):
   13-13 ..... Installation of Sprinkler Systems
   25-14 ..... Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems
   101-15 ..... Life Safety Code
   170-15 ..... Fire Safety Symbols

C. Underwriters Laboratories, Inc. (UL):
   Fire Protection Equipment Directory (2011)

D. Factory Mutual Engineering Corporation (FM):
   Approval Guide

PART 2 - PRODUCTS

2.1 PIPING & FITTINGS

A. Piping and fittings for private underground water mains shall be in accordance with NFPA 13.
   1. Pipe and fittings from inside face of building 300 mm (12 in.) above finished floor to a distance of approximately 1500 mm (5 ft.) outside building: Ductile Iron, flanged fittings and 316 stainless steel bolting.

B. Piping and fittings for sprinkler systems shall be in accordance with NFPA 13.
   1. Plain-end pipe fittings with locking lugs or shear bolts are not permitted.
   2. Piping sizes 50 mm (2 inches) and smaller shall be black steel Schedule 40 with threaded end connections.
   3. Piping sizes 65 mm (2 ½ inches) and larger shall be black steel Schedule 10 with grooved connections. Grooves in Schedule 10 piping shall be rolled grooved only.
   4. Use nonferrous piping in MRI Scanning Rooms.
   5. Plastic piping shall not be permitted except for drain piping.
   6. Flexible sprinkler hose shall be FM Approved and limited to hose with threaded end fittings with a minimum inside diameter or 1-inch and a maximum length of 6-feet.

2.2 VALVES

A. General:
   1. Valves shall be in accordance with NFPA 13.
   2. Do not use quarter turn ball valves for 50 mm (2 inch) or larger drain valves.

B. Control Valve: The control valves shall be a listed indicating type. Control valves shall be UL Listed or FM Approved for fire protection installations. System control valve shall be rated for normal system pressure but in no case less than 175 PSI.

C. Check Valve: Shall be of the swing type with a flanged cast iron body and flanged inspection plate.

D. Automatic Ball Drips: Cast brass 20 mm (3/4 inch) in-line automatic ball drip with both ends threaded with iron pipe threads.

E. Alarm Check Valve: Alarm check valve shall be UL Listed and Factory Mutual Approved. The alarm check valve shall be listed for installation in the vertical or horizontal position. The alarm check valve shall be equipped with a removable cover assembly, gauge connections on the system side and supply side of the valve clapper, variable pressure trim, and an external bypass to eliminate false water flow alarms. The alarm check valve trim piping shall be galvanized. Maximum water working pressure to 250 PSI.

2.3 FIRE DEPARTMENT SIAMESE CONNECTION

A. Not Applicable

2.4 SPRINKLERS

A. All sprinklers shall be FM approved quick response except “institutional” type sprinklers shall be permitted to be UL Listed quick response. Provide FM approved quick response sprinklers in all areas, except that standard response sprinklers shall be provided in freezers, refrigerators, elevator hoistways, elevator machine rooms, and generator rooms.

B. Temperature Ratings: In accordance with NFPA 13 except that sprinklers in elevator shafts and elevator machine rooms shall be no less than intermediate temperature rated and sprinklers in generator rooms shall be no less than high temperature rated.

C. Provide sprinkler guards in accordance with NFPA 13 and when the elevation of the sprinkler head is less than 7 feet 6 inches above finished floor. The sprinkler guard shall be UL listed or FM approved for use with the corresponding sprinkler.

2.5 SPRINKLER CABINET

A. Provide sprinkler cabinet with the required number of sprinkler heads of all ratings and types installed, and a sprinkler wrench for each type of sprinkler in accordance with NFPA 13. Locate adjacent to the riser.

B. Provide a list of sprinklers installed in the property in the cabinet. The list shall include the following:
   1. Manufacturer, model, orifice, deflector type, thermal sensitivity, and pressure for each type of sprinkler in the cabinet.
   2. General description of where each sprinkler is used.
   3. Quantity of each type present in the cabinet.
   4. Issue or revision date of list.

2.6 SPRINKLER SYSTEM SIGNAGE

A. Rigid plastic, steel or aluminum signs with white lettering on a red background with holes for easy attachment. Sprinkler system signage shall be attached to the valve or piping with chain.

2.7 SWITCHES:

A. OS&Y Valve Supervisory Switches shall be in a weatherproof die cast/red baked enamel, oil resistant, aluminum housing with tamper resistant screws, 13 mm (1/2 inch) conduit entrance and necessary facilities for attachment to the valves. Provide two SPDT switches rated at 2.5 amps at 24 VDC.

B. Water flow Alarm Switches: Mechanical, non-coded, non-accumulative retard and adjustable from 0 to 60 seconds minimum. Set flow switches at an initial setting between 20 and 30 seconds.

C. Alarm Pressure Switches: Activation by any flow of water equal to or in excess of the discharge from one sprinkler. The alarm pressure switch shall be UL Listed or Factory Mutual Approved for the application in which it is used. Activation of the alarm pressure switch shall cause an alarm on the fire alarm system control unit.

D. Valve Supervisory Switches for Ball and Butterfly Valves: May be integral with the valve.

2.8 GAUGES

A. Provide gauges as required by NFPA 13. Provide gauges where the normal pressure of the system is at the midrange of the gauge.

2.9 PIPE HANGERS, SUPPORTS AND RESTRAINT OF SYSTEM PIPING

A. Pipe hangers, supports, and restraint of system piping shall be in accordance with NFPA 13.

2.10 WALL, FLOOR AND CEILING PLATES

A. Provide chrome plated steel escutcheon plates.

2.11 ANTIFREEZE SOLUTION

A. Antifreeze solution shall be in accordance with NFPA 13 and shall be compatible with use in a potable water supply.

2.12 VALVE TAGS

A. Engraved black filled numbers and letters not less than 15 mm (1/2 inch) high for number designation, and not less than 8 mm (1/4 inch) for service designation on 19 gage, 40 mm (1-1/2 inches) round brass disc, attached with brass "S" hook, brass chain, or nylon twist tie.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be accomplished by the licensed contractor. Provide a qualified technician, experienced in the installation and operation of the type of system being installed, to supervise the installation and testing of the system.

B. Installation of Piping: Accurately cut pipe to measurements established by the installer and work into place without springing or forcing. In any situation where bending of the pipe is required, use a standard pipe-bending template. Concealed piping in spaces that have finished ceilings. Where ceiling mounted equipment exists, such as in operating and radiology rooms, install sprinklers so as not to obstruct the movement or operation of the equipment. Sidewall heads may need to be utilized. In stairways, locate piping as near to the ceiling as possible to prevent tampering by unauthorized personnel and to provide a minimum headroom clearance of 2250 mm (seven feet six inches). Piping shall not obstruct the minimum means of egress clearances required by NFPA 101. Pipe hangers, supports, and restraint of system piping, shall be installed accordance with NFPA 13.

C. Welding: Conform to the requirements and recommendations of NFPA 13.

D. Drains: Provide drips and drains, including low point drains, in accordance with NFPA 13. Pipe drains to discharge at safe points outside of the building or to sight cones attached to drains of adequate size to readily carry the full flow from each drain under maximum pressure. Do not provide a direct drain connection to sewer system or discharge into sinks. Install drips and drains where necessary and required by NFPA 13. The drain piping shall not be restricted or reduced and shall be of the same diameter as the drain collector.

E. Supervisory Switches: Provide supervisory switches for sprinkler control valves.

F. Waterflow Alarm Switches: Install waterflow alarm switches and valves in stairwells or other easily accessible locations.

G. Inspector's Test Connection: Install and supply in accordance with NFPA 13, locate in a secured area, and discharge to the exterior of the building.

H. Affix cutout disks, which are created by cutting holes in the walls of pipe for flow switches and non-threaded pipe connections to the respective waterflow switch or pipe connection near to the pipe from where they were cut.

I. Provide escutcheon plates for exposed piping passing through walls, floors or ceilings.

J. Clearances: For systems requiring seismic protection, piping that passes through floors or walls shall have penetrations sized 50 mm (2 inches) nominally larger than the penetrating pipe for pipe sizes 25 mm (1 inch) to 90 mm (3 ½ inches) and 100 mm (4 inches) nominally larger for penetrating pipe sizes 100 mm (4 inches) and larger.

K. Sleeves: Provide for pipes passing through masonry or concrete. Provide space between the pipe and the sleeve in accordance with NFPA 13. Seal this space with a UL Listed through penetration fire stop material in accordance with Section 07 84 00, FIRESTOPPING. Where core drilling is used in lieu of sleeves, also seal space. Seal penetrations of walls, floors and ceilings of other types of construction, in accordance with Section 07 84 00, FIRESTOPPING.

L. Where dry pendent sprinklers are used for freezers or similar spaces and they are connected to the wet pipe system, provide an EPDM boot around the dry pendent sprinkler on the heated side and securely seal to the pipe and freezer to prevent condensation from entering the freezer.

M. Provide pressure gauges at each water flow alarm switch location and at each main drain connection.

N. For each fire department connection, provide the symbolic sign given in NFPA 170 and locate 2400 to 3000 mm (8 to 10 feet) above each connection location. Size the sign to 450 by 450 mm (18 by 18 inches) with the symbol being at least 350 by 350 mm (14 by 14 inches).

O. Firestopping shall be provided for all penetrations of fire resistance rated construction. Firestopping shall comply with Section 07 84 00, FIRESTOPPING.

P. MRI Suite: Provide no more than one penetration of the MRI shield enclosure.

Q. Painting of Pipe: In finished areas where walls and ceilings have been painted, paint primed surfaces with two coats of paint to match adjacent surfaces, except paint valves and operating accessories with two coats of gloss red enamel. Exercise care to avoid painting sprinklers. Painting of sprinkler systems above suspended ceilings and in crawl spaces is not required. Painting shall comply with Section 09 91 00, PAINTING. Any painted sprinkler shall be replaced with a new sprinkler.

R. Sprinkler System Signage: Provide rigid sprinkler system signage in accordance with NFPA 13 and NFPA 25. Sprinkler system signage shall include, but not limited to, the following:
   1. Identification Signs:
      a. Provide signage for each control valve, drain valve, sprinkler cabinet, and inspector's test.
      b. Provide valve tags for each operable valve. Coordinate nomenclature and identification of operable valves with COR. Where existing nomenclature does not exist, the Tag Identification shall include no less than the following: (FP-B-F/SZ-#) Fire Protection, Building Number, Floor Number/Smoke Zone (if applicable), and Valve Number. (E.g., FP-500-1E-001) Fire Protection, Building 500, First Floor East, Number 001.)
   2. Instruction/Information Signs:
      a. Provide signage for each control valve to indicate valve function and to indicate what system is being controlled.
      b. Provide signage indicating the number and location of low point drains.
   3. Hydraulic Placards:
      a. Provide signage indicating hydraulic design information. The placard shall include location of the design area, discharge densities, required flow and residual pressure at the base of riser, occupancy classification, hose stream allowance, flow test information, and installing contractor. Locate hydraulic placard information signs at each alarm check valve.

S. Repairs: Repair damage to the building or equipment resulting from the installation of the sprinkler system by the installer at no additional expense to the Government.

T. Interruption of Service: There shall be no interruption of the existing sprinkler protection, water, electric, or fire alarm services without prior permission of the Contracting Officer. Contractor shall develop an interim fire protection program where interruptions involve occupied spaces. Request in writing at least one week prior to the planned interruption.

3.2 INSPECTION AND TEST

A. Preliminary Testing: Flush newly installed systems prior to performing hydrostatic tests in order to remove any debris which may have been left as well as ensuring piping is unobstructed. Hydrostatically test system, including the fire department connections, as specified in NFPA 13, in the presence of the Contracting Officers Representative (COR) or his designated representative. Test and flush underground water line prior to performing these hydrostatic tests.

B. Final Inspection and Testing: Subject system to tests in accordance with NFPA 13, and when all necessary corrections have been accomplished, advise COR to schedule a final inspection and test. Connection to the fire alarm system shall have been in service for at least ten days prior to the final inspection, with adjustments made to prevent false alarms. Furnish all instruments, labor and materials required for the tests and provide the services of the installation foreman or

other competent representative of the installer to perform the tests. Correct deficiencies and retest system as necessary, prior to the final acceptance. Include the operation of all features of the systems under normal operations in test

3.3 INSTRUCTIONS

A. Furnish the services of a competent instructor for not less than two hours for instructing personnel in the operation and maintenance of the system, on the dates requested by the COR.

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SECTION 22 05 11
COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 DESCRIPTION

A. The requirements of this Section will apply to all sections of Division 22.

B. Definitions:

1. Exposed: Piping and equipment exposed to view in finished rooms.
2. Exterior: Piping and equipment exposed to weather be it temperature, humidity, precipitation, wind or solar radiation.

C. Abbreviations/Acronyms:

1. ABS: Acrylonitrile Butadiene Styrene
2. AC: Alternating Current
3. ACR: Air Conditioning and Refrigeration
4. A/E: Architect/Engineer
5. AFF: Above Finish Floor
6. AFG: Above Finish Grade
7. AI: Analog Input
8. AISI: American Iron and Steel Institute
9. AO: Analog Output
10. ASHRAE: American Society of Heating Refrigeration, Air Conditioning Engineers
11. ASJ: All Service Jacket
12. ASME: American Society of Mechanical Engineers
13. ASPE: American Society of Plumbing Engineers
14. AWG: American Wire Gauge
15. BACnet: Building Automation and Control Network
16. BAg: Silver-Copper-Zinc Brazing Alloy
17. BAS: Building Automation System
18. BCuP: Silver-Copper-Phosphorus Brazing Alloy
19. bhp: Brake Horsepower
20. Btu: British Thermal Unit
21. Btu/h: British Thermal Unit per Hour
22. BSG: Borosilicate Glass Pipe
23. C: Celsius
24. CA: Compressed Air
25. CD: Compact Disk
26. CDA: Copper Development Association

27. CGA: Compressed Gas Association
28. CFM: Cubic Feet per Minute
29. CI: Cast Iron
30. CLR: Color
31. CO: Contracting Officer
32. COR: Contracting Officer's Representative
33. CPVC: Chlorinated Polyvinyl Chloride
34. CR: Chloroprene
35. CRS: Corrosion Resistant Steel
36. CWP: Cold Working Pressure
37. CxA: Commissioning Agent
38. dB: Decibels
39. db(A): Decibels (A weighted)
40. DCW: Domestic Cold Water
41. DDC: Direct Digital Control
42. DFU: Drainage Fixture Units
43. DHW: Domestic Hot Water
44. DHWR: Domestic Hot Water Return
45. DHWS: Domestic How Water Supply
46. DI: Digital Input
47. DI: Deionized Water
48. DISS: Diameter Index Safety System
49. DN: Diameter Nominal
50. DO: Digital Output
51. DOE: Department of Energy
52. DVD: Digital Video Disc
53. DWG: Drawing
54. DWH: Domestic Water Heater
55. DWS: Domestic Water Supply
56. DWV: Drainage, Waste and Vent
57. ECC: Engineering Control Center
58. EL: Elevation
59. EMCS: Energy Monitoring and Control System
60. EPA: Environmental Protection Agency
61. EPACT: Energy Policy Act
62. EPDM: Ethylene Propylene Diene Monomer
63. EPT: Ethylene Propylene Terpolymer

64. ETO: Ethylene Oxide
65. F: Fahrenheit
66. FAR: Federal Acquisition Regulations
67. FD: Floor Drain
68. FDC: Fire Department (Hose) Connection
69. FED: Federal
70. FG: Fiberglass
71. FNPT: Female National Pipe Thread
72. FOR: Fuel Oil Return
73. FOS: Fuel Oil Supply
74. FOV: Fuel Oil Vent
75. FPM: Fluoroelastomer Polymer
76. FSK: Foil-Scrim-Kraft Facing
77. FSS: VA Construction & Facilities Management, Facility Standards Service
78. FU: Fixture Units
79. GAL: Gallon
80. GCO: Grade Cleanouts
81. GPD: Gallons per Day
82. GPH: Gallons per Hour
83. GPM: Gallons per Minute
84. HDPE: High Density Polyethylene
85. HEFP: Healthcare Environment and Facilities Program (replacement for OCAMES)
86. HEX: Heat Exchanger
87. Hg: Mercury
88. HOA: Hands-Off-Automatic
89. HP: Horsepower
90. HVE: High Volume Evacuation
91. Hz: Hertz
92. ID: Inside Diameter
93. IE: Invert Elevation
94. INV: Invert
95. IPC: International Plumbing Code
96. IPS: Iron Pipe Size
97. IW: Indirect Waste
98. IWH: Instantaneous Water Heater
99. Kg: Kilogram
100. kPa: Kilopascal

101. KW: Kilowatt
102. KWH: Kilowatt Hour
103. lb: Pound
104. lbs/hr: Pounds per Hour
105. LNG: Liquid Natural Gas
106. L/min: Liters per Minute
107. LOX: Liquid Oxygen
108. L/s: Liters per Second
109. m: Meter
110. MA: Medical Air
111. MAWP: Maximum Allowable Working Pressure
112. MAX: Maximum
113. MBH: 1000 Btu per Hour
114. MED: Medical
115. MER: Mechanical Equipment Room
116. MFG: Manufacturer
117. mg: Milligram
118. mg/L: Milligrams per Liter
119. ml: Milliliter
120. mm: Millimeter
121. MIN: Minimum
122. MV: Medical Vacuum
123. N2: Nitrogen
124. N20: Nitrogen Oxide
125. NC: Normally Closed
126. NF: Oil Free Dry (Nitrogen)
127. NG: Natural Gas
128. NIC: Not in Contract
129. NO: Normally Open
130. NOM: Nominal
131. NPTF: National Pipe Thread Female
132. NPS: Nominal Pipe Size
133. NPT: Nominal Pipe Thread
134. NTS: Not to Scale
135. O2: Oxygen
136. OC: On Center
137. OD: Outside Diameter

138. OSD: Open Sight Drain
139. OS&Y: Outside Stem and Yoke
140. PA: Pascal
141. PBPU: Prefabricated Bedside Patient Units
142. PD: Pressure Drop or Difference
143. PDI: Plumbing and Drainage Institute
144. PH: Power of Hydrogen
145. PID: Proportional-Integral-Differential
146. PLC: Programmable Logic Controllers
147. PP: Polypropylene
148. ppb: Parts per Billion
149. ppm: Parts per Million
150. PSI: Pounds per Square Inch
151. PSIA: Pounds per Square Inch Atmosphere
152. PSIG: Pounds per Square Inch Gauge
153. PTFE: Polytetrafluoroethylene
154. PVC: Polyvinyl Chloride
155. PVDF: Polyvinylidene Fluoride
156. RAD: Radians
157. RO: Reverse Osmosis
158. RPM: Revolutions Per Minute
159. RTD: Resistance Temperature Detectors
160. RTRP: Reinforced Thermosetting Resin Pipe
161. SAN: Sanitary Sewer
162. SCFM: Standard Cubic Feet per Minute
163. SDI: Silt Density Index
164. SMACNA: Sheet Metal and Air Conditioning Contractors National Association
165. SPEC: Specification
166. SPS: Sterile Processing Services
167. SQFT/SF: Square Feet
168. SS: Stainless Steel
169. STD: Standard
170. SUS: Saybolt Universal Second
171. SWP: Steam Working Pressure
172. TD: Temperature Difference
173. TDH: Total Dynamic Head
174. TEFC: Totally Enclosed Fan-Cooled

175. TEMP: Temperature
176. TFE: Tetrafluoroethylene
177. THERM: 100,000 Btu
178. THHN: Thermoplastic High-Heat Resistant Nylon Coated Wire
179. THWN: Thermoplastic Heat & Water Resistant Nylon Coated Wire
180. TIL: Technical Information Library http//www.cfm.va.gov/til/indes.asp
181. T/P: Temperature and Pressure
182. TYP: Typical
183. USDA: U.S. Department of Agriculture
184. V: Vent
185. V: Volt
186. VA: Veterans Administration
187. VA CFM: VA Construction & Facilities Management
188. VA CFM CSS: VA Construction & Facilities Management, Consulting Support Service
189. VAC: Vacuum
190. VAC: Voltage in Alternating Current
191. VAMC: Veterans Administration Medical Center
192. VHA OCAMES: This has been replaced by HEFP.
193. VSD: Variable Speed Drive
194. VTR: Vent through Roof
195. W: Waste
196. WAGD: Waste Anesthesia Gas Disposal
197. WC: Water Closet
198. WG: Water Gauge
199. WOG: Water, Oil, Gas
200. WPD: Water Pressure Drop
201. WSFU: Water Supply Fixture Units

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.
B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
C. Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.
D. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.
E. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.
F. Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT.
G. Section 02 82 13.13, GLOVEBAG ASBESTOS ABATEMENT.
H. Section 03 30 00, CAST-IN-PLACE CONCRETE: Concrete and Grout.
I. Section 05 50 00, METAL FABRICATIONS.

J. Section 07 60 00, FLASHING AND SHEET METAL: Flashing for Wall and Roof Penetrations.
K. Section 07 84 00, FIRESTOPPING.
L. Section 07 92 00, JOINT SEALANTS.
M. Section 09 91 00, PAINTING.
N. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.
O. Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT.
P. Section 22 07 11, PLUMBING INSULATION.
Q. Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.
R. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.
S. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
T. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.
U. Section 26 29 11, MOTOR CONTROLLERS.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below will form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standard will govern.
B. American Society of Mechanical Engineers (ASME):
B31.1-2013.....Power Piping
ASME Boiler and Pressure Vessel Code -
BPVC Section IX-2019..... Welding, Brazing, and Fusing Qualifications
C. American Society for Testing and Materials (ASTM):
A36/A36M-2019 .....Standard Specification for Carbon Structural Steel
A575-96(2013)e1 .....Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades
E84-2013a.....Standard Test Method for Surface Burning Characteristics of Building Materials
E119-2012a.....Standard Test Methods for Fire Tests of Building Construction and Materials
D. International Code Council, (ICC):
IBC-2018 .....International Building Code
IPC-2018 .....International Plumbing Code
E. Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry, Inc:
SP-58-2018 .....Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application and Installation
F. Military Specifications (MIL):
P-21035B .....Paint High Zinc Dust Content, Galvanizing Repair (Metric)

G. National Electrical Manufacturers Association (NEMA):
MG 1-2016 .....Motors and Generators

H. National Fire Protection Association (NFPA):
51B-2019.....Standard for Fire Prevention During Welding, Cutting and Other Hot Work
54-2018 .....National Fuel Gas Code
70-2020 .....National Electrical Code (NEC)
99-2018 .....Healthcare Facilities Code

I. NSF International (NSF):
5-2019 .....Water Heaters, Hot Water Supply Boilers, and Heat Recovery Equipment
14-2019 .....Plastic Piping System Components and Related Materials
61-2019 .....Drinking Water System Components – Health Effects
372-2016 .....Drinking Water System Components – Lead Content

J. Department of Veterans Affairs (VA):
PG-18-102014(R18).....Plumbing Design Manual
PG-18-13-2017(R18) .....Barrier Free Design Guide

1.4 SUBMITTALS

A. Submittals, including number of required copies, will be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Information and material submitted under this section will be marked "SUBMITTED UNDER SECTION 22 05 11, COMMON WORK RESULTS FOR PLUMBING", with applicable paragraph identification.

C. If the project is phased, contractors will submit complete phasing plan/schedule with manpower levels prior to commencing work. The phasing plan will be detailed enough to provide milestones in the process that can be verified.

D. Contractor will make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements, and all equipment that requires regular maintenance, calibration, etc are accessable from the floor or permanent work platform. It is the Contractor's responsibility to ensure all submittals meet the VA specifications and requirements and it is assumed by the VA that all submittals do meet the VA specifications unless the Contractor has requested a variance in writing and approved by COR prior to the submittal. If at any time during the project it is found that any item does not meet the VA specifications and there was no variance approval the Contractor will correct at no additional cost or time to the Government even if a submittal was approved.

E. If equipment is submitted which differs in arrangement from that shown, provide documentation proving equivalent performance, design standards and drawings that show the rearrangement of

all associated systems. Additionally, any impacts on ancillary equipment or services such as foundations, piping, and electrical will be the Contractor's responsibility to design, supply, and install at no additional cost or time to the Government. VA approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.

F. Prior to submitting shop drawings for approval, Contractor will certify in writing that manufacturers of all major items of equipment have each reviewed drawings and specifications, and have jointly coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.

G. Submittals and shop drawings for interdependent items, containing applicable descriptive information, will be furnished together and complete in a group. Coordinate and properly integrate materials and equipment in each group to provide a completely compatible and efficient installation. Final review and approvals will be made only by groups.

H. Manufacturer's Literature and Data including: Manufacturer's literature will be submitted under the pertinent section rather than under this section.
   1. Electric motor data and variable speed drive data will be submitted with the driven equipment.
   2. Equipment and materials identification.
   3. Firestopping materials.
   4. Hangers, inserts, supports and bracing. Provide load calculations for variable spring and constant support hangers.
   5. Wall, floor, and ceiling plates.

I. Coordination/Shop Drawings:
   1. Submit complete consolidated and coordinated shop drawings for all new systems, and for existing systems that are in the same areas.
   2. The coordination/shop drawings will include plan views, elevations and sections of all systems and will be on a scale of not less than 1:32 (3/8-inch equal to 1 foot). Clearly identify and dimension the proposed locations of the principal items of equipment. The drawings will clearly show locations and adequate clearance for all equipment, piping, valves, control panels and other items. Show the access means for all items requiring access for operations and maintenance. Provide detailed coordination/shop drawings of all piping and duct systems. The drawings should include all lockout/tagout points for all energy/hazard sources for each piece of equipment. Coordinate lockout/tagout procedures and practices with local VA requirements.
   3. Do not install equipment foundations, equipment or piping until coordination/shop drawings have been approved.
   4. In addition, for plumbing systems, provide details of the following:
      a. Mechanical equipment rooms.

b. Hangers, inserts, supports, and bracing.
c. Pipe sleeves.
d. Duct or equipment penetrations of floors, walls, ceilings, or roofs.

J. Rigging Plan: Provide documentation of the capacity and weight of the rigging and equipment intended to be used. The plan will include the path of travel of the load, the staging area and intended access, and qualifications of the operator and signal person.

K. Plumbing Maintenance Data and Operating Instructions:
1. Maintenance and operating manuals in accordance with Section 01 00 00, GENERAL REQUIREMENTS, Article, INSTRUCTIONS, for systems and equipment.
2. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replacement parts, and troubleshooting guide:
a. Include complete list indicating all components of the systems.
b. Include complete diagrams of the internal wiring for each item of equipment.
c. Diagrams will have their terminals identified to facilitate installation, operation and maintenance.
3. Provide a listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment. Include in the listing belts for equipment: Belt manufacturer, model number, size and style, and distinguished whether of multiple belt sets.

L. Provide copies of approved plumbing equipment submittals to the TAB and Commissioning Subcontractor.

M. Completed System Readiness Checklist provided by the CxA and completed by the Contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 22 08 00 COMMISSIONING OF PLUMBING SYSTEMS.

N. Submit training plans, trainer qualifications and instructor qualifications in accordance with the requirements of Section 22 08 00 COMMISSIONING OF PLUMBING SYSTEMS.

1.5 QUALITY ASSURANCE

A. Mechanical, electrical, and associated systems will be safe, reliable, efficient, durable, easily and safely operable and maintainable, easily and safely accessible, and in compliance with applicable codes as specified. The systems will be comprised of high quality institutional-class and industrial-class products of manufacturers that are experienced specialists in the required product lines. All construction firms and personnel will be experienced and qualified specialists in industrial and institutional plumbing.

B. Products Criteria:
1. Standard Products: Material and equipment will be the standard products of a manufacturer regularly engaged in the manufacture, supply and servicing of the specified products for at least 5 years. However, digital electronics devices, software and systems such as controls,

instruments, computer work station, will be the current generation of technology and basic design that has a proven satisfactory service record of at least 5 years.

2. Equipment Service: There will be permanent service organizations, authorized and trained by manufacturers of the equipment supplied, located within 160 km (100 miles) of the project. These organizations will come to the site and provide acceptable service to restore operations within 4 hours of receipt of notification by phone, e-mail or fax in event of an emergency, such as the shut-down of equipment; or within 24 hours in a non-emergency. Names, mail and e-mail addresses and phone numbers of service organizations providing service under these conditions for (as applicable to the project): pumps, compressors, water heaters, critical instrumentation, computer workstation and programming will be submitted for project record and inserted into the operations and maintenance manual.
3. All items furnished will be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.
4. The products and execution of work specified in Division 22 will conform to the referenced codes and standards as required by the specifications. Local codes and amendments enforced by the local code official will be enforced, if required by local authorities such as the natural gas supplier. If the local codes are more stringent, then the local code will apply. Any conflicts will be brought to the attention of the Contracting Officers Representative (COR).
5. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units will be of the same manufacturer and model number, or if different models are required they will be of the same manufacturer and identical to the greatest extent possible (i.e., same model series).
6. Assembled Units: Performance and warranty of all components that make up an assembled unit will be the responsibility of the manufacturer of the completed assembly.
7. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark will be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
8. Asbestos products or equipment or materials containing asbestos is prohibited.
9. Bio-Based Materials: For products designated by the USDA's bio-based Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

C. Welding: Before any welding is performed, Contractor will submit a certificate certifying that welders comply with the following requirements:
   1. Qualify welding processes and operators for piping according to ASME BPVC, Section IX, "Welding and Brazing Qualifications". Provide proof of current certification to CO.

2. Comply with provisions of ASME B31 series "Code for Pressure Piping".
3. Certify that each welder and welding operator has passed American Welding Society (AWS) qualification tests for the welding processes involved, and that certification is current.
4. All welds will be stamped according to the provisions of the AWS or ASME as required herein and by the association code.

D. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations will be furnished to the COR prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

E. Execution (Installation, Construction) Quality:
1. All items will be applied and installed in accordance with manufacturer's written instructions. Conflicts between the manufacturer's instructions and the contract documents will be referred to the COR for resolution. Printed copies or electronic files of manufacturer’s installation instructions will be provided to the COR at least 10 working days prior to commencing installation of any item.
2. All items that require access, such as for operating, cleaning, servicing, maintenance, and calibration, will be easily and safely accessible by persons standing at floor level, or standing on permanent platforms, without the use of portable ladders. Examples of these items include but are not limited to: all types of valves, filters and strainers, transmitters, and control devices. Prior to commencing installation work, refer conflicts between this requirement and contract documents to COR for resolution. Failure of the Contractor to resolve or call attention to any discrepancies or deficiencies to the COR will result in the Contractor correcting at no additional cost or time to the Government.
3. Complete layout drawings will be required by Paragraph, SUBMITTALS. Construction work will not start on any system until the layout drawings have been approved by VA.
4. Installer Qualifications: Installer will be licensed and will provide evidence of the successful completion of at least five projects of equal or greater size and complexity. Provide tradesmen skilled in the appropriate trade.
5. Workmanship/craftsmanship will be of the highest quality and standards. The VA reserves the right to reject any work based on poor quality of workmanship this work will be removed and done again at no additional cost or time to the Government.

F. Upon request by Government, provide lists of previous installations for selected items of equipment. Include contact persons who will serve as references, with current telephone numbers and e-mail addresses.

G. Guaranty: Warranty of Construction, FAR clause 52.246-21.

H. Plumbing Systems: IPC, International Plumbing Code. Unless otherwise required herein, perform plumbing work in accordance with the latest version of the IPC. For IPC codes referenced in the contract documents, advisory provisions will be considered mandatory, the word “should” will be interpreted as “will”. Reference to the “code official” or “owner” will be interpreted to mean the COR.

I. Cleanliness of Piping and Equipment Systems:
   1. Care will be exercised in the storage and handling of equipment and piping material to be incorporated in the work. Debris arising from cutting, threading and welding of piping will be removed.
   2. Piping systems will be flushed, blown or pigged as necessary to deliver clean systems.
   3. The interior of all tanks will be cleaned prior to delivery and beneficial use by the Government. All piping will be tested in accordance with the specifications and the International Plumbing Code (IPC). All filters, strainers, fixture faucets will be flushed of debris prior to final acceptance.
   4. Contractor will be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

1.6 DELIVERY, STORAGE AND HANDLING

A. Protection of Equipment:
   1. Equipment and material placed on the job site will remain in the custody of the Contractor until phased acceptance, whether or not the Government has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for the protection of such equipment and material against any damage or theft.
   2. Damaged equipment will be replaced with an identical unit as determined and directed by the COR. Such replacement will be at no additional cost or additional time to the Government.
   3. Interiors of new equipment and piping systems will be protected against entry of foreign matter. Both inside and outside will be cleaned before painting or placing equipment in operation.
   4. Existing equipment and piping being worked on by the Contractor will be under the custody and responsibility of the Contractor and will be protected as required for new work.
   5. Protect plastic piping and tanks from ultraviolet light (sunlight) while in pre-construction. Plastic piping and tanks will not be installed exposed to sunlight without metal jacketing to block ultraviolet rays.

1.7 AS-BUILT DOCUMENTATION

A. Submit manufacturer’s literature and data updated to include submittal review comments and any equipment substitutions.

B. Submit operation and maintenance data updated to include submittal review comments, VA approved substitutions and construction revisions will be in electronic version and inserted into a

three ring binder. All aspects of system operation and maintenance procedures, including applicable piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation will be included in the operation and maintenance manual. The operations and maintenance manual will include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices will be included. A List of recommended spare parts (manufacturer, model number, and quantity) will be furnished. Information explaining any special knowledge or tools the owner will be required to employ will be inserted into the As-Built documentation.

C. The installing Contractor will maintain as-built drawings of each completed phase for verification; and, will provide the complete set at the time of final systems certification testing. Should the installing Contractor engage the testing company to provide as-built or any portion thereof, it will not be deemed a conflict of interest or breach of the 'third party testing company' requirement. Provide record drawings as follows:
   1. As-built drawings are to be provided, with a copy of them on AutoCAD version 2020 provided on CD or DVD. The CAD drawings will use multiple line layers with a separate individual layer for each system.

D. The as-built drawings will indicate the location and type of all lockout/tagout points for all energy sources for all equipment and pumps to include breaker location and numbers, valve tag numbers, etc. Coordinate lockout/tagout procedures and practices with local VA requirements.

E. Certification documentation will be provided to COR 21 working days prior to submitting the request for final inspection. The documentation will include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and provide documentation/certification that all results of tests were within limits specified. Test results will contain written sequence of test procedure with written test results annotated at each step along with the expected outcome or setpoint. The results will include all readings, including but not limited to data on device (make, model and performance characteristics_), normal pressures, switch ranges, trip points, amp readings, and calibration data to include equipment serial numbers or individual identifications, etc.

1.8 JOB CONDITIONS – WORK IN EXISTING BUILDING

A. Building Operation: Government employees will be continuously operating and managing all facilities, including temporary facilities that serve the VAMC.

B. Maintenance of Service: Schedule all work to permit continuous service as required by the VAMC.

C. Steam and Condensate Service Interruptions: Limited steam and condensate service interruptions, as required for interconnections of new and existing systems, will be permitted by the COR during periods when the demands are not critical to the operation of the VAMC. These non-critical periods are limited to between 8 pm and 5 am in the appropriate off-season (if

applicable). Provide at least 10 working days advance notice to the COR. The request will include a detailed plan on the proposed shutdown and the intended work to be done along with manpower levels. All equipment and materials must be onsite and verified with plan 5 calendar days prior to the shutdown or it will need to be rescheduled.

D. Phasing of Work: Comply with all requirements shown on contract documents. Contractor will submit a complete detailed phasing plan/schedule with manpower levels prior to commencing work. The phasing plan will be detailed enough to provide milestones in the process that can be verified.

E. Building Working Environment: Maintain the architectural and structural integrity of the building and the working environment at all times. Maintain the interior of building at 18 degrees C (65 degrees F) minimum. Limit the opening of doors, windows or other access openings to brief periods as necessary for rigging purposes. Storm water or ground water leakage is prohibited. Provide daily clean-up of construction and demolition debris on all floor surfaces and on all equipment being operated by VA. Maintain all egress routes and safety systems/devices.

F. Acceptance of Work for Government Operation: As new equipment, systems and facilities are made available for operation and these items are deemed of beneficial use to the Government, inspections and tests will be performed. Based on the inspections, a list of contract deficiencies will be issued to the Contractor. After correction of deficiencies as necessary for beneficial use, the Contracting Officer will process necessary acceptance and the equipment will then be under the control and operation of Government personnel.

G. Temporary Facilities: Refer to Paragraph, TEMPORARY PIPING AND EQUIPMENT in this section.

PART 2 - PRODUCTS

2.1 MATERIALS FOR VARIOUS SERVICES

A. Non-pressure PVC pipe will contain a minimum of 25 percent recycled content. Steel pipe will contain a minimum of 25 percent recycled content.

B. Plastic pipe, fittings and solvent cement will meet NSF 14 and will bear the NSF seal “NSF-PW”. Polypropylene pipe and fittings will comply with NSF 14 and NSF 61. Solder or flux containing lead will not be used with copper pipe.

C. Material or equipment containing a weighted average of greater than 0.25 percent lead will not be used in any potable water system intended for human consumption and will be certified in accordance with NSF 61 or NSF 372.

D. In-line devices such as water meters, building valves, check valves, stops, valves, fittings, tanks and backflow preventers will comply with NSF 61 and NSF 372.

E. End point devices such as drinking fountains, lavatory faucets, kitchen and bar faucets, ice makers supply stops, and end-point control valves used to dispense drinking water must meet requirements of NSF 61 and NSF 372.

2.2 FACTORY-ASSEMBLED PRODUCTS

A. Standardization of components will be maximized to reduce spare part requirements.

B. Manufacturers of equipment assemblies that include components made by others will assume complete responsibility for final assembled unit.

1. All components of an assembled unit need not be products of same manufacturer.
2. Constituent parts that are alike will be products of a single manufacturer.
3. Components will be compatible with each other and with the total assembly for intended service.
4. Contractor will guarantee performance of assemblies of components and will repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly at no additional cost or time to the Government.

C. Components of equipment will bear manufacturer's name and trademark, model number, serial number and performance data on a name plate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.

D. Major items of equipment, which serve the same function, will be the same make and model.

2.3 COMPATIBILITY OF RELATED EQUIPMENT

A. Equipment and materials installed will be compatible in all respects with other items being furnished and with existing items so that the result will be a complete and fully operational system that conforms to contract requirements.

2.4 SAFETY GUARDS

A. Pump shafts and couplings will be fully guarded by a sheet steel guard, covering coupling and shaft but not bearings. Material will be minimum 16-gauge sheet steel; ends will be braked and drilled and attached to pump base with minimum of four 8 mm (1/4 inch) bolts. Reinforce guard as necessary to prevent side play forcing guard onto couplings.

B. All Equipment will have moving parts protected from personal injury.

2.5 LIFTING ATTACHMENTS

A. Equipment will be provided with suitable lifting attachments to enable equipment to be lifted in its normal position. Lifting attachments will withstand any handling conditions that might be encountered, without bending or distortion of shape, such as rapid lowering and braking of load.

2.6 ELECTRIC MOTORS, MOTOR CONTROL, CONTROL WIRING

A. All material and equipment furnished and installation methods used will conform to the requirements of Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT; Section 26 29 11, MOTOR CONTROLLERS; and, Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES. All electrical wiring, conduit, and devices necessary for the proper connection, protection and operation of the systems will be provided. Premium efficient motors will be provided. Unless otherwise specified for a particular application, electric motors will have the following requirements.

B. Special Requirements:
   1. Where motor power requirements of equipment furnished deviate from power shown on plans, provide electrical service designed under the requirements of NFPA 70 at no additional cost or time to the Government.
   2. Assemblies of motors, starters, and controls and interlocks on factory assembled and wired devices will be in accordance with the requirements of this specification.
   3. Wire and cable materials specified in the electrical division of the specifications will be modified as follows:
      a. Wiring material located where temperatures can exceed 71° C (160° F) will be stranded copper with Teflon FEP insulation with jacket. This includes wiring on the boilers and water heaters.
      b. Other wiring at boilers and water heaters, and to control panels, will be NFPA 70 designation THWN.
      c. Shielded conductors or wiring in separate conduits for all instrumentation and control systems will be provided where recommended by manufacturer of equipment.
   4. Motor sizes will be selected so that the motors do not operate into the service factor at maximum required loads on the driven equipment. Motors on pumps will be sized for non-overloading at all points on the pump performance curves.
   5. Motors utilized with variable frequency drives will be rated “inverter-ready” per NEMA Standard, MG1.

C. Motor Efficiency and Power Factor: All motors, when specified as “high efficiency or Premium Efficiency” by the project specifications on driven equipment, will conform to efficiency and power factor requirements in Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT, with no consideration of annual service hours. Motor manufacturers generally define these efficiency requirements as “NEMA premium efficient” and the requirements generally exceed those of the Energy Policy Act (EPACT), revised 2005. Motors not specified as “high efficiency or premium efficient” will comply with EPACT.

D. Single-phase Motors: Capacitor-start type for hard starting applications. Motors for centrifugal pumps may be split phase or permanent split capacitor (PSC).

E. Poly-phase Motors: NEMA Design B, Squirrel cage, induction type. Each two-speed motor will have two separate windings. A time delay (20 seconds minimum) relay will be provided for switching from high to low speed.

F. Rating: Rating will be continuous duty at 100 percent capacity in an ambient temperature of 40° C (104° F); minimum horsepower as shown on drawings; maximum horsepower in normal operation will not exceed nameplate rating without service factor.

G. Insulation Resistance: Not less than one-half meg-ohm between stator conductors and frame will be measured at the time of final inspection.

2.7 VARIABLE SPEED MOTOR CONTROLLERS

A. Refer to Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS and Section 26 29 11, MOTOR CONTROLLERS for specifications.

B. The combination of controller and motor will be provided by the respective pump manufacturer and will be rated for 100 percent output performance. Multiple units of the same class of equipment, i.e. pumps, will be product of a single manufacturer.

C. Motors will be premium efficient type, “invertor duty”, and be approved by the motor controller manufacturer. The controller-motor combination will be guaranteed to provide full motor nameplate horsepower in variable frequency operation. Both driving and driven motor sheaves will be fixed pitch.

D. Controller will not add any current or voltage transients to the input AC power distribution system, DDC controls, sensitive medical equipment, etc., nor will be affected from other devices on the AC power system.

2.8 EQUIPMENT AND MATERIALS IDENTIFICATION

A. Interior (Indoor) Equipment: Engraved nameplates, with letters not less than 7 mm (3/16 inch) high of brass with black-filled letters, or rigid black plastic with white letters specified in Section 09 91 00, PAINTING will be permanently fastened to the equipment. Unit components such as water heaters, tanks, coils, filters, etc. will be identified.

B. Exterior (Outdoor) Equipment: Brass nameplates, with engraved black filled letters, not less than 7 mm (3/16 inch) high riveted or bolted to the equipment.

C. Control Items: All temperature, pressure, and controllers will be labeled and the component’s function identified. Identify and label each item as they appear on the control diagrams.

D. Valve Tags and Lists:

1. Plumbing: All valves will be provided with valve tags and listed on a valve list (Fixture stops not included).
2. Valve tags: Engraved black filled numbers and letters not less than 15 mm (1/2 inch) high for number designation, and not less than 8 mm (1/4 inch) for service designation on 19 gauge, 40 mm (1-1/2 inches) round brass disc, attached with brass "S" hook or brass chain.
3. Valve lists: Valve lists will be created using a word processing program and printed on plastic coated cards. The plastic-coated valve list card(s), sized 215 mm (8-1/2 inches) by 275 mm (11 inches) will show valve tag number, valve function and area of control for each service or system. The valve list will be in a punched 3-ring binder notebook. An additional copy of the valve list will be mounted in picture frames for mounting to a wall. COR will instruct Contractor where frames will be mounted.
4. A detailed plan for each floor of the building indicating the location and valve number for each valve will be provided in the 3-ring binder notebook. Each valve location will be identified with a color-coded sticker or thumb tack in ceiling or access door.

2.9 FIRESTOPPING

A. Section 07 84 00, FIRESTOPPING specifies an effective barrier against the spread of fire, smoke and gases where penetrations occur for piping. Refer to Section 22 07 11, PLUMBING INSULATION, for pipe insulation.

2.10 GALVANIZED REPAIR COMPOUND

A. Mil. Spec. DOD-P-21035B, paint.

2.11 PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS

A. In lieu of the paragraph which follows, suspended equipment support and restraints may be designed and installed in accordance with the International Building Code (IBC) and Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS. Submittals based on the International Building Code (IBC) and Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS requirements, or the following paragraphs of this Section will be stamped and signed by a professional engineer registered in the state where the project is located. The Support system of suspended equipment over 227 kg (500 pounds) will be submitted for approval of the COR in all cases. See the above specifications for lateral force design requirements.

B. Type Numbers Specified: For materials, design, manufacture, selection, application, and installation refer to MSS SP-58. Refer to Section 05 50 00, METAL FABRICATIONS, for miscellaneous metal support materials and prime coat painting.

C. For Attachment to Concrete Construction:
   1. Concrete insert: Type 18, MSS SP-58.
   2. Self-drilling expansion shields and machine bolt expansion anchors: Permitted in concrete not less than 100 mm (4 inches) thick when approved by the COR for each job condition.
   3. Power-driven fasteners: Permitted in existing concrete or masonry not less than 100 mm (4 inches) thick when approved by the COR for each job condition.

D. For Attachment to Steel Construction: MSS SP-58.
   1. Welded attachment: Type 22.
   2. Beam clamps: Types 20, 21, 28 or 29. Type 23 C-clamp may be used for individual copper tubing up to 23 mm (7/8 inch) outside diameter.

E. For Attachment to Wood Construction: Wood screws or lag bolts.

F. Hanger Rods: Hot-rolled steel, ASTM A36/A36M or ASTM A575 for allowable load listed in MSS SP-58. For piping, provide adjustment means for controlling level or slope. Types 13 or 15 turn-buckles will provide 40 mm (1-1/2 inches) minimum of adjustment and incorporate locknuts. All-thread rods are acceptable.

G. Multiple (Trapeze) Hangers: Galvanized, cold formed, lipped steel channel horizontal member, not less than 43 mm by 43 mm (1-5/8 inches by 1-5/8 inches), 2.7 mm (No. 12 gauge), designed to accept special spring held, hardened steel nuts.

1. Allowable hanger load: Manufacturers rating less 91kg (200 pounds).
2. Guide individual pipes on the horizontal member of every other trapeze hanger with 8 mm (1/4 inch) U-bolt fabricated from steel rod. Provide Type 40 insulation shield, secured by two 15 mm (1/2 inch) galvanized steel bands, or insulated calcium silicate shield for insulated piping at each hanger.

H. Pipe Hangers and Supports: (MSS SP-58), use hangers sized to encircle insulation on insulated piping. Refer to Section 22 07 11, PLUMBING INSULATION for insulation thickness. To protect insulation, provide Type 39 saddles for roller type supports or insulated calcium silicate shields. Provide Type 40 insulation shield or insulated calcium silicate shield at all other types of supports and hangers including those for insulated piping.

1. General Types (MSS SP-58):
   a. Standard clevis hanger: Type 1; provide locknut.
   b. Riser clamps: Type 8.
   c. Wall brackets: Types 31, 32 or 33.
   d. Roller supports: Type 41, 43, 44 and 46.
   e. Saddle support: Type 36, 37 or 38.
   f. Turnbuckle: Types 13 or 15.
   g. U-bolt clamp: Type 24.
   h. Copper Tube:
      1) Hangers, clamps and other support material in contact with tubing will be painted with copper colored epoxy paint, copper-coated, plastic coated or taped with isolation tape to prevent electrolysis.
      2) For vertical runs use epoxy painted, copper-coated or plastic coated riser clamps.
      3) For supporting tube to strut: Provide epoxy painted pipe straps for copper tube or plastic inserted vibration isolation clamps.
      4) Insulated Lines: Provide pre-insulated calcium silicate shields sized for copper tube.
   i. Supports for plastic or glass piping: As recommended by the pipe manufacturer with black rubber tape extending 1 inch beyond steel support or clamp. Spring Supports (Expansion and contraction of vertical piping):
      1) Movement up to 20 mm (3/4 inch): Type 51 or 52 variable spring unit with integral turn buckle and load indicator.
      2) Movement more than 20 mm (3/4 inch): Type 54 or 55 constant support unit with integral adjusting nut, turn buckle and travel position indicator.
   j. Spring hangers are required on all plumbing system pumps one horsepower and greater.
2. Plumbing Piping (Other Than General Types):
   a. Horizontal piping: Type 1, 5, 7, 9, and 10.
   b. Chrome plated piping: Chrome plated supports.

c. Hangers and supports in pipe chase: Prefabricated system ABS self-extinguishing material, not subject to electrolytic action, to hold piping, prevent vibration and compensate for all static and operational conditions.

d. Blocking, stays and bracing: Angle iron or preformed metal channel shapes, 1.3 mm (18 gauge) minimum.

I. Pre-insulated Calcium Silicate Shields:

1. Provide 360-degree water resistant high density 965 kPa (140 psig) compressive strength calcium silicate shields encased in galvanized metal.
2. Pre-insulated calcium silicate shields to be installed at the point of support during erection.
3. Shield thickness will match the pipe insulation.
4. The type of shield is selected by the temperature of the pipe, the load it must carry, and the type of support it will be used with.
   a. Shields for supporting cold water will have insulation that extends a minimum of 25 mm (1 inch) past the sheet metal.
   b. The insulated calcium silicate shield will support the maximum allowable water filled span as indicated in MSS SP-58. To support the load, the shields will have one or more of the following features: structural inserts 4138 kPa (600 psig) compressive strength, an extra bottom metal shield, or formed structural steel (ASTM A36/A36M) wear plates welded to the bottom sheet metal jacket.
5. Shields may be used on steel clevis hanger type supports, trapeze hangers, roller supports or flat surfaces.

J. Seismic Restraint of Piping: Refer to Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

2.12 PIPE PENETRATIONS

A. Pipe penetration sleeves will be installed for all pipe other than rectangular blocked out floor openings for risers in mechanical bays.

B. Pipe penetration sleeve materials will comply with all firestopping requirements for each penetration.

C. To prevent accidental liquid spills from passing to a lower level, provide the following:

1. For sleeves: Extend sleeve 25 mm (1 inch) above finished floor and provide sealant for watertight joint.
2. For blocked out floor openings: Provide 40 mm (1-1/2 inch) angle set in silicone adhesive around opening.
3. For drilled penetrations: Provide 40 mm (1-1/2 inch) angle ring or square set in silicone adhesive around penetration.

D. Penetrations are prohibited through beams or ribs, but may be installed in concrete beam flanges, with structural engineer prior approval. Any deviation from these requirements must receive prior approval of COR.

E. Sheet metal, plastic, or moisture resistant fiber sleeves will be provided for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.

F. Cast iron or zinc coated pipe sleeves will be provided for pipe passing through exterior walls below grade. The space between the sleeve and pipe will be made watertight with a modular or link rubber seal. The link seal will be applied at both ends of the sleeve.

G. Galvanized steel or an alternate black iron pipe with asphalt coating sleeves will be for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. A galvanized steel sleeve will be provided for pipe passing through floor of mechanical rooms, laundry work rooms, and animal rooms above basement. Except in mechanical rooms, sleeves will be connected with a floor plate.

H. Brass Pipe Sleeves will be provided for pipe passing through quarry tile, terrazzo or ceramic tile floors. The sleeve will be connected with a floor plate.

I. Sleeve clearance through floors, walls, partitions, and beam flanges will be 25 mm (1 inch) greater in diameter than external diameter of pipe. Sleeve for pipe with insulation will be large enough to accommodate the insulation plus 25 mm (1 inch) in diameter. Interior openings will be caulked tight with firestopping material and sealant to prevent the spread of fire, smoke, water and gases.

J. Sealant and Adhesives: Will be as specified in Section 07 92 00, JOINT SEALANTS. Bio-based materials will be utilized when possible.

K. Pipe passing through roof will be installed through a 4.9 kg per square meter copper flashing with an integral skirt or flange. Skirt or flange will extend not less than 200 mm (8 inches) from the pipe and set in a solid coating of bituminous cement. Extend flashing a minimum of 250 mm (10 inches) up the pipe. Pipe passing through a waterproofing membrane will be provided with a clamping flange. The annular space between the sleeve and pipe will be sealed watertight.

2.13 TOOLS AND LUBRICANTS

A. Furnish, and turn over to the COR, special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.

B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.

C. Tool Containers: metal, permanently identified for intended service and mounted, or located, where directed by the COR.

D. Lubricants: A minimum of 0.95 L (1 quart) of oil, and 0.45 kg (1 pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application. Bio-based materials will be utilized when possible.

2.14 WALL, FLOOR AND CEILING PLATES

A. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.

B. Thickness: Not less than 2.4 mm (3/32 inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025 inch) for up to 75 mm (3 inch) pipe, 0.89 mm (0.035 inch) for larger pipe.

C. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Wall plates will be used where insulation ends on exposed water supply pipe drop from overhead. A watertight joint will be provided in spaces where brass or steel pipe sleeves are specified.

2.15 ASBESTOS

A. Materials containing asbestos are prohibited.

PART 3 - EXECUTION

3.1 ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING

A. Location of piping, sleeves, inserts, hangers, and equipment, access provisions will be coordinated with the work of all trades. Piping, sleeves, inserts, hangers, and equipment will be located clear of windows, doors, openings, light outlets, and other services and utilities. Equipment layout drawings will be prepared to coordinate proper location and personnel access of all facilities. The drawings will be submitted for review.

B. Manufacturer's published recommendations will be followed for installation methods not otherwise specified.

C. Operating Personnel Access and Observation Provisions: All equipment and systems will be arranged to provide clear view and easy access, without use of portable ladders, for maintenance, testing and operation of all devices including, but not limited to: all equipment items, valves, backflow preventers, filters, strainers, transmitters, sensors, meters and control devices. All gauges and indicators will be clearly visible by personnel standing on the floor or on permanent platforms. Maintenance and operating space and access provisions that are shown in the drawings will not be changed nor reduced.

D. Structural systems necessary for pipe and equipment support will be coordinated to permit proper installation.

E. Location of pipe sleeves, trenches and chases will be accurately coordinated with equipment and piping locations.

F. Cutting Holes:
   1. Holes will be located to avoid interference with structural members such as beams or grade beams. Holes will be laid out in advance and drilling done only after approval by COR. If the Contractor considers it necessary to drill through structural members, this matter will be referred to COR for approval.
   2. Waterproof membrane will not be penetrated. Pipe floor penetration block outs will be provided outside the extents of the waterproof membrane.
   3. Holes through concrete and masonry will be cut by rotary core drill. Pneumatic hammer, impact electric, and hand or manual hammer type drill will not be allowed, except as permitted by COR where working area space is limited.

G. Minor Piping: Generally, small diameter pipe runs from drips and drains, water cooling, and other services are not shown but must be provided.

H. Protection and Cleaning:
   1. Equipment and materials will be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the COR. Damaged or defective items in the opinion of the COR, will be replaced at no additional cost or time to the Government.
   2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Pipe openings, equipment, and plumbing fixtures will be tightly covered against dirt or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.

I. Concrete and Grout: Concrete and shrink compensating grout 25 MPa (3000 psig) minimum, specified in Section 03 30 00, CAST-IN-PLACE CONCRETE, will be used for all pad or floor mounted equipment.

J. Gauges, thermometers, valves and other devices will be installed with due regard for ease in reading or operating and maintaining said devices. Thermometers and gauges will be located and positioned to be easily read by operator or staff standing on floor or walkway provided. Servicing will not require dismantling adjacent equipment or pipe work.

K. Interconnection of Controls and Instruments: Electrical interconnection is generally not shown but will be provided. This includes interconnections of sensors, transmitters, transducers, control devices, control and instrumentation panels, alarms, instruments and computer workstations. Comply with NFPA 70.

L. Domestic cold and hot water systems interface with the HVAC control system for the temperature, pressure and flow monitoring requirements to mitigate legionella. See the HVAC control points list and Section 23 09 23, DIRECT DIGITAL CONTROL SYSTEM FOR HVAC.

M. Work in Existing Building:
   1. Perform as specified in Article, OPERATIONS AND STORAGE AREAS, Article, ALTERATIONS, and Article, RESTORATION of the Section 01 00 00, GENERAL REQUIREMENTS for relocation of existing equipment, alterations and restoration of existing building(s).
   2. As specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, OPERATIONS AND STORAGE AREAS, make alterations to existing service piping at times that will cause the least interfere with normal operation of the facility.

N. Work in Animal Research Areas: Seal all pipe penetrations with silicone sealant to prevent entrance of insects.

O. Work in bathrooms, restrooms, housekeeping closets: All pipe penetrations behind escutcheons will be sealed with plumbers' putty.

P. Switchgear Drip Protection: Every effort will be made to eliminate the installation of pipe above data equipment, and electrical and telephone switchgear. If this is not possible, encase pipe in a second pipe with a minimum of joints. Drain valve will be provided in low point of casement pipe.

Q. Inaccessible Equipment:
   1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment will be removed and reinstalled or remedial action performed as directed at no additional cost or additional time to the Government.
   2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as electrical conduit, motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

3.2 TEMPORARY PIPING AND EQUIPMENT

A. Continuity of operation of existing facilities may require temporary installation or relocation of equipment and piping. Temporary equipment or pipe installation or relocation will be provided to maintain continuity of operation of existing facilities.

B. The Contractor will provide all required facilities in accordance with the requirements of phased construction and maintenance of service. All piping and equipment will be properly supported, sloped to drain, operate without excessive stress, and will be insulated where injury can occur to personnel by contact with operating facilities. The requirements of paragraph 3.1 will apply.

C. Temporary facilities and piping will be completely removed back to the nearest active distribution branch or main pipe line and any openings in structures sealed. Dead legs are prohibited in potable water systems. Necessary blind flanges and caps will be provided to seal open piping remaining in service.

3.3 RIGGING

A. Openings in building structures will be planned to accommodate design scheme.

B. Alternative methods of equipment delivery may be offered and will be considered by Government under specified restrictions of phasing and service requirements as well as structural integrity of the building.

C. All openings in the building will be closed when not required for rigging operations to maintain proper environment in the facility for Government operation and maintenance of service.

D. Contractor will provide all facilities required to deliver specified equipment and place on foundations. Attachments to structures for rigging purposes and support of equipment on structures will be Contractor's full responsibility.

E. Contractor will check all clearances, weight limitations and will provide a rigging plan designed by a Registered Professional Engineer. All modifications to structures, including reinforcement thereof, will be at Contractor's cost, time and responsibility.

F. Rigging plan and methods will be referred to COR for evaluation prior to actual work.

3.4 PIPE AND EQUIPMENT SUPPORTS

A. Where hanger spacing does not correspond with joist or rib spacing, use structural steel channels secured directly to joist and rib structure that will correspond to the required hanger spacing, and then suspend the equipment and piping from the channels. Holes will be drilled or burned in structural steel ONLY with the prior written approval of the COR.

B. The use of chain pipe supports, wire or strap hangers; wood for blocking, stays and bracing, or hangers suspended from piping above will not be permitted. Rusty products will be replaced.

C. Hanger rods will be used that are straight and vertical. Turnbuckles for vertical adjustments may be omitted where limited space prevents use. A minimum of 15 mm (1/2 inch) clearance between pipe or piping covering and adjacent work will be provided.

D. For horizontal and vertical plumbing pipe supports, refer to the International Plumbing Code (IPC) and these specifications.

E. Overhead Supports:

1. The basic structural system of the building is designed to sustain the loads imposed by equipment and piping to be supported overhead.
2. Provide steel structural members, in addition to those shown, of adequate capability to support the imposed loads, located in accordance with the final approved layout of equipment and piping.
3. Tubing and capillary systems will be supported in channel troughs.

F. Floor Supports:

1. Provide concrete bases, concrete anchor blocks and pedestals, and structural steel systems for support of equipment and piping. Concrete bases and structural systems will be anchored and doweled to resist forces under operating and seismic conditions (if applicable) without excessive displacement or structural failure.

2. Bases and supports will not be located and installed until equipment mounted thereon has been approved. Bases will be sized to match equipment mounted thereon plus 50 mm (2 inch) excess on all edges. Structural drawings will be reviewed for additional requirements. Bases will be neatly finished and smoothed, will have chamfered edges at the top, and will be suitable for painting.
3. All equipment will be shimmed, leveled, firmly anchored, and grouted with epoxy grout. Anchor bolts will be placed in sleeves, anchored to the bases. Fill the annular space between sleeves and bolts with a grout material to permit alignment and realignment.
4. For seismic anchoring, refer to Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

3.5 LUBRICATION

A. All equipment and devices requiring lubrication will be lubricated prior to initial operation. All devices and equipment will be field checked for proper lubrication.

B. All devices and equipment will be equipped with required lubrication fittings. A minimum of 1 liter (1 quart) of oil and 0.45 kg (1 pound) of grease of manufacturer's recommended grade and type for each different application will be provided. All materials will be delivered to COR in unopened containers that are properly identified as to application.

C. A separate grease gun with attachments for applicable fittings will be provided for each type of grease applied.

D. All lubrication points will be accessible without disassembling equipment, except to remove access plates.

E. All lubrication points will be extended to one side of the equipment.

3.6 PLUMBING SYSTEMS DEMOLITION

A. Rigging access, other than indicated in the drawings, will be provided after approval for structural integrity by the COR. Such access will be provided at no additional cost or time to the Government. Where work is in an operating plant, approved protection from dust and debris will be provided at all times for the safety of plant personnel and maintenance of plant operation and environment of the plant.

B. In an operating plant, cleanliness and safety will be maintained. The plant will be kept in an operating condition. Government personnel will be carrying on their normal duties of operating, cleaning and maintaining equipment and plant operation. Work will be confined to the immediate area concerned; maintain cleanliness and wet down demolished materials to eliminate dust. Dust and debris will not be permitted to accumulate in the area to the detriment of plant operation. All flame cutting will be performed to maintain the fire safety integrity of this plant. Adequate fire extinguishing facilities will be available at all times. All work will be performed in accordance with recognized fire protection standards including NFPA 51B. Inspections will be made by personnel

of the VAMC, and the Contractor will follow all directives of the COR with regard to rigging, safety, fire safety, and maintenance of operations.

C. Unless specified otherwise, all piping, wiring, conduit, and other devices associated with the equipment not re-used in the new work will be completely removed from Government property per Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT. This includes all concrete equipment pads, pipe, valves, fittings, insulation, and all hangers including the top connection and any fastenings to building structural systems. All openings will be sealed after removal of equipment, pipes, ducts, and other penetrations in roof, walls, floors, in an approved manner and in accordance with plans and specifications where specifically covered. Structural integrity of the building system will be maintained. Reference will also be made to the drawings and specifications of the other disciplines in the project for additional facilities to be demolished or handled.

D. All valves including gate, globe, ball, butterfly and check, all pressure gauges and thermometers with wells will remain Government property and will be removed and delivered to COR and stored as directed. The Contractor will remove all other material and equipment, devices and demolition debris under these plans and specifications. Such material will be removed from Government property expeditiously and will not be allowed to accumulate. Coordinate with the COR and Infection Control.

E. Asbestos Insulation Removal: Conform to Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT.

3.7 CLEANING AND PAINTING

A. Prior to final inspection and acceptance of the plant and facilities for beneficial use by the Government, the plant facilities, equipment and systems will be thoroughly cleaned and painted. Refer to Section 09 91 00, PAINTING.

B. In addition, the following special conditions apply:

1. Cleaning will be thorough. Solvents, cleaning materials and methods recommended by the manufacturers will be used for the specific tasks. All rust will be removed prior to painting and from surfaces to remain unpainted. Scratches, scuffs, and abrasions will be repaired prior to applying prime and finish coats.
2. The following Material and Equipment will NOT be painted:
   a. Motors, controllers, control switches, and safety switches.
   b. Control and interlock devices.
   c. Regulators.
   d. Pressure reducing valves.
   e. Control valves and thermostatic elements.
   f. Lubrication devices and grease fittings.
   g. Copper, brass, aluminum, stainless steel and bronze surfaces.

h. Valve stems and rotating shafts.
i. Pressure gauges and thermometers.
j. Glass.
k. Name plates.

3. Control and instrument panels will be cleaned and damaged surfaces repaired. Touch-up painting will be made with matching paint type and color obtained from manufacturer or computer matched.
4. Pumps, motors, steel and cast-iron bases, and coupling guards will be cleaned, and will be touched-up with the same paint type and color as utilized by the pump manufacturer.
5. Temporary Facilities: Apply paint to surfaces that do not have existing finish coats per Section 09 91 00, Painting.
6. The final result will be a smooth, even-colored, even-textured factory finish on all items. The entire piece of equipment will be repainted, if necessary, to achieve this. Lead based paints will not be used.

3.8 IDENTIFICATION SIGNS

A. Laminated plastic signs, with engraved lettering not less than 7 mm (3/16 inch) high, will be provided that designates equipment function, for all equipment, switches, motor controllers, relays, meters, control devices, including automatic control valves. Nomenclature and identification symbols will correspond to that used in maintenance manual, and in diagrams specified elsewhere. Attach by chain, adhesive, or screws.

B. Factory Built Equipment: Metal plate, securely attached, with name and address of manufacturer, serial number, model number, size, and performance data will be placed on factory-built equipment.

C. Pipe Identification: Refer to Section 09 91 00, PAINTING.

3.9 STARTUP AND TEMPORARY OPERATION

A. Startup of equipment will be performed as described in the equipment specifications. Vibration within specified tolerance will be verified prior to extended operation. Temporary use of equipment is specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT.

B. The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the Contracting Officer’s Representative and CxA. Provide a minimum of 2 weeks prior notice.

3.10 OPERATING AND PERFORMANCE TESTS

A. Prior to the final inspection, all required tests will be performed as specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TESTS and submit the test reports and records to the COR.

B. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost to the Government.

C. When completion of certain work or systems occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then conduct such performance tests and finalize control settings during the first actual seasonal use of the respective systems following completion of work. Rescheduling of these tests will be requested in writing to COR for approval.

D. Perform tests as required for commissioning provisions in accordance with Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS and Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

3.11 OPERATION AND MAINTENANCE MANUALS

A. All new and temporary equipment and all elements of each assembly will be included.

B. Data sheet on each device listing model, size, capacity, pressure, speed, horsepower, impeller size, and other information will be included.

C. Manufacturer's installation, maintenance, repair, and operation instructions for each device will be included. Assembly drawings and parts lists will also be included. A summary of operating precautions and reasons for precautions will be included in the Operations and Maintenance Manual.

D. Lubrication instructions, type and quantity of lubricant will be included.

E. Schematic diagrams and wiring diagrams of all control systems corrected to include all field modifications will be included.

F. Set points of all interlock devices will be listed.

G. Trouble-shooting guide for the control system troubleshooting will be inserted into the Operations and Maintenance Manual.

H. The control system sequence of operation corrected with submittal review comments will be inserted into the Operations and Maintenance Manual.

I. Emergency procedures for shutdown and startup of equipment and systems.

3.12 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

B. Components provided under this section of the specification will be tested as part of a larger system.

3.13 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer's technical representative for 16 hours for big equipment and 4 hours for smaller equipment to instruct each VA personnel responsible in operation and maintenance of the system.

B. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

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SECTION 22 05 12

GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section describes the general motor requirements for plumbing equipment and applies to all sections of Division 22.

B. A complete listing of common acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

E. Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

F. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

G. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

H. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and VHA standard will govern.

B. American Bearing Manufacturers Association (ABMA):
ABMA 9–2015 ..... Load Ratings and Fatigue Life for Ball Bearings

C. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
112-2017 ..... IEEE Standard Test Procedure for Polyphase Induction Motors and Generators

841-2018 ..... IEEE Standard for Petroleum and Chemical Industry-Premium-Efficiency, Severe-Duty, Totally Enclosed Fan-Cooled (TEFC) Squirrel Cage Induction Motors--Up to and Including 370 kW (500 HP)

D. International Code Council (ICC):
IPC-2018 ..... International Plumbing Code

E. National Electrical Manufacturers Association (NEMA):
MG 1-2016 ..... Motors and Generators

MG 2-2014 ..... Safety Standard for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators

250-2018 ..... Enclosures for Electrical Equipment (1000 Volts Maximum)

F. National Fire Protection Association (NFPA):
70-2017 ..... National Electrical Code (NEC)

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT”, with applicable paragraph identification.

C. Submit motor submittals with drive equipment.

D. Shop Drawings:
1. Provide documentation to demonstrate compliance with contract documents.
2. Motor nameplate information shall be submitted including electrical ratings, efficiency, bearing data, power factor, frame size, dimensions, mounting details, materials, horsepower, voltage, phase, speed (RPM), enclosure, starting characteristics, torque characteristics, code letter, full load and locked rotor current, service factor, and lubrication method.
3. Motor parameters required for the determination of the Reed Critical Frequency of vertical hollow shaft motors shall be submitted.

E. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

F. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts and troubleshooting guide:
1. Include complete list indicating all components of the systems.
2. Include complete diagrams of the internal wiring for each item of equipment.
3. iagrams shall have their terminals identified to facilitate installation, operation and maintenance.

G. Certification: Two weeks prior to final inspection, unless otherwise noted, the following certification shall be submitted to the Contracting Officer’s Representative (COR).
1. Certification shall be submitted stating that the motors have been properly applied, installed, adjusted, lubricated, and tested.

H. Completed System Readiness Checklist provided by the CxA and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

I. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

1.5 QUALITY ASSURANCE

A. Bio-Based Materials: For products designated by the USDA’s bio-based Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

B. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

1.6 AS-BUILT DOCUMENTATION

A. Comply with requirements in Paragraph “AS-BUILT DOCUMENTATION” of Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

PART 2 - PRODUCTS

2.1 MOTORS

A. All material and equipment furnished and installation methods shall conform to the requirements of Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES. Provide all electrical wiring, conduit, and devices necessary for the proper connection, protection and operation of the systems. Provide premium efficiency type motors. Unless otherwise specified for a particular application, use electric motors with the following requirements.

B. For alternating current, fractional and integral horsepower motors, NEMA MG 1 and NEMA MG 2 shall apply.

C. For severe duty totally enclosed motors, IEEE 841 shall apply. For severe duty totally enclosed motors, IEEE 841 shall apply.

D. Single-phase Motors: Motors for centrifugal fans and pumps may be split phase or permanent split capacitor (PSC) type. Provide capacitor-start type for hard starting applications.

E. Poly-phase Motors: NEMA Design B, Squirrel cage, induction type.
   1. Two Speed Motors: Each two-speed motor shall have two separate windings. Provide a time- delay (20 seconds minimum) relay for switching from high to low speed.

F. Voltage ratings shall be as follows:
   1. Single phase:
      a. Motors connected to 120-volt systems: 115 volts.
      b. Motors connected to 208-volt systems: 200 volts.
      c. Motors connected to 240-volt or 480-volt systems: 230/460 volts, dual connection.
   2. Three phase:
      a. Motors connected to 208-volt systems: 200 volts.
      b. Motors, less than 74.6 kW (100 HP), connected to 240-volt or 480-volt systems: 230/460 volts, dual connection.
      c. Motors, 74.6 kW (100 HP) or greater, connected to 240-volt systems: 230 volts.
      d. Motors, 74.6 kW (100 HP) or greater, connected to 480-volt systems: 460 volts.
      e. Motors connected to high voltage systems (Over 600V): Shall conform to NEMA MG 1 for connection to the nominal system voltage shown in the drawings.

G. Number of phases shall be as follows:
   1. Motors, less than 373 W (1/2 HP): Single phase.
   2. Motors, 373 W (1/2 HP) and greater: 3 phase.
   3. Exceptions:
      a. Hermetically sealed motors.
      b. Motors for equipment assemblies, less than 746 W (1 HP), may be single phase provided the manufacturer of the proposed assemblies cannot supply the assemblies with three phase motors.

H. Horsepower ratings shall be adequate for operating the connected loads continuously in the prevailing ambient temperatures in areas where the motors are installed, without exceeding the NEMA standard temperature rises for the motor insulation.

I. Motor designs, as indicated by the NEMA code letters, shall be coordinated with the connected loads to assure adequate starting, acceleration and running torque without exceeding nameplate ratings or considering service factor.

J. Motor Enclosures:
   1. Shall be the NEMA types as specified and/or shown in the Contract Documents.
   2. Where the types of motor enclosures are not shown in the drawings, they shall be the NEMA types per NEMA 250, which are most suitable for the environmental conditions where the motors are being installed. Enclosure requirements for certain conditions are as follows:

a. Motors located outdoors, indoors in wet or high humidity locations, or in unfiltered airstreams shall be totally enclosed type.
b. Where motors are located in an NEC 511 classified area, provide TEFC explosion proof motor enclosures.
c. Where motors are located in a corrosive environment, provide TEFC enclosures with corrosion resistant finish.

3. Enclosures shall be primed and finish coated at the factory with manufacturer's prime coat and standard finish.

K. Electrical Design Requirements:
1. Motors shall be continuous duty.
2. The insulation system shall be rated minimum of Class B, 130 degrees C (266 degrees F).
3. The maximum temperature rise by resistance at rated power shall not exceed Class B limits, 80 degrees C (144 degrees F).
4. The speed/torque and speed/current characteristics shall comply with NEMA Design A or B, as specified.
5. Motors shall be suitable for full voltage starting, unless otherwise noted. Coordinate motor features with applicable motor controllers.
6. Motors for variable frequency drive applications shall adhere to NEMA MG 1, Part 30, Application Considerations for Constant Speed Motors Used on a Sinusoidal Bus with Harmonic Content and General Purpose Motors Used with Adjustable Voltage or Adjustable Frequency Controls, or both, or NEMA MG 1, Part 31, Definite Purpose Inverter Fed Polyphase Motors.

L. Mechanical Design Requirements:
1. Bearings shall be rated for a minimum fatigue life of 26,280 hours for belt-driven loads and 100,000 hours for direct-drive loads based on L10 (Basic Rating Life) at full load direct coupled, except vertical high thrust motors which require a 40,000 hour rating. A minimum fatigue life of 40,000 hours is required for VFD drives.
2. Vertical motors shall be capable of withstanding a momentary up thrust of at least 30 percent of normal down thrust.
3. Grease lubricated bearings shall be designed for electric motor use. Grease shall be capable of the temperatures associated with electric motors and shall be compatible with Polyurea based greases.
4. Grease fittings, if provided, shall be Alemite type or equivalent.
5. Oil lubricated bearings, when specified, shall have an externally visible sight glass to view oil level.
6. Vibration shall not exceed 3.8 mm (0.15 inch) per second, unfiltered peak.
7. Noise level shall meet the requirements of the application.
8. Motors on 180 frames and larger shall have provisions for lifting eyes or lugs capable of a safety factor of 5.
9. All external fasteners shall be corrosion resistant.
10. Condensation heaters, when specified, shall keep motor windings at least 5 degrees C (9 degrees F) above ambient temperature.
11. Winding thermostats, when specified shall be normally closed, connected in series.
12. Grounding provisions shall be in the main terminal box.

M. Special Requirements:
1. Where motor power requirements of equipment furnished deviate from power shown on plans, provide electrical service designed under the requirements of NFPA 70 without additional cost or time to the Government.
2. Assemblies of motors, starters, controls and interlocks on factory assembled and wired devices shall be in accordance with the requirements of this specification.
3. Wire and cable materials specified in the electrical division of the specifications shall be modified as follows:

a. Wiring material located where temperatures can exceed 71 degrees C (160 degrees F) shall be stranded copper with Teflon FEP insulation with jacket. This includes wiring on the boilers.
b. Other wiring at boilers and to control panels shall be NFPA 70 designation THWN.
c. Provide shielded conductors or wiring in separate conduits for all instrumentation and control systems where recommended by manufacturer of equipment.

4. Select motor sizes so that the motors do not operate into the service factor at maximum required loads on the driven equipment. Motors on pumps shall be sized for non-overloading at all points on the pump performance curves.
5. Motors utilized with variable frequency drives shall be rated “inverter-duty” per NEMA MG 1, Part 31, Definite-Purpose Inverter-Fed Polyphase Motors. Provide motor shaft grounding apparatus that will protect bearings from damage from stray currents.

N. Additional requirements for specific motors, as indicated in other sections, shall also apply.

O. NEMA Premium Efficiency Electric Motors, Motor Efficiencies: All permanently wired polyphase motors of 746 W (1 HP) or greater shall meet the minimum full-load efficiencies as indicated in the following table, and as specified in this specification. Motors of 746 W (1 HP) or greater with open, drip-proof or totally enclosed fan-cooled enclosures shall be NEMA premium efficiency type, unless otherwise indicated. Motors provided as an integral part of motor driven equipment are excluded from this requirement if a minimum seasonal or overall efficiency requirement is indicated for that equipment by the provisions of another section.

Minimum Efficiencies Open Drip-Proof				Minimum Efficiencies Totally Enclosed Fan-Cooled			
Rating kW (HP)	1200 RPM	1800 RPM	3600 RPM	Rating kW (HP)	1200 RPM	1800 RPM	3600 RPM
0.746 (1)	82.5%	85.5%	77.0%	0.746 (1)	82.5%	85.5%	77.0%
1.12 (1.5)	86.5%	86.5%	84.0%	1.12 (1.5)	87.5%	86.5%	84.0%
1.49 (2)	87.5%	86.5%	85.5%	1.49 (2)	88.5%	86.5%	85.5%
2.24 (3)	88.5%	89.5%	85.5%	2.24 (3)	89.5%	89.5%	86.5%
3.73 (5)	89.5%	89.5%	86.5%	3.73 (5)	89.5%	89.5%	88.5%
5.60 (7.5)	90.2%	91.0%	88.5%	5.60 (7.5)	91.0%	91.7%	89.5%
7.46 (10)	91.7%	91.7%	89.5%	7.46 (10)	91.0%	91.7%	90.2%
11.2 (15)	91.7%	93.0%	90.2%	11.2 (15)	91.7%	92.4%	91.0%
14.9 (20)	92.4%	93.0%	91.0%	14.9 (20)	91.7%	93.0%	91.0%
18.7 (25)	93.0%	93.6%	91.7%	18.7 (25)	93.0%	93.6%	91.7%
22.4 (30)	93.6%	94.1%	91.7%	22.4 (30)	93.0%	93.6%	91.7%
29.8 (40)	94.1%	94.1%	92.4%	29.8 (40)	94.1%	94.1%	92.4%
37.3 (50)	94.1%	94.5%	93.0%	37.3 (50)	94.1%	94.5%	93.0%
44.8 (60)	94.5%	95.0%	93.6%	44.8 (60)	94.5%	95.0%	93.6%
56.9 (75)	94.5%	95.0%	93.6%	56.9 (75)	94.5%	95.4%	93.6%
74.6 (100)	95.0%	95.4%	93.6%	74.6 (100)	95.0%	95.4%	94.1%
93.3 (125)	95.0%	95.4%	94.1%	93.3 (125)	95.0%	95.4%	95.0%
112 (150)	95.4%	95.8%	94.1%	112 (150)	95.8%	95.8%	95.0%
149.2 (200)	95.4%	95.8%	95.0%	149.2 (200)	95.8%	96.2%	95.4%

P. Minimum Power Factor at Full Load and Rated Voltage: 90 percent at 1200 RPM, 1800 RPM and 3600 RPM. Power factor correction capacitors shall be provided unless the motor meets the 0.9 requirement without it or if the motor is controlled by a variable frequency drive. The power factor correction capacitors shall be able to withstand high voltage transients and power line variations without breakdown.

Q. Energy Efficiency of Small Motors (Motor Efficiencies): All motors under 746 W (1 hp) shall meet the requirements of the DOE Small Motor Regulation.

Polyphase Open Motors Average full load efficiency				**Capacitor-start capacitor-run and capacitor-start induction run open motors Average full load efficiency**			
Rating kW (hp)	**6 poles**	**4 poles**	**2 poles**	**Rating kW (hp)**	**6 poles**	**4 poles**	**2 poles**
0.18 (0.25)	67.5	69.5	65.6	0.18 (0.25)	62.2	68.5	66.6

0.25 (0.33)	71.4	73.4	69.5	0.25 (0.33)	66.6	72.4	70.5
0.37 (0.5)	75.3	78.2	73.4	0.37 (0.5)	76.2	76.2	72.4
0.55 (0.75)	81.7	81.1	76.8	0.55 (0.75)	80.2	81.8	76.2

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install motors in accordance with manufacturer's recommendations, the NEC, NEMA, as shown in the drawings and/or as required by other sections of these specifications.

B. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no additional cost or time to the Government.

3.2 FIELD TESTS

A. All tests shall be witnessed by the CxA or by the COR.

B. Perform an electric insulation resistance Test using a megohmmeter on all motors after installation, before startup. All shall test free from grounds.

C. Perform Load test in accordance with IEEE 112, Test Method B, to determine freedom from electrical or mechanical defects and compliance with performance data.

D. Insulation Resistance: Not less than 1/2 meg-ohm between stator conductors and frame, to be determined at the time of final inspection.

E. All test data shall be complied into a report form for each motor and provided to the contracting officer or their representative.

3.3 STARTUP AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

C. The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with COR and CxA. Provide a minimum notice of 10 working days prior to startup and testing.

3.4 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

B. Components provided under this section of the specification shall be tested as part of a larger system.

3.5 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer's technical representative for 16 hours for large equipment and 4 hours for small equipment to instruct each VA personnel responsible in operation and maintenance of the system.

B. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

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SECTION 22 05 19

METERS AND GAUGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section describes the requirements for water meters and gauges primarily used for troubleshooting the system and to indicate system performance.

B. A complete listing of common acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

C. Components intended to be connected to BAS shall be furnished under Section 23 09 23 DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC for installation under this section.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

E. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

F. Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS. Requirements for commissioning, systems readiness checklist, and training.

G. Section 23 09 23, DIRECT DIGITAL CONTROL SYSTEMS FOR HAVC.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standard will govern.

B. American Society of Mechanical Engineers (ASME):
B40.100-2013.....Pressure Gauges and Gauge Attachments

B40.200-2008.....Thermometers, Direct Reading and Remote Reading

C. American Water Works Association (AWWA):
C700-2015.....Cold Water Meters, Displacement Type, Bronze Main Case

C701-2015.....Cold Water Meters-Turbine Type, for Customer Service

C702-20115.....Cold Water Meters – Compound Type

C707-2010 (R2016) .....Encoder-Type Remote-Registration Systems for Cold-Water Meters

D. Institute of Electrical and Electronics Engineers (IEEE):
C2–2017.....National Electrical Safety Code (NESC)

E. International Code Council (ICC):
IPC-2018 .....International Plumbing Code

F. National Fire Protection Association (NFPA):
70–2020 .....National Electrical Code (NEC)

G. NSF International (NSF):

61-2019 .....Drinking Water System Components – Health Effects

372-2016 .....Drinking Water System Components – Lead Content

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 22 05 19, METERS AND GAUGES FOR PLUMBING PIPING”, with applicable paragraph identification.

C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
   1. Water Meter.
   2. Pressure Gauges.
   3. Thermometers.
   4. Product certificates for each type of meter and gauge.
   5. BACnet communication protocol.
   6. Complete operating and maintenance manual shall including wiring diagrams, technical data sheets, information for ordering replaceable parts, and troubleshooting guide:
   7. Include complete list indicating all components of the system.
   8. Include complete diagrams of the internal wiring for each item of equipment.
   9. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

D. Completed System Readiness Checklist provided by the CxA and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

E. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

1.5 AS-BUILT DOCUMENTATION

A. Comply with requirements in Paragraph “AS-BUILT DOCUMENTATION” of Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

PART 2 - PRODUCTS

2.1 DISPLACEMENT WATER METER

A. For pipe sizes 50 mm (2 inches) and smaller, the water meter shall be displacement type, full size nutating disc, magnetic drive, sealed register, and fully conform to AWWA C700. Peak domestic flow shall be 2.2 L/s (34 gpm). The meter register shall indicate flow in liters (U.S. gallons).

B. The water meter shall be rated for use at temperatures ranging from -40 degrees C (-40 degrees F) and 70 degrees C (158 degrees F) and operate at a working pressure of 1035 kPa (150 psig).

C. The meter case, bottom caps, and register box lids shall be constructed from cast bronze.

D. The meter shall register plus or minus 3 percent of the water actually passing through it at any rate of flow within the normal test flow limits specified in AWWA 700.

E. The water meter shall conform to NSF 61 and NSF 372.

2.2 TURBINE WATER METER

A. The water meter shall be Turbine type, Class II, in-line, horizontal axis, and fully conform to AWWA C701. Peak domestic flow shall be ____L/s (____ gpm). The meter Register shall indicate flow in liters (U.S. gallons).

B. The water meter shall be rated for use at temperatures ranging from -40 degrees C (-40 degrees F) and 70 degrees C (158 degrees F) and operate at a working pressure of 1035 kPa (150 psig).

C. The turbine case shall be constructed of cast bronze.

D. The register box rings and lid shall be made of cast copper alloy containing not less than 75 percent copper. Forged or die cast copper alloy containing not less than 75 percent copper or a suitable synthetic polymer.

E. The flow measuring turbine shall be made of a suitable synthetic polymer with specific gravity approximately equal to that of water. The measuring turbine shall have sufficient dimensional stability to retain operating clearances at the full range of working temperatures.

F. All external case closures, such as rings, clamps, screws, bolts, cap bolts, nuts and washers shall be designed for easy removal following lengthy service.

G. The turbine meter shall have flanged ends and supplied with companion flanges, gaskets, and with bolts and nuts. The companion flanges shall be made of cast iron.

H. The meter shall register plus or minus 3 percent of the water actually passing through it at any rate of flow within the normal test flow limits specified in AWWA 701.

I. The water meter shall conform to NSF 61 and NSF 372.

2.3 COMPOUND WATER METER

A. The compound water meter shall be a combination of a main line meter of the turbine type and a meter of appropriate size for measuring low rates of flow. The compound meter shall have an automatic valve mechanism for diverting low rates of flow through the bypass meter. Both metering devices shall be provided with registers contained in the same case. The operating characteristics shall fully conform to AWWA C702. Peak domestic flow rate shall be ____L/s (____ gpm). The bypass meter flow rate shall be ____L/s (____ gpm). Each Register shall indicate in liters (U.S. gallons).

B. The water meter shall be rated for use at temperatures ranging from -40 degrees C (-40 degrees F) and 70 degrees C (158 degrees F) and operate at a working pressure of 1035 kPa (150 psig).

C. The main case shall be made of copper alloy containing no less than 75 percent copper.

D. The register box rings and lids shall be made of a cast copper alloy.

E. The measuring chambers shall be made of a copper alloy containing not less than 84 percent copper.

F. The measuring turbines shall be made of a suitable synthetic polymer with specific gravity approximately equal to that of water or stainless steel. The measuring turbines shall have sufficient dimensional stability to retain operating clearances at working temperatures.

G. The turbine meter shall have flanged ends and supplied with companion flanges, gaskets, and with bolts and nuts. The companion flanges shall be made of cast iron.

H. The meter shall register plus or minus 3 percent of the water actually passing through it at any rate of flow within the normal test flow limits specified in AWWA C702 except in the registration of flows within the changeover period from bypass meter to main meter.

I. The water meter shall conform to NSF 61 and NSF 372.

2.4 WATER METER STRAINER

A. All meters shall be fitted with a factory installed integral strainer or bronze inlet strainer with top access. The strainer shall conform to AWWA C702.

B. The water meter strainer shall conform to NSF 61 and NSF 372.

2.5 WATER METER PROGRAMMING

A. All meters 50 mm or DN 50 (2 inches) and greater shall be programmable with software supplied by the meter manufacturer.

B. The software shall have a Microsoft based interface and operate on the latest Windows operating system. The software shall allow the user to configure the meter, troubleshoot the meter, query and display meter parameters, and configure data and stored values.

C. The meter firmware shall be upgradeable through one of the communication ports without removing the unit from service.

D. The meter shall include output for analog 4-20 milliamp signals and binary output.

E. The meter shall have two dry contact relays outputs for alarm or control functions.

2.6 WATER METER COMMUNICATION PROTOCOL

A. The meter shall use a native BACnet Ethernet communication protocol compatible with the existing controls system. The communications shall be protected against surges induced on its communications channels.

2.7 REMOTE READOUT REGISTER

A. All meters shall be equipped with a remote readout register in accordance with AWWA C707.

2.8 PRESSURE GAUGES FOR WATER AND SEWAGE USAGE

A. ASME B40.100 all metal case 115 mm (4-1/2 inches) diameter, bottom connected throughout, graduated as required for service, and identity labeled. Range shall be 0 to 1380 kPa (0 to 200 psig) gauge.

B. The pressure element assembly shall be bourdon tube. The mechanical movement shall be lined to pressure element and connected to pointer.

C. The dial shall be non-reflective aluminum with permanently etched scale markings graduated in kPa and psig.

D. The pointer shall be dark colored metal.

E. The window shall be glass.

F. The ring shall be brass or stainless steel.

G. The accuracy shall be grade A, plus or minus 1 percent of middle half of scale range.

H. The pressure gauge for water domestic use shall conform to NSF 61 and NSF 372.

2.9 THERMOMETERS

A. Thermometers shall be straight stem, metal case, red liquid-filled thermometer, approximately 175 mm (7 inches) high, 4 degrees C to 100 degrees C (40 degrees F to 212 degrees F). Thermometers shall comply with ASME B40.200.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Direct mounted pressure gauges shall be installed in piping tees with pressure gauge located on pipe at the most readable position.

B. Valves and snubbers shall be installed in piping for each pressure gauge.

C. Test plugs shall be installed on the inlet and outlet pipes of all heat exchangers or water heaters serving more than one plumbing fixture.

D. Pressure gauges shall be installed where indicated in the drawings and at the following locations:
   1. Building water service entrance into building.
   2. Inlet and outlet of each pressure reducing valve.
   3. Suction and discharge of each domestic water pump or re-circulating hot water return pump.

E. Water meter installation shall conform to AWWA C700, AWWA C701, and AWWA C702. Electrical installations shall conform to IEEE C2, NFPA 70, and to the requirements specified herein. New materials shall be provided.

F. Remote readout register shall be mounted at the location indicated in the drawings or as directed by the COR.

G. Thermometers shall be installed on the water heater inlet and outlet piping, thermostatic mixing valve outlet piping, and the hot water circulation pump inlet piping.

H. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no additional cost or time to the Government.

I. Install portable water temperature, pressure and flow meters provided under Section 23 09 23 DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC.

3.2 FIELD QUALITY CONTROL

A. The meter assembly shall be visually inspected and operationally tested. The correct multiplier placement on the face of the meter shall be verified.

3.3 STARTUP AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

C. The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the COR and CxA. Provide a minimum notice of 10 working days prior to startup and testing.

3.4 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

B. Components provided under this section of the specification will be tested as part of a larger system.

3.5 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer's technical representative for 16 for large equipment and 4 hours for smaller equipment to instruct each VA personnel responsible in operation and maintenance of the system.

B. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

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SECTION 22 05 23

GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section describes the requirements for general-duty valves for domestic water and sewer systems.

B. A complete listing of common acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

E. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

F. Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standard will govern.

B. American Society of Mechanical Engineers (ASME):
A112.14.1-2003 ..... Backwater Valves

C. American Society of Sanitary Engineering (ASSE):
1001-2017 ..... Performance Requirements for Atmospheric Type Vacuum Breakers

1003-2009 ..... Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems

1011-2017 ..... Performance Requirements for Hose Connection Vacuum Breakers

1013-2011 ..... Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers

1015-2011 ..... Performance Requirements for Double Check Backflow Prevention Assemblies and Double Check Fire Protection Backflow Prevention Assemblies

1017-2009 ..... Performance Requirements for Temperature Actuated Mixing Valves for Hot Water Distribution Systems

1020-2004 ..... Performance Requirements for Pressure Vacuum Breaker Assembly

1035-2008 ..... Performance Requirements for Laboratory Faucet Backflow Preventers

1069-2005 ..... Performance Requirements for Automatic Temperature Control Mixing Valves

1070-2015 ..... Performance Requirements for Water Temperature Limiting Devices

1071-2012 ..... Performance Requirements for Temperature Actuated Mixing Valves for Plumbed Emergency Equipment

D. American Society for Testing and Materials (ASTM):

A126-2004(R2019)..... Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings

A276/A276M-2017 ..... Standard Specification for Stainless Steel Bars and Shapes

A536-1984(R2019e)..... Standard Specification for Ductile Iron Castings

B62-2017..... Standard Specification for Composition Bronze or Ounce Metal Castings

B584-2014..... Standard Specification for Copper Alloy Sand Castings for General Applications

E. International Code Council (ICC):

IPC-2018 ..... International Plumbing Code

F. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS):

SP-25-2018 ..... Standard Marking Systems for Valves, Fittings, Flanges and Unions

SP-67-2017 ..... Butterfly Valves

SP-70-2011 ..... Gray Iron Gate Valves, Flanged and Threaded Ends

SP-71-2018 ..... Gray Iron Swing Check Valves, Flanged and Threaded Ends

SP-80-2019 ..... Bronze Gate, Globe, Angle, and Check Valves

SP-85-2011 ..... Gray Iron Globe & Angle Valves, Flanged and Threaded Ends

SP-110-2010 ..... Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

G. National Environmental Balancing Bureau (NEBB):

8th Edition 2015 ..... Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems

H. NSF International (NSF):

61-2019 ..... Drinking Water System Components – Health Effects

372-2016 ..... Drinking Water System Components – Lead Content

I. University of Southern California Foundation for Cross Connection Control and Hydraulic Research (USC FCCCHR):

10th Edition ..... Manual of Cross-Connection Control

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING”, with applicable paragraph identification.

C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
   1. Ball Valves.
   2. Gate Valves.
   3. Butterfly Valves.
   4. Balancing Valves.
   5. Check Valves.
   6. Globe Valves.
   7. Water Pressure Reducing Valves and Connections.
   8. Backwater Valves.
   9. Backflow Preventers.
   10. Chainwheels.
   11. Thermostatic Mixing Valves.

D. Test and Balance reports for balancing valves.

E. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts and troubleshooting guide:
   1. Include complete list indicating all components of the systems.
   2. Include complete diagrams of the internal wiring for each item of equipment.
   3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.
   4. Piping diagrams of thermostatic mixing valves to be installed.

F. Completed System Readiness Checklist provided by the CxA and completed by the Contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

G. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Valves shall be prepared for shipping as follows:
   1. Protect internal parts against rust and corrosion.
   2. Protect threads, flange faces, grooves, and weld ends.
   3. Set angle, gate, and globe valves closed to prevent rattling.
   4. Set ball and plug valves open to minimize exposure of functional surfaces.
   5. Set butterfly valves closed or slightly open.
   6. Block check valves in either closed or open position.

B. Valves shall be prepared for storage as follows:
   1. Maintain valve end protection.
   2. Store valves indoors and maintain at higher than ambient dew point temperature.

C. A sling shall be used for large valves. The sling shall be rigged to avoid damage to exposed parts. Hand wheels or stems shall not be used as lifting or rigging points.

1.6 AS BUILT DOCUMENTATION

A. Comply with requirements in Paragraph “AS-BUILT DOCUMENTATION” of Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

PART 2 - PRODUCTS

2.1 VALVES, GENERAL

A. Asbestos packing and gaskets are prohibited.

B. Bronze valves shall be made with dezincification resistant materials. Bronze valves made with copper alloy (brass) containing greater than 15 percent zinc shall not be permitted.

C. Valves in insulated piping shall have 50 mm or DN50 (2 inch) stem extensions and extended handles of non-thermal conductive material that allows operating the valve without breaking the vapor seal or disturbing the insulation. Memory stops shall be fully adjustable after insulation is applied.

D. Exposed Valves over 65 mm or DN65 (2-1/2 inches) installed at an elevation over 3.6 m (12 feet) shall have a chain-wheel attachment to valve hand-wheel, stem, or other actuator.

E. All valves used to supply potable water shall meet the requirements of NSF 61 and NSF 372.

F. Bio-Based Materials: For products designated by the USDA's bio-based Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

G. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

2.2 SHUT-OFF VALVES

A. Cold, Hot and Re-circulating Hot Water:
   1. 50 mm or DN50 (2 inches) and smaller: Ball, MSS SP-110, Ball valve shall be full port three piece or two piece with a union design with adjustable stem package. Threaded stem designs are not allowed. The ball valve shall have a SWP rating of 1035 kPa (150 psig) and a CWP rating of 4138 kPa (600 psig). The body material shall be Bronze ASTM B584, Alloy C844. The ends shall be non-lead solder.
   2. Less than 100 mm DN100 (4 inches): Butterfly shall have an iron body with EPDM seal and aluminum bronze disc. The butterfly valve shall meet MSS SP-67, type I standard. The butterfly valve shall have a SWP rating of 1380 kPa (200 psig). The valve design shall be lug type suitable for bidirectional dead-end service at rated pressure. The body material shall meet ASTM A536, ductile iron.
   3. 100 mm DN100 (4 inches) and greater:
      a. Class 125, OS&Y, Cast Iron Gate Valve. The gate valve shall meet MSS SP-70 type I standard. The gate valve shall have a CWP rating of 1380 kPa (200 psig). The valve materials shall meet ASTM A126, grey iron with bolted bonnet, flanged ends, bronze trim, and positive-seal resilient solid wedge disc. The gate valve shall be gear operated for sizes under 200 mm or DN200 (8 inches) and crank operated for sizes 200 mm or DN200 (8 inches) and greater.
      b. Single flange, ductile iron butterfly valves: The single flanged butterfly valve shall meet the MSS SP-67 standard. The butterfly valve shall have a CWP rating of 1380 kPa (200 psig). The butterfly valve shall be lug type, suitable for bidirectional dead-end service at rated pressure without use of downstream flange. The body material shall comply with ASTM A536 ductile iron. The seat shall be EPDM with stainless steel disc and stem.
      c. Grooved end, ductile iron butterfly valves. The grooved butterfly valve shall meet the MSS SP-67 standard. The grooved butterfly valve shall have a CWP rating of 1380 kPa (200 psig). The valve materials shall be epoxy coated ductile iron conforming to ASTM A536 with two-piece stainless-steel stem, Buna-N or EPDM encapsulated ductile iron disc, and EPDM seal. The butterfly valve shall be gear operated.

B. Reagent Grade Water: Valves for reagent grade, reverse osmosis, or deionized water service shall be ball type of same material as used for pipe.

2.3 MANUAL BALANCING VALVES

A. Hot Water Re-circulating, 75 mm or DN75 (3 inches) and smaller manual balancing valve shall be of bronze body, brass ball construction with glass and carbon filled TFE seat rings and designed for positive shutoff. The manual balancing valve shall have differential pressure read-out ports across the valve seat area. The read out ports shall be fitted with internal EPT inserts and check valves. The valve body shall have 8 mm or DN8 NPT (1/4 inch NPT) tapped drain and purge port. The valves shall have memory stops that allow the valve to close for service and then reopened to set point without disturbing the balance position. All valves shall have calibrated nameplates to assure specific valve settings.

B. Greater than 75 mm or DN75 (3 inches): Manual balancing valves shall be of heavy duty cast iron flanged construction with 861 kPa (125 psig) flange connections. The flanged manual balancing valves shall have either a brass ball with glass and carbon filled TFE seal rings or fitted with a bronze seat, replaceable bronze disc with EPDM seal insert and stainless steel stem. The design pressure shall be 1200 kPa (175 psig) at 121 degrees C (250 degrees F).

2.4 THERMOSTATIC BALANCING VALVES

A. Thermostatic recirculation balancing valves for domestic hot water and domestic cold water application. Thermostatically controlled, spring actuated automatic balancing valve to very recirculation flow to maintain constant return temperatures. Stainless steel body, spring and brass or stainless steel thermal actuator and actuator carrier. Provide with threaded inlet, integral outlet union and stainless steel check valve. PTFE seat seal ring and EPDM body seal.

2.5 CHECK VALVES

A. 75 mm or DN75 (3 inches) and smaller shall be Class 125, bronze swing check valves with non-metallic disc suitable for type of service. The check valve shall meet MSS SP-80 Type 4 standard. The check valve shall have a CWP rating of 1380 kPa (200 psig). The check valve shall have a Y pattern horizontal body design with bronze body material conforming to ASTM B62, solder joints, and PTFE or TFE disc.

B. 100 mm or DN100 (4 inches) and greater:
   1. Check valves shall be Class 125, iron swing check valve with lever and weight closure control. The check valve shall meet MSS SP-71 Type I standard. The check valve shall have a CWP rating of 1380 kPa (200 psig). The check valve shall have a clear or full waterway body design with gray iron body material conforming to ASTM A126, bolted bonnet, flanged ends, bronze trim.
   2. All check valves on the discharge side of submersible sump pumps shall have factory installed exterior level and weight with sufficient weight to prevent the check valve from hammering against the seat when the sump pump stops.

2.6 GLOBE VALVES

A. 75 mm or DN75 (3 inches) or smaller: Class 150, bronze globe valve with non-metallic disc. The globe valve shall meet MSS SP-80, Type 2 standard. The globe valve shall have a CWP rating of 2070 kPa (300 psig). The valve material shall be bronze with integral seal and union ring bonnet conforming to ASTM B62 with solder ends, copper-silicon bronze stem, PTFE or TFE disc, and malleable iron hand wheel.

B. Greater than 75 mm or DN75 (3 inches): Similar to above, except with cast iron body and bronze trim, Class 125, iron globe valve. The globe valve shall meet MSS SP-85, Type 1 standard. The globe valve shall have a CWP rating of 1380 kPa (200 psig). The valve material shall be gray iron with bolted bonnet conforming to ASTM A126 with flanged ends, bronze trim, and malleable iron handwheel.

2.7 WATER PRESSURE REDUCING VALVE AND CONNECTIONS

A. 75 mm or DN75 (3 inches) or smaller: The pressure reducing valve shall consist of a bronze body and bell housing, a separate access cover for the plunger, and a bolt to adjust the downstream pressure. The pressure reducing valve shall meet ASSE 1003. The bronze bell

housing and access cap shall be threaded to the body and shall not require the use of ferrous screws. The assembly shall be of the balanced piston design and shall reduce pressure in both flow and no flow conditions. The assembly shall be accessible for maintenance without having to remove the body from the line.

B. 100 mm or DN100 (4 inches) and greater: The pressure reducing valve shall consist of a flanged cast iron body and rated to 1380 kPa (200 psig). The valve shall have a large elastomer diaphragm for sensitive response. The pressure reducing valve shall meet ASSE 1003.

C. The regulator shall have a tap for pressure gauge.

D. The regulator shall have a temperature rating of 100 degrees C (212 degrees F) for hot water or hot water return service. Pressure regulators shall have accurate pressure regulation to 6.9 kPa (+/- 1 psig).

E. Setting: Entering water pressure, discharge pressure, capacity, size, and related measurements shall be as shown on the drawings.

F. Connections Valves and Strainers: Shut off valves shall be installed on each side of reducing valve and a bypass line equal in size to the regulator inlet pipe shall be installed with a normally closed globe valve. A strainer shall be installed on inlet side of, and same size as pressure reducing valve. A pressure gauge shall be installed on the inlet and outlet of the valve.

2.8 BACKWATER VALVE

A. The backwater valve shall have a cast iron body, automatic thermoplastic type valve seat and flapper suited for water service. The flapper shall be slightly open during periods of non-operation. The pressure reducing valve shall meet ASME A112.14.1. The cleanout shall be extended to the finish floor and fit with a threaded countersunk plug. A clamping device shall be included when the cleanout extends through the waterproofing membrane.

B. When the backwater valve is installed greater than 600 mm (24 inches) below the finish floor elevation, a pit or manhole large enough for a repair person can enter to service the backwater valve shall be installed.

2.9 BACKFLOW PREVENTERS

A. A backflow prevention assembly shall be installed at any point in the plumbing system where the potable water supply comes in contact with a potential source of contamination. The backflow prevention assembly shall be approved by the University of Southern California Foundation for Cross Connection Control and Hydraulic Research (USCFCCC).

B. The reduced pressure principle backflow prevention assembly shall be ASSE listed 1013 with full port OS&Y positive-seal resilient gate valves and an integral relief monitor switch. The main body and access cover shall be epoxy coated ductile iron conforming to ASTM A536 grade 4. The seat ring and check valve shall be the thermoplastic type suited for water service. The stem shall be stainless steel conforming to ASTM A276/A276M. The seat disc shall be the elastomer type suited for water service. The checks and the relief valve shall be accessible for maintenance without removing the device from the line. An epoxy coated wye type strainer with flanged connections shall be installed on the inlet. Reduced pressure backflow preventers shall be installed in the following applications.
   1. Deionizers.
   2. Sterilizers.
   3. Dialysis, Deionized or Reverse Osmosis Water Systems.
   4. Water make up to heating systems, cooling tower, chilled water system, generators, and similar equipment consuming water.
   5. Water service entrance from loop system.
   6. Dental equipment.
   7. Power washer.
   8. Medical equipment.
   9. Process equipment.

10. Autopsy, on each hot and cold water outlet at each table or sink.
11. Reclaimed water systems.

C. The pipe applied or integral atmospheric vacuum breaker shall be ASSE listed 1001. The main body shall be cast bronze. The seat disc shall be the elastomer type suited for water service. The device shall be accessible for maintenance without removing the device from the service line. The installation shall not be in a concealed or inaccessible location or where the venting of water from the device during normal operation is deemed objectionable. Atmospheric vacuum breakers shall be installed in the following applications.
1. Hose bibs and sinks with threaded outlets.
2. Disposers.
3. Showers (telephone/handheld type).
4. Hydrotherapy units.
5. All kitchen equipment, if not protected by air gap.
6. Ventilating hoods with wash down system.
7. Film processor.
8. Detergent system.
9. Fume hoods.
10. Glassware washers.
11. Service sinks (integral with faucet only).
12. Laundry tubs (integral with faucet only).
13. Sitz baths.

D. The hose connection vacuum breaker shall be ASSE listed 1011. The main body shall be cast brass with stainless steel working parts. The diaphragm and disc shall be the elastomer type suited for water service. The device shall permit the attachment of portable hoses to hose thread outlets. Hose connection vacuum breakers shall be installed in the following locations requiring non-continuous pressure:
1. Hose bibbs and wall hydrants.

E. The pressure vacuum breaker shall be ASSE listed 1020. The main body shall be brass. The disc and O-ring seal shall be the elastomer type. The valve seat and disc float shall be the thermoplastic type. Tee handle or lever handle shut-off ball valves. Test cocks for testing and draining where freezing conditions occur. All materials shall be suitable for water service. The device shall be accessible for maintenance without removing the device from the service line. The installation shall not be in a concealed or inaccessible location or where the venting of water from the device during normal operation is deemed objectionable. Pressure vacuum breakers shall be installed in the following locations requiring continuous pressure and no backpressure including equipment with submerged inlet connections:
1. Lawn Irrigation.

F. The laboratory faucet vacuum breaker shall be ASSE listed 1035. The main body shall be cast brass. Dual check valves with stainless steel working parts. The diaphragm and disc shall be the elastomer type suited for water service. The device shall permit the attachment of portable hoses to laboratory faucets for non-continuous pressure applications.

G. The double check backflow prevention assembly shall be ASSE listed 1015 and supply with full port, OS&Y, positive-seal, resilient gate valves. The main body and access cover shall be epoxy coated ductile iron conforming to ASTM A536 grade. The seat ring and check valve shall be the thermoplastic type suited for water service. The stem shall be stainless steel conforming to ASTM A276/A276M. The seat disc shall be the elastomer type suited for water service. The first and second check valve shall be accessible for maintenance without removing the device from the line. Double check valves shall be installed in the following location requiring continuous pressure subject to backpressure and backsiphonage conditions.
1. Lawn Irrigation.
2. Food Processing Equipment.
3. Laundry equipment.

2.10 CHAINWHEELS

A. Valve chain wheel assembly with sprocket rim brackets and chain shall be constructed according to the following:
   1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
   2. Attachment: For connection to ball or butterfly valve stem.
   3. Sprocket rim with chain guides: Ductile or cast iron of type and size required for valve with zinc coating.
   4. Chain: Hot dipped galvanized steel or Stainless steel of size required to fit sprocket rim.

2.11 THERMOSTATIC MIXING VALVES

A. Thermostatic Mixing Valves shall comply with the following general performance requirements:
   1. Shall meet ASSE requirements for water temperature control.
   2. The body shall be cast bronze or brass with corrosion resistant internal parts preventing scale and biofilm build-up. Provide chrome-plated finish in exposed areas.
   3. No special tool shall be required for temperature adjustment, maintenance, replacing parts and disinfecting operations.
   4. Valve shall be able to be placed in various positions without making temperature adjustment or reading difficult.
   5. Valve finish shall be chrome plated in exposed areas.
   6. Valve shall allow easy temperature adjustments to allow hot water circulation. Internal parts shall be able to withstand disinfecting operations of chemical and thermal treatment of water temperatures up to 82°C (180°F) for 30 minutes or 50 mg/L (50 ppm) chlorine residual concentration for 24 hours.
   7. Parts shall be easily removed or replaced without dismantling the valves, for easy scale removal and disinfecting of parts.
   8. Valve shall have a manual adjustable temperature control with locking mechanism to prevent tampering by end user. Outlet temperature shall be visible to ensure outlet temperature does not exceed specified limits, particularly after thermal eradication procedures.
   9. Provide mixing valves with integral check valves with screens and stop valves.

B. Water Temperature Limiting Devices (ANTISCALD):
   1. Application: Single plumbing fixture point-of-use such as sinks or lavatories.
   2. Standard: ASSE 1070.
   3. Pressure Rating: 861 kPa (125 psig).
   4. Type: Thermostatic/ pressure controlled water mixing valve set at 43 degrees C (110 degrees F).
   5. Connections: Threaded union, compression or soldered inlets and outlet.
   6. Upon cold water supply failure the hot water flow shall automatically be reduced to 0.2 gpm maximum.
   7. Provide with override button to be activated for thermal eradication of pipes.

C. Temperature Activated Mixing Valves:
   1. Application: Emergency eye/face/drench shower equipment.
   2. Standard: ASSE 1071.
   3. Pressure Rating: 861 kPa (125 psig).
   4. Type: Thermostatically controlled water mixing valve set at 24-30 degrees C (75-85 degrees F).
   5. Connections: Soldered or threaded union inlets and outlet.
   6. Thermometers shall be provided to indicate mixed water temperature.
   7. Upon cold water supply failure the hot water flow shall automatically be reduced to 0.5 gpm maximum.
   8. Provide with override button to be activated for thermal eradication of pipes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Valve interior shall be examined for cleanliness, freedom from foreign matter, and corrosion. Special packing materials shall be removed, such as blocks, used to prevent disc movement during shipping and handling.

B. Valves shall be operated in positions from fully open to fully closed. Guides and seats shall be examined and made accessible by such operations.

C. Threads on valve and mating pipe shall be examined for form and cleanliness.

D. Mating flange faces shall be examined for conditions that might cause leakage. Bolting shall be checked for proper size, length, and material. Gaskets shall be verified for proper size and that its material composition is suitable for service and free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Valves shall be located for easy access and shall be provide with separate support. Valves shall be accessible with access doors when installed inside partitions or above hard ceilings.

C. Valves shall be installed in horizontal piping with stem at or above center of pipe.

D. Valves shall be installed in a position to allow full stem movement.

E. Install chain wheels on operators for ball, butterfly, and gate valves NPS 100 mm or DN100 (4 inches) and greater and installed greater than 3.0 m (10 feet) above floor. Chains shall be extended to 1524 mm (60 inches) above finished floor.

F. Check valves shall be installed for proper direction of flow and as follows:
   1. Swing Check Valves: In horizontal position with hinge pin level and on top of valve.

G. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that shall be sources of contamination. Comply with authorities having jurisdiction. Locate backflow preventers in same room as connected equipment or system.
   1. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are prohibited for this application.

H. Install pressure gauges on outlet of backflow preventers.

I. Do not install bypass piping around backflow preventers.

J. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets.
   1. Install thermometers if specified.
   2. Install cabinet-type units recessed in or surface mounted on wall as specified.

K. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no additional cost or time to the Government.

L. Install thermostatic balancing valves with inlet strainer and inlet and outlet isolation valves.

3.3 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
   1. Calibrated balancing valves.
   2. Master, thermostatic, water mixing valves.

3. Manifold, thermostatic, water-mixing-valve assemblies.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.

3.4 ADJUSTING

A. Valve packing shall be adjusted or replaced after piping systems have been tested and put into service but before final adjusting and balancing. Valves shall be replaced if persistent leaking occurs.

B. Set field-adjustable flow set points of balancing valves and record data. Ensure recorded data represents actual measured or observed conditions. Permanently mark settings of valves and other adjustment devices allowing settings to be restored. Set and lock memory stops. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

D. Testing and adjusting of balancing valves shall be performed by an independent NEBB Accredited Test and Balance Contractor. A final settings and flow report shall be submitted to the VA Contracting Officer's Representative (COR).

3.5 STARTUP AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

C. The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the COR and CxA. Provide a minimum notice of 10 working days prior to startup and testing.

3.6 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

B. Components provided under this section of the specification will be tested as part of a larger system.

3.7 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer's technical representative for 16 hours for large equipment and 4 hours for smaller equipment to instruct each VA personnel responsible in operation and maintenance of the system.

B. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

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SECTION 22 07 11

PLUMBING INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Field applied insulation for thermal efficiency and condensation control for the following:
   1. Plumbing piping and equipment.

B. Definitions:
   1. ASJ: All Service Jacket, Kraft paper, white finish facing or jacket.
   2. Air conditioned space: Space having air temperature and/or humidity controlled by mechanical equipment.
   3. All insulation systems installed within supply, return, exhaust, relief and ventilation air plenums shall be limited to uninhabited crawl spaces, areas above a ceiling or below the floor, attic spaces, interiors of air conditioned or heating ducts, and mechanical equipment rooms shall be noncombustible or shall be listed and labeled as having a flame spread indexes of not more than 25 and a smoke-developed index of not more than 50 when tested in accordance with ASTM E84 or UL 723. Note: ICC IMC, Section 602.2.1.
   4. Cold: Equipment or piping handling media at design temperature of 15 degrees C (60 degrees F) or below.
   5. Concealed: Piping above ceilings and in chases, interstitial space, and pipe spaces.
   6. Exposed: Piping and equipment exposed to view in finished areas including mechanical equipment rooms or exposed to outdoor weather. Shafts, chases, interstitial spaces, unfinished attics, crawl spaces and pipe basements are not considered finished areas.
   7. FSK: Foil-scrim-Kraft facing.
   8. Hot: Plumbing equipment or piping handling media above 40 degrees C (104 degrees F).
   9. Density: kg/m^3 - kilograms per cubic meter (Pcf - pounds per cubic foot).
   10. Thermal conductance: Heat flow rate through materials.
      a. Flat surface: Watts per square meter (BTU per hour per square foot).
      b. Pipe or Cylinder: Watts per linear meter (BTU per hour per linear foot) for a given outside diameter.
   11. Thermal Conductivity (k): Watts per meter, per degree K (BTU - inch thickness, per hour, per square foot, per degree F temperature difference).
   12. Vapor Retarder (Vapor Barrier): A material which retards the transmission (migration) of water vapor. Performance of the vapor retarder is rated in terms of permeance (perms). For the purpose of this specification, vapor retarders/vapor barriers shall have a maximum published permeance of .02 perms.
   13. HWR: Hot water recirculating.
   14. CW: Cold water.
   15. SW: Soft water.
   16. HW: Hot water.
   17. PVDC: Polyvinylidene chloride vapor retarder jacketing, white.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS: Insulation material and insulation production method.

D. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

E. Section 02 82 13.13, GLOVEBAG ASBESTOS ABATEMENT: Insulation containing asbestos material.

F. Section 07 84 00, FIRESTOPPING: Mineral fiber and bond breaker behind sealant.

G. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING: General mechanical requirements and items, which are common to more than one section of Division 22.

H. Section 22 05 19, METERS AND GAGES FOR PLUMBING PIPING: Hot and cold water piping.

I. Section 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING: Hot and cold water piping.

J. Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

K. Section 23 21 13, HYDRONIC PIPING: electrical heat tracing systems.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.

B. American Society for Testing and Materials (ASTM):

B209-2014 ..... Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

C411-2011 ..... Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation

C449-2007 (R2013) ..... Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement

C450-2008 (R2014) ..... Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging

Adjunct to C450 ..... Compilation of Tables that Provide Recommended Dimensions for Prefab and Field Thermal Insulating Covers, etc.

C533-2013 ..... Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation

C534/C534M-2014 ..... Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form

C547-2015 ..... Standard Specification for Mineral Fiber Pipe Insulation

C552-2014 ..... Standard Specification for Cellular Glass Thermal Insulation

C553-2013 ..... Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications

C591-2013 ..... Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation

C680-2014 ..... Standard Practice for Estimate of the Heat Gain or Loss and the Surface Temperatures of Insulated Flat, Cylindrical, and Spherical Systems by Use of Computer Programs

C612-2014 ..... Standard Specification for Mineral Fiber Block and Board Thermal Insulation

C1126-2014 ..... Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation

C1136-2012 ..... Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation

C1710-2011.....Standard Guide for Installation of Flexible Closed Cell Preformed Insulation in Tube and Sheet Form

D1668/D1668M-1997a (2014)e1 Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing

E84-2015a.....Standard Test Method for Surface Burning Characteristics of Building Materials

E2231-2015.....Standard Practice for Specimen Preparation and Mounting of Pipe and Duct Insulation to Assess Surface Burning Characteristics

C. Federal Specifications (Fed. Spec.):
L-P-535E-1979.....Plastic Sheet (Sheeting): Plastic Strip; Poly (Vinyl Chloride) and Poly (Vinyl Chloride - Vinyl Acetate), Rigid.

D. International Code Council, (ICC):
IMC-2012.....International Mechanical Code

E. Military Specifications (Mil. Spec.):
MIL-A-3316C (2)-1990 .....Adhesives, Fire-Resistant, Thermal Insulation

MIL-A-24179A (2)-1987 .....Adhesive, Flexible Unicellular-Plastic Thermal Insulation

MIL-PRF-19565C (1)-1988 ...Coating Compounds, Thermal Insulation, Fire-and Water-Resistant, Vapor-Barrier

MIL-C-20079H-1987 .....Cloth, Glass; Tape, Textile Glass; and Thread, Glass and Wire-Reinforced Glass

F. National Fire Protection Association (NFPA):
90A-2015.....Standard for the Installation of Air-Conditioning and Ventilating Systems

G. Underwriters Laboratories, Inc (UL):
723-2008 (R2013).....Standard for Test for Surface Burning Characteristics of Building Materials

1887-2004 (R2013).....Standard for Fire Test of Plastic Sprinkler Pipe for Visible Flame and Smoke Characteristics

H. 3E Plus® version 4.1 Insulation Thickness Computer Program: Available from NAIMA with free download; https://insulationinstitute.org/tools-resources/

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 22 07 11, PLUMBING INSULATION”, with applicable paragraph identification.

C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

D. Shop Drawings:
1. All information, clearly presented, shall be included to determine compliance with drawings and specifications and ASTM Designation, Federal and Military specifications.
   a. Insulation materials: Specify each type used and state surface burning characteristics.
   b. Insulation facings and jackets: Each type used and state surface burning characteristics.

c. Insulation accessory materials: Each type used.
d. Manufacturer's installation and fitting fabrication instructions for flexible unicellular insulation shall follow the guidelines in accordance with ASTM C1710.
e. Make reference to applicable specification paragraph numbers for coordination.
f. All insulation fittings (exception flexible unicellular insulation) shall be fabricated in accordance with ASTM C450 and the referenced Adjunct to ASTM C450.

E. Completed System Readiness Checklist provided by the CxA and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

1.5 QUALITY ASSURANCE

A. Refer to article QUALITY ASSURANCE, in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

B. Criteria:
1. Comply with NFPA 90A, particularly paragraphs 4.3.3.1 through 4.3.3.6, 4.3.11.2.6, parts of which are quoted as follows:
4.3.3.1 Pipe and duct insulation and coverings, duct linings, vapor retarder facings, adhesives, fasteners, tapes, and supplementary materials added to air ducts, plenums, panels and duct silencers used in duct systems shall have, in the form in which they are used, a maximum flame spread index of 25 without evidence of continued progressive combustion and a maximum smoke developed index of 50 when tested in accordance with ASTM E84 and appropriate mounting practice, e.g. ASTM E2231.
4.3.3.3 Coverings and linings for air ducts, pipes, plenums and panels including all pipe and duct insulation materials shall not flame, glow, smolder, or smoke when tested in accordance with a similar test for pipe covering, ASTM C411, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation, at the temperature to which they are exposed in service. In no case shall the test temperature be below 121 degrees C (250 degrees F).
4.3.11.2.6.3 Nonferrous fire sprinkler piping shall be listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with UL 1887, Standard for Safety Fire Test of Plastic Sprinkler Pipe for Visible Flame and Smoke Characteristics.
4.3.11.2.6.8 Smoke detectors shall not be required to meet the provisions of Section 4.3.
2. Test methods: ASTM E84, UL 723, and ASTM E2231.
3. Specified k factors are at 24 degrees C (75 degrees F) mean temperature unless stated otherwise. Where optional thermal insulation material is used, select thickness to provide thermal conductance no greater than that for the specified material. For pipe, use insulation manufacturer's published heat flow tables. For domestic hot water supply and return, run out insulation and condensation control insulation, no thickness adjustment need be made.
4. All materials shall be compatible and suitable for service temperature, and shall not contribute to corrosion or otherwise attack surface to which applied in either the wet or dry state.

C. Every package or standard container of insulation or accessories delivered to the job site for use shall have a manufacturer's stamp or label giving the name of the manufacturer, description of the material, and the production date or code.

D. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

1.6 AS-BUILT DOCUMENTATION

A. Submit manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.

B. Submit operation and maintenance data updated to include submittal review comments, substitutions and construction revisions shall be in electronic version on compact disc or DVD and inserted into a three ring binder. All aspects of system operation and maintenance procedures, including piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices such as damper and door closure interlocks shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.

C. The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. As-built drawings are to be provided, and a copy of them in Auto-CAD version 2013 provided on compact disk or DVD. Should the installing contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement.

D. Certification documentation shall be provided prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and certification that all results of tests were within limits specified.

1.7 STORAGE AND HANDLING OF MATERIAL

A. Store materials in clean and dry environment, pipe insulation jackets shall be clean and unmarred. Place adhesives in original containers. Maintain ambient temperatures and conditions as required by printed instructions of manufacturers of adhesives, mastics and finishing cements.

PART 2 - PRODUCTS

2.1 MINERAL FIBER OR FIBER GLASS

A. ASTM C612 (Board, Block), Class 1 or 2, density 48 kg/m^3 (nominal 3 pcf), k = 0.037 (.26) at 24 degrees C (75 degrees F), external insulation for temperatures up to 204 degrees C (400 degrees F).

B. ASTM C553 (Blanket, Flexible) Type I, at 24 degrees C (75 degrees F), for use at temperatures up to 204 degrees C (400 degrees F).

C. ASTM C547 (Pipe Fitting Insulation and Preformed Pipe Insulation), Class 1, k = 0.037 (0.26) at 24 degrees C (75 degrees F), for use at temperatures up to 230 degrees C (446 degrees F) with an all service vapor retarder jacket (ASJ) and with polyvinyl chloride (PVC) premolded fitting covering.

2.2 MINERAL WOOL OR REFRACTORY FIBER

A. Comply with Standard ASTM C612, Class 3, 450 degrees C (842 degrees F).

2.3 RIGID CELLULAR PHENOLIC FOAM

A. Preformed (molded) pipe insulation, ASTM C1126, Type III, grade 1, k = 0.021(0.15) at 10 degrees C (50 degrees F), for use at temperatures up to 121 degrees C (250 degrees F) with vapor retarder and all service vapor retarder jacket (ASJ) and with PVC premolded fitting covering.

B. Equipment Insulation, ASTM C1126, Type II, grade 1, k = 0.021 (0.15) at 10 degrees C (50 degrees F), for use at temperatures up to 121 degrees C (250 degrees F) with rigid cellular phenolic insulation and covering, and all service vapor retarder jacket (ASJ).

2.4 CELLULAR GLASS CLOSED-CELL

A. Comply with Standard ASTM C552, density 120 kg/m^3 (7.5 pcf) nominal, k = 0.033 (0.29) at 24 degrees C (75 degrees F).

B. Pipe insulation for use at process temperatures below ambient air to 482 degrees C (900 degrees F) with or without all service vapor retarder jacket (ASJ).

C. Pipe insulation for use at process temperatures for pipe and tube below ambient air temperatures or where condensation control is necessary are to be installed with a vapor retarder/barrier system of with or without all service vapor retarder sealed jacket (ASJ) system. Without ASJ shall require all longitudinal and circumferential joints to be vapor sealed with vapor barrier mastic.

D. Cellular glass thermal insulation intended for use on surfaces operating at temperatures between −268 and 482 degrees C (−450 and 900 degrees F). It is possible that special fabrication or techniques for pipe insulation, or both, shall be required for application in the temperature range from 121 to 427 degrees C (250 to 800 degrees F).

2.5 POLYISOCYANURATE CLOSED-CELL RIGID

A. Not Used.

2.6 FLEXIBLE ELASTOMERIC CELLULAR THERMAL

A. ASTM C534/C534M, k = 0.039 (0.27) at 24 degrees C (75 degrees F), flame spread not over 25, smoke developed not over 50, for temperatures from minus 4 degrees C (40 degrees F) to 93 degrees C (199 degrees F). Under high humidity exposures for condensation control an external vapor retarder/barrier jacket is required. Consult ASTM C1710.

2.7 CALCIUM SILICATE

A. Preformed pipe Insulation: ASTM C533, Type I and Type II with indicator denoting asbestos-free material.

B. Premolded Pipe Fitting Insulation: ASTM C533, Type I and Type II with indicator denoting asbestos-free material.

C. Equipment Insulation: ASTM C533, Type I and Type II.

D. Characteristics:

Insulation Characteristics		
ITEMS	**TYPE I**	**TYPE II**
Surface Temperature, maximum degrees C (degrees F)	649 (1200)	927 (1700)
Density (dry), Kg/m^3 (lb/ ft3)	240 (15)	352 (22)
Thermal conductivity: Min W/ m K (Btu in/h ft^2 degrees F)@ mean temperature of 93 degrees C (199 degrees F)	0.065 (0.45)	0.078 (0.540)
Surface burning characteristics: Flame spread Index, Maximum	0	0
Smoke Density index, Maximum	0	0

2.8 INSULATION FACINGS AND JACKETS

A. Vapor Retarder, higher strength with low water permeance = 0.02 or less perm rating, Beach puncture 50 units for insulation facing on pipe insulation jackets. Facings and jackets shall be ASJ or PVDC Vapor Retarder jacketing.

B. ASJ shall be white finish (kraft paper) bonded to 0.025 mm (1 mil) thick aluminum foil, fiberglass reinforced, with pressure sensitive adhesive closure. Comply with ASTM C1136. Beach puncture is 50 units, suitable for painting without sizing. Jackets shall have minimum 40 mm (1-1/2 inch) lap on longitudinal joints and minimum 75 mm (3 inch) butt strip on end joints. Butt strip material shall be same as the jacket. Lap and butt strips shall be self-sealing type with factory-applied pressure sensitive adhesive.

C. Vapor Retarder medium strength with low water vapor permeance of 0.02 or less perm rating), Beach puncture 25 units: FSK or PVDC type for concealed ductwork and equipment.

D. Except for flexible elastomeric cellular thermal insulation (not for high humidity exposures), field applied vapor barrier jackets shall be provided, in addition to the specified facings and jackets, on all exterior piping as well as on interior piping exposed to outdoor air (i.e.; in ventilated attics, piping in ventilated (not air conditioned) spaces, etc.)in high humidity locations conveying fluids below ambient temperature. The vapor barrier jacket shall consist of a multi-layer laminated cladding with a maximum water vapor permeance of 0.001 perms. The minimum puncture resistance shall be 35 cm-kg (30 inch-pounds) for interior locations and 92 cm-kg (80 inch-pounds) for exterior or exposed locations or where the insulation is subject to damage.

E. Except for cellular glass thermal insulation, when all longitudinal and circumferential joints are vapor sealed with a vapor barrier mastic or caulking, vapor barrier jackets may not be provided. For aesthetic and physical abuse applications, exterior jacketing is recommended. Otherwise field applied vapor barrier jackets shall be provided, in addition to the applicable specified facings and jackets, on all exterior piping as well as on interior piping exposed to outdoor air (i.e.; in ventilated attics, piping in ventilated (not air conditioned) spaces, etc.) in high humidity locations conveying fluids below ambient temperature. The vapor barrier jacket shall consist of a multi-layer laminated cladding with a maximum water vapor permeance of 0.001 perms. The minimum puncture resistance shall be 35 cm-kg (30 inch-pounds) for interior locations and 92 cm-kg (80 inch-pounds) for exterior or exposed locations or where the insulation is subject to damage.

F. Glass Cloth Jackets: Presized, minimum 0.18 kg per square meter (7.8 ounces per square yard), 2070 kPa (300 psig) bursting strength with integral vapor retarder where required or specified. Weather proof if utilized for outside service.

G. Pipe fitting insulation covering (jackets): Fitting covering shall be premolded to match shape of fitting and shall be PVC conforming to Fed Spec L-P-535E, composition A, Type II Grade GU, and Type III, minimum thickness 0.7 mm (0.03 inches). Provide color matching vapor retarder pressure sensitive tape. Staples, tacks, or any other attachment that penetrates the PVC covering is not allowed on any form of a vapor barrier system in below ambient process temperature applications.

H. Aluminum Jacket-Piping systems and circular breeching and stacks: ASTM B209, 3003 alloy, H-14 temper, 0.6 mm (0.023 inch) minimum thickness with locking longitudinal joints. Jackets for elbows, tees and other fittings shall be factory-fabricated or with cut aluminum gores to match shape of fitting and of 0.6 mm (0.024 inch) minimum thickness aluminum. Aluminum fittings shall be of same construction with an internal moisture barrier as straight run jackets but need not be of the same alloy. Factory-fabricated stainless steel bands with wing seals shall be installed on all circumferential joints. Bands shall be 15 mm (0.5 inch) wide on 450 mm (18 inch) centers. System shall be weatherproof if utilized for outside service.

I. Aluminum jacket-Rectangular breeching: ASTM B209, 3003 alloy, H-14 temper, 0.5 mm (0.020 inches) thick with 32 mm (1-1/4 inch) corrugations or 0.8 mm (0.032 inches) thick with no corrugations. System shall be weatherproof if used for outside service.

2.9 PIPE COVERING PROTECTION SADDLES

A. Cold pipe support: Premolded pipe insulation 180 degrees (half-shells) on bottom half of pipe at supports. Material shall be cellular glass or high density Polyisocyanurate insulation of the same thickness as adjacent insulation. Density of Polyisocyanurate insulation shall be a minimum of 48 kg/m^3 (3.0 pcf).

Nominal Pipe Size and Accessories Material (Insert Blocks)	
Nominal Pipe Size mm (inches)	**Insert Blocks mm (inches)**
Up through 125 (5)	150 (6) long
150 (6)	150 (6) long
200 (8), 250 (10), 300 (12)	225 (9) long
350 (14), 400 (16)	300 (12) long
450 through 600 (18 through 24)	350 (14) long

B. Warm or hot pipe supports: Premolded pipe insulation (180 degree half-shells) on bottom half of pipe at supports. Material shall be high density Polyisocyanurate (for temperatures up to 149 degrees C (300 degrees F)), cellular glass or calcium silicate. Insulation at supports shall have same thickness as adjacent insulation. Density of Polyisocyanurate insulation shall be a minimum of 48 kg/m^3 (3.0 pcf).

2.10 ADHESIVE, MASTIC, CEMENT

A. Mil. Spec. MIL-A-3316, Class 1: Jacket and lap adhesive and protective finish coating for insulation.

B. Mil. Spec. MIL-A-3316, Class 2: Adhesive for laps and for adhering insulation to metal surfaces.

C. Mil. Spec. MIL-A-24179A, Type II Class 1: Adhesive for installing flexible unicellular insulation and for laps and general use.

D. Mil. Spec. MIL-PRF-19565C, Type I: Protective finish for outdoor use.

E. Mil. Spec. MIL-PRFC-19565C, Type I or Type II: Vapor barrier compound for indoor use.

F. ASTM C449: Mineral fiber hydraulic-setting thermal insulating and finishing cement.

G. Other: Insulation manufacturers' published recommendations.

2.11 MECHANICAL FASTENERS

A. Pins, anchors: Welded pins, or metal or nylon anchors with galvanized steel or fiber washer, or clips. Pin diameter shall be as recommended by the insulation manufacturer.

B. Staples: Outward clinching galvanized steel. Staples are not allowed for below ambient vapor barrier applications.

C. Wire: 1.3 mm thick (18 gage) soft annealed galvanized or 1.9 mm (14 gage) copper clad steel or nickel copper alloy or stainless steel.

D. Bands: 13 mm (1/2 inch) nominal width, brass, galvanized steel, aluminum or stainless steel.

E. Tacks, rivets, screws or any other attachment device capable of penetrating the vapor retarder shall NOT be used to attach/close the any type of vapor retarder jacketing. Thumb tacks sometimes used on PVC jacketing and preformed fitting covers closures are not allowed for below ambient vapor barrier applications.

2.12 REINFORCEMENT AND FINISHES

A. Glass fabric, open weave: ASTM D1668/D1668M, Type III (resin treated) and Type I (asphalt or white resin treated).

B. Glass fiber fitting tape: Mil. Spec MIL-C-20079H, Type II, Class 1.

C. Tape for Flexible Elastomeric Cellular Insulation: As recommended by the insulation manufacturer.

D. Hexagonal wire netting: 25 mm (one inch) mesh, 0.85 mm thick (22 gage) galvanized steel.

E. Corner beads: 50 mm (2 inch) by 50 mm (2 inch), 0.55 mm thick (26 gage) galvanized steel; or, 25 mm (1 inch) by 25 mm (1 inch), 0.47 mm thick (28 gage) aluminum angle adhered to 50 mm (2 inch) by 50 mm (2 inch) Kraft paper.

F. PVC fitting cover: Fed. Spec L-P-535E, Composition A, 11-86 Type II, Grade GU, with Form B Mineral Fiber insert, for media temperature 10 to 121 degrees C (50 to 250 degrees F). Below 10 degrees C (50 degrees F) and above 121 degrees C (250 degrees F) provide mitered pipe insulation of the same type as insulating straight pipe. Provide double layer insert. Provide vapor barrier pressure sensitive tape matching the color of the PVC jacket.

2.13 FIRESTOPPING MATERIAL

A. Other than pipe insulation, refer to Section 07 84 00, FIRESTOPPING.

2.14 FLAME AND SMOKE

A. Unless shown otherwise all assembled systems shall meet flame spread 25 and smoke developed 50 rating as developed under ASTM and UL standards and specifications. See paragraph "Quality Assurance".

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Required pressure tests of piping joints and connections shall be completed and the work approved by the Contracting Officer’s Representative (COR) for application of insulation. Surface shall be clean and dry with all foreign materials, such as dirt, oil, loose scale and rust removed.

B. Except for specific exceptions or as noted, insulate all specified equipment, and piping (pipe, fittings, valves, accessories). Insulate each pipe individually. Do not use scrap pieces of insulation where a full length section will fit.

C. Where removal of insulation of piping and equipment is required to comply with Section 02 82 13.13, GLOVEBAG ASBESTOS ABATEMENT, such areas shall be reinsulated to comply with this specification.

D. Insulation materials shall be installed with smooth and even surfaces, with jackets and facings drawn tight and smoothly cemented down and sealed at all laps. Insulation shall be continuous through all sleeves and openings, except at fire dampers and duct heaters (NFPA 90A).

E. Vapor retarders shall be continuous and uninterrupted throughout systems with operating temperature 15 degrees C (60 degrees F) and below. Lap and seal vapor barrier over ends and exposed edges of insulation. Anchors, supports and other metal projections through insulation on cold surfaces shall be insulated and vapor sealed for a minimum length of 150 mm (6 inches).

F. Install vapor stops with operating temperature 15 degrees C (60 degrees F) and below at all insulation terminations on either side of valves, pumps, fittings, and equipment and particularly in straight lengths every 4.6 to 6.1 meters (approx. 15 to 20 feet) of pipe insulation. The annular space between the pipe and pipe insulation of approx. 25 mm (1 inch) in length at every vapor

stop shall be sealed with appropriate vapor barrier sealant. Bio-based materials shall be utilized when possible.

G. Construct insulation on parts of equipment such as cold water pumps and heat exchangers that must be opened periodically for maintenance or repair, so insulation can be removed and replaced without damage. Install insulation with bolted 1 mm thick (20 gage) galvanized steel or aluminum covers as complete units, or in sections, with all necessary supports, and split to coincide with flange/split of the equipment. Do not insulate over equipment nameplate data.

H. Insulation on hot piping and equipment shall be terminated square at items not to be insulated, access openings and nameplates. Cover all exposed raw insulation with white sealer coating (caution about coating's maximum temperature limit) or jacket material.

I. Protect all insulations outside of buildings with aluminum jacket using lock joint or other approved system for a continuous weather tight system. Access doors and other items requiring maintenance or access shall be removable and sealable.

J. Plumbing work not to be insulated unless otherwise noted:
   1. Piping and valves of fire protection system.
   2. Chromium plated brass piping.
   3. Water piping in contact with earth.
   4. Distilled water piping.

K. Apply insulation materials subject to the manufacturer's recommended temperature limits. Apply adhesives, mastic and coatings at the manufacturer's recommended minimum wet or dry film thickness. Bio-based materials shall be utilized when possible.

L. Elbows, flanges and other fittings shall be insulated with the same material as is used on the pipe straights. Use of polyurethane or polyisocyanurate spray-foam to fill a PVC elbow jacket is prohibited on cold applications.

M. Firestop Pipe insulation:
   1. Provide firestopping insulation at fire and smoke barriers through penetrations. Firestopping insulation shall be UL listed as defined in Section 07 84 00, FIRESTOPPING.
   2. Pipe penetrations requiring fire stop insulation including, but not limited to the following:
      a. Pipe risers through floors
      b. Pipe chase walls and floors
      c. Smoke partitions
      d. Fire partitions
      e. Hourly rated walls

N. Freeze protection of above grade outdoor piping (over heat tracing tape): 20 mm (3/4 inch) thick insulation, for all pipe sizes 75 mm (3 inches) and smaller and 25 mm (1 inch) thick insulation for larger pipes. Provide metal jackets for all pipe insulations. Provide freeze protection for cold water make-up piping and equipment where indicated on the drawings as described in Section 23 21 13, HYDRONIC PIPING (electrical heat tracing systems).

O. Provide vapor barrier systems as follows:
   1. All piping exposed to outdoor weather.
   2. All interior piping conveying fluids exposed to outdoor air (i.e. in attics, ventilated (not air conditioned) spaces, etc.) below ambient air temperature in high humidity locations.

P. Provide metal jackets over insulation as follows:
   1. All plumbing piping exposed to outdoor weather.
   2. Piping exposed in building, within 1829 mm (6 feet) of the floor, that connects to sterilizers, kitchen and laundry equipment. Jackets may be applied with pop rivets except for cold pipe or tubing applications. Provide aluminum angle ring escutcheons at wall, ceiling or floor penetrations.
   3. A 50 mm (2 inch) jacket overlap is required at longitudinal and circumferential joints with the overlap at the bottom.

Q. Provide PVC jackets over insulation as follows:
   1. Piping exposed in building, within 1829 mm (6 feet) of the floor, on piping that is not precluded in previous sections.
   2. A 50 mm (2 inch) jacket overlap is required at longitudinal and circumferential joints with the overlap at the bottom.

3.2 INSULATION INSTALLATION

A. Mineral Fiber Board:
   1. Vapor retarder faced board: Apply board on pins spaced not more than 300 mm (12 inches) on center each way, and not less than 75 mm (3 inches) from each edge of board. In addition to pins, apply insulation bonding adhesive to entire underside of horizontal metal surfaces. (Bio-based materials shall be utilized when possible.) Butt insulation edges tightly and seal all joints with laps and butt strips. After applying speed clips cut pins off flush and apply vapor seal patches over clips.
   2. Plain unfaced board:
      a. Insulation shall be scored, beveled or mitered to provide tight joints and be secured to equipment with bands spaced 225 mm (9 inches) on center for irregular surfaces or with pins and clips on flat surfaces. Use corner beads to protect edges of insulation.
      b. For hot equipment: Stretch 25 mm (1 inch) mesh wire, with edges wire laced together, over insulation and finish with insulating and finishing cement applied in one coat, 6 mm (1/4 inch) thick, trowelled to a smooth finish.
      c. For cold equipment: Apply meshed glass fabric in a tack coat 1.5 to 1.7 square meter per liter (60 to 70 square feet per gallon) of vapor mastic and finish with mastic at 0.3 to 0.4 square meter per liter (12 to 15 square feet per gallon) over the entire fabric surface.
   3. Cold equipment: 40 mm (1-1/2inch) thick insulation faced with vapor retarder ASJ or FSK. Seal all facings, laps, and termination points and do not use staples or other attachments that may puncture ASJ or FSK.
      a. Water filter, chemical feeder pot or tank.
      b. Pneumatic, cold storage water and surge tanks.
   4. Hot equipment: 40 mm (1-1/2 inch) thick insulation faced with unsealed ASJ or FSK.
      a. Domestic water heaters and hot water storage tanks (not factory insulated).
      b. Booster water heaters for dietetics dish and pot washers and for washdown grease-extracting hoods.

B. Molded Mineral Fiber Pipe and Tubing Covering:
   1. Fit insulation to pipe, aligning all longitudinal joints. Seal longitudinal joint laps and circumferential butt strips by rubbing hard with a nylon sealing tool to assure a positive seal. Staples may be used to assist in securing insulation except for cold piping. Seal all vapor retarder penetrations on cold piping with a generous application of vapor barrier mastic. Provide cellar glass inserts and install with metal insulation shields at outside pipe supports. Install freeze protection insulation over heating cable.
   2. Contractor's options for fitting, flange and valve insulation:
      a. Insulating and finishing cement for sizes less than 100 mm (4 inches) operating at surface temperature of 15 degrees C (60 degrees F) or more.
      b. Factory premolded, one piece PVC covers with mineral fiber, (Form B), inserts surface temperature of above 4 degrees C (40 degrees F) to 121 degrees C (250 degrees F). Provide mitered preformed insulation of the same type as the installed straight pipe insulation for pipe temperatures below 4 degrees C (40 degrees F). Secure first layer of mineral fiber insulation with twine. Seal seam edges with vapor barrier mastic and secure with fitting tape.
      c. Factory preformed, ASTM C547 or fabricated mitered sections, joined with adhesive or (hot only) wired in place. (Bio-based materials shall be utilized when possible.) For hot piping finish with a smoothing coat of finishing cement. For cold

fittings, 15 degrees C (60 degrees F) or less, vapor seal with a layer of glass fitting tape imbedded between two 2 mm (1/16 inch) coats of vapor barrier mastic.

d. Fitting tape shall extend over the adjacent pipe insulation and overlap on itself at least 50 mm (2 inches).

3. Nominal thickness in millimeters and inches specified in the schedule at the end of this section.

C. Rigid Cellular Phenolic Foam:

1. Rigid closed cell phenolic insulation may be provided, exterior only, for piping, ductwork and equipment for temperatures up to 121 degrees C (250 degrees F).
2. Note the ASTM E84 or UL 723 surface burning characteristics requirements of maximum 25/50 indexes in paragraph "Quality Assurance".
3. Provide secure attachment facilities such as welding pins.
4. Apply insulation with joints tightly drawn together.
5. Apply adhesives, coverings, neatly finished at fittings, and valves.
6. Final installation shall be smooth, tight, neatly finished at all edges.
7. Minimum thickness in millimeters (inches) specified in the schedule at the end of this section.
8. Condensation control insulation: Minimum 25 mm (1 inch) thick for all pipe sizes depending on high humidity exposures.
   a. Body of roof and overflow drains horizontal runs and offsets (including elbows) of interior downspout piping in all areas above pipe basement.
   b. Waste piping from electric water coolers and icemakers to drainage system.
   c. Waste piping located above basement floor from ice making and film developing equipment and air handling units, from equipment (including trap) to main vertical waste pipe.
   d. MRI quench vent piping.
   e. Bedpan sanitizer atmospheric vent
   f. Reagent grade water piping.
   g. Cold water piping, exterior only.

D. Cellular Glass Insulation:

1. Pipe and tubing, covering nominal thickness in millimeters and inches as specified in the schedule at the end of this section.
2. Underground piping other than or in lieu of that specified in Section 22 11 00, FACILITY WATER DISTRIBUTION: Type II, factory jacketed with a 3 mm laminate jacketing consisting of 3000 mm x 3000 mm (10 ft x 10 ft) asphalt impreganted glass fabric, bituminous mastic and outside protective plastic film.
   a. 75 mm (3 inches) thick for hot water piping.
   b. As scheduled at the end of this section for chilled water piping.
   c. Underground piping: Apply insulation with joints tightly butted. Seal longitudinal self-sealing lap. Use field fabricated or factory made fittings. Seal butt joints and fitting with jacketing as recommended by the insulation manufacturer. Use 100 mm (4 inch) wide strips to seal butt joints.
   d. Provide expansion chambers for pipe loops, anchors and wall penetrations as recommended by the insulation manufacturer.
   e. Underground insulation shall be inspected and approved by the COR as follows:
      1) Insulation in place before coating.
      2) After coating.
   f. Sand bed and backfill: Minimum 75 mm (3 inches) all around insulated pipe or tank, applied after coating has dried.
   g. All piping up to 482 degrees C (900 degrees F) requiring protection from physical heavy contact/abuse including in mechanical rooms and exposures to the public.
3. Cold equipment: 50 mm (2 inch) thick insulation faced with ASJ.

E. Not Used

F. Flexible Elastomeric Cellular Thermal Insulation:

1. Apply insulation and fabricate fittings in accordance with the manufacturer's installation instructions and finish with two coats of weather resistant finish as recommended by the insulation manufacturer. External vapor barrier jacketing may be required for expected or anticipated high humidity exposures. See ASTM C1710.
2. Pipe and tubing insulation:
   a. Use proper size material. Do not stretch or strain insulation.
   b. To avoid undue compression of insulation, use supports as recommended by the elastomeric insulation manufacturer. Insulation shields are specified under Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
   c. Where possible, slip insulation over the pipe or tubing prior to connection, and seal the butt joints with adhesive. Where the slip-on technique is not possible, slit the insulation and apply it to the pipe sealing the seam and joints with contact adhesive. Optional tape sealing, as recommended by the manufacturer, may be employed. Bio-based materials shall be utilized when possible.
3. Apply sheet insulation to flat or large curved surfaces with 100 percent adhesive coverage. For fittings and large pipe, apply adhesive to seams only.
4. Pipe insulation: nominal thickness in millimeters (inches as specified in the schedule at the end of this section.

G. Calcium Silicate:
1. Minimum thickness in millimeter (inches) specified below for piping other than in boiler plant.

Nominal Thickness Of Calcium Silicate Insulation (Non-Boiler Plant)				
Nominal Pipe Size Millimeters (Inches)	Thru 25 (1)	32 to 75 (1-1/4 to 3)	100-200 (4 to 8)	Greater than 200 (8)
93-260 degrees C (199-500 degrees F)(HPS, HPR)	100(4)	125(5)	150(6)	Greater than 150(6)

2. MRI Quench Vent Insulation: Type I, class D, 150 mm (6 inch) nominal thickness.

3.3 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

B. Components provided under this section of the specification will be tested as part of a larger system.

3.4 PIPE INSULATION SCHEDULE

A. Provide insulation for piping systems as scheduled below:

Insulation Thickness Millimeters (Inches)					
		Nominal Pipe Size Millimeters (Inches)			
Operating Temperature Range/Service	**Insulation Material**	**Less than 25 (1)**	**25 – 32 (1 – 1¼)**	**38 – 75 (1½ - 3)**	**100 (4) and Greater**
38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)	Mineral Fiber (Above ground piping only)	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
38-60 degrees C (100-140 degrees F)	Rigid Cellular Phenolic Foam (Above ground	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)

(Domestic Hot Water Supply and Return)	piping only) (exterior locations only)				
38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)	Polyiso-cyanurate Closed-Cell Rigid (Exterior Locations only)	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)	Flexible Elastomeric Cellular Thermal (Above ground piping only)	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)	Cellular Glass Thermal	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)

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SECTION 22 08 00
COMMISSIONING OF PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. The requirements of this Section apply to all sections of Division 22.

B. This project will have selected building systems commissioned. The complete list of equipment and systems to be commissioned are specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS. The commissioning process, which the Contractor is responsible to execute, is defined in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS. A Commissioning Agent (CxA) appointed by the Department of Veterans Affairs will manage the commissioning process.

1.2 RELATED WORK

A. Section 01 00 00 GENERAL REQUIREMENTS.

B. Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

C. Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

1.3 SUMMARY

A. This Section includes requirements for commissioning plumbing systems, subsystems and equipment. This Section supplements the general requirements specified in Section 01 91 00 General Commissioning Requirements.

B. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for more specifics regarding processes and procedures as well as roles and responsibilities for all Commissioning Team members.

1.4 DEFINITIONS

A. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for definitions.

1.5 COMMISSIONED SYSTEMS

A. Commissioning of a system or systems specified in Division 22 is part of the construction process. Documentation and testing of these systems, as well as training of the VA's Operation and Maintenance personnel in accordance with the requirements of Section 01 91 00 and of Division 22, is required in cooperation with the VA and the Commissioning Agent.

B. The Plumbing systems commissioning will include the systems listed in Section 01 91 00 General Commissioning Requirements:

1.6 SUBMITTALS

A. The commissioning process requires review of selected Submittals. The Commissioning Agent will provide a list of submittals that will be reviewed by the Commissioning Agent. This list will be reviewed and approved by the VA prior to forwarding to the Contractor. Refer to Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, and SAMPLES for further details.

B. The commissioning process requires Submittal review simultaneously with engineering review. Specific submittal requirements related to the commissioning process are specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 CONSTRUCTION INSPECTIONS

A. Commissioning of the Building Plumbing Systems will require inspection of individual elements of the Plumbing construction throughout the construction period. The Contractor shall coordinate with the Commissioning Agent in accordance with Section 01 91 00 and the Commissioning Plan to schedule inspections as required to support the commissioning process.

3.2 PRE-FUNCTIONAL CHECKLISTS

A. The Contractor shall complete Pre-Functional Checklists to verify systems, subsystems, and equipment installation is complete and systems are ready for Systems Functional Performance Testing. The Commissioning Agent will prepare Pre-Functional Checklists to be used to document equipment installation. The Contractor shall complete the checklists. Completed checklists shall be submitted to the VA and to the Commissioning Agent for review. The Commissioning Agent may spot check a sample of completed checklists. If the Commissioning Agent determines that the information provided on the checklist is not accurate, the Commissioning Agent will return the marked-up checklist to the Contractor for correction and resubmission. If the Commissioning Agent determines that a significant number of completed checklists for similar equipment are not accurate, the Commissioning Agent will select a broader sample of checklists for review. If the Commissioning Agent determines that a significant number of the broader sample of checklists is also inaccurate, all the checklists for the type of equipment will be returned to the Contractor for correction and resubmission. Refer to SECTION 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for submittal requirements for Pre-Functional Checklists, Equipment Startup Reports, and other commissioning documents.

3.3 CONTRACTORS TESTS

A. Contractor tests as required by other sections of Division 22 shall be scheduled and documented in accordance with Section 01 00 00 GENERAL REQUIREMENTS. . All testing shall be incorporated into the project schedule. Contractor shall provide no less than 7 calendar days' notice of testing. The Commissioning Agent will witness selected Contractor tests at the sole discretion of the Commissioning Agent. Contractor tests shall be completed prior to scheduling Systems Functional Performance Testing.

3.4 SYSTEMS FUNCTIONAL PERFORMANCE TESTING:

A. The Commissioning Process includes Systems Functional Performance Testing that is intended to test systems functional performance under steady state conditions, to test system reaction to changes in operating conditions, and system performance under emergency conditions. The Commissioning Agent will prepare detailed Systems Functional Performance Test procedures for review and approval by the Resident Engineer. The Contractor shall review and comment on the tests prior to approval. The Contractor shall provide the required labor, materials, and test equipment identified in the test procedure to perform the tests. The Commissioning Agent will witness and document the testing. The Contractor shall sign the test reports to verify tests were performed. See Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS, for additional details.

1. The contractor shall be able to provide all testing points for system functional performance testing from the front-end user graphical interface of the fully integrated BMS control program.

3.5 TRAINING OF VA PERSONNEL

A. Training of the VA operation and maintenance personnel is required in cooperation with the Resident Engineer and Commissioning Agent. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the

location, operation, and troubleshooting of the installed systems. Contractor shall submit training agendas and trainer resumes in accordance with the requirements of Section 01 91 00. The instruction shall be scheduled in coordination with the Resident Engineer after submission and approval of formal training plans. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS and Division 22 Sections for additional Contractor training requirements.

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SECTION 22 11 00

FACILITY WATER DISTRIBUTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Domestic water systems, including piping, equipment and all necessary accessories as designated in this section.

B. A complete listing of all acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

E. Section 07 84 00, FIRESTOPPING.

F. Section 07 92 00, JOINT SEALANTS.

G. Section 09 91 00, PAINTING.

H. .

I. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

J. Section 22 07 11, PLUMBING INSULATION.

K. SECTION 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society of Mechanical Engineers (ASME):

A13.1-2007 (R2013).....Scheme for Identification of Piping Systems

B16.3-2011.....Malleable Iron Threaded Fittings: Classes 150 and 300

B16.9-2012.....Factory-Made Wrought Buttwelding Fittings

B16.11-2011.....Forged Fittings, Socket-Welding and Threaded

B16.12-2009 (R2014).....Cast Iron Threaded Drainage Fittings

B16.15-2013 .....Cast Copper Alloy Threaded Fittings: Classes 125 and 250

B16.18-2012.....Cast Copper Alloy Solder Joint Pressure Fittings

B16.22-2013.....Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings

B16.24-2011.....Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500, and 2500

ASME Boiler and Pressure Vessel Code -

BPVC Section IX-2015.....Welding, Brazing, and Fusing Qualifications

C. Association for the Advancement of Medical Instrumentation (AAMI)
   1. ANSI/AAMI/ISO 23500-1…… Preparation and quality management of fluids for hemodialysis and related therapies - Part 1: General requirements

D. American Society of Sanitary Engineers (ASSE):
   1010-2004 ..... Performance Requirements for Water Hammer Arresters

E. American Society for Testing and Materials (ASTM):
   A47/A47M-1999 (R2014) ..... Standard Specification for Ferritic Malleable Iron Castings

   A53/A53M-2012 ..... Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

   A183-2014 ..... Standard Specification for Carbon Steel Track Bolts and Nuts

   A269/A269M-2014e1 ..... Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service

   A312/A312M-2015 ..... Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes

   A403/A403M-2014 ..... Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings

   A536-1984 (R2014)..... Standard Specification for Ductile Iron Castings

   A733-2013 ..... Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples

   B32-2008 (R2014)..... Standard Specification for Solder Metal

   B43-2014 ..... Standard Specification for Seamless Red Brass Pipe, Standard Sizes

   B61-2008 (R2013)..... Standard Specification for Steam or Valve Bronze Castings

   B62-2009 ..... Standard Specification for Composition Bronze or Ounce Metal Castings

   B75/B75M-2011 ..... Standard Specification for Seamless Copper Tube

   B88-2014 ..... Standard Specification for Seamless Copper Water Tube

   B584-2014 ..... Standard Specification for Copper Alloy Sand Castings for General Applications

   B687-1999 (R2011)..... Standard Specification for Brass, Copper, and Chromium-Plated Pipe Nipples

   C919-2012 ..... Standard Practice for Use of Sealants in Acoustical Applications

   D1785-2012 ..... Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120

   D2000-2012 ..... Standard Classification System for Rubber Products in Automotive Applications

   D2564-2012 ..... Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems

   D2657-2007 ..... Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings

   D2855-1996 (R2010) ..... Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings

D4101-2014.....Standard Specification for Polypropylene Injection and Extrusion Materials

E1120-2008.....Standard Specification for Liquid Chlorine

E1229-2008.....Standard Specification for Calcium Hypochlorite

F2389-2010.....Standard Specification for Pressure-rated Polypropylene (PP) Piping Systems

F2620-2013.....Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings

F2769-2014.....Standard Specification for Polyethylene of Raised Temperature (PE-RT) Plastic Hot and Cold-Water Tubing and Distribution Systems

F. American Water Works Association (AWWA):

C110-2012.....Ductile-Iron and Gray-Iron Fittings

C151-2009.....Ductile Iron Pipe, Centrifugally Cast

C153-2011.....Ductile-Iron Compact Fittings

C203-2008.....Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied

C213-2007.....Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines

C651-2014.....Disinfecting Water Mains

G. American Welding Society (AWS):

A5.8M/A5.8-2011-AMD1.....Specification for Filler Metals for Brazing and Braze Welding

H. International Code Council (ICC):

IPC-2021.....International Plumbing Code

I. Manufacturers Specification Society (MSS):

SP-58-2009.....Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation

SP-72-2010a.....Ball Valves with Flanged or Butt-Welding Ends for General Service

SP-110-2010.....Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

J. NSF International (NSF):

14-2015.....Plastics Piping System Components and Related Materials

61-2014a.....Drinking Water System Components – Health Effects

372-2011.....Drinking Water System Components – Lead Content

K. Plumbing and Drainage Institute (PDI):

PDI-WH 201-2010.....Water Hammer Arrestors

L. Department of Veterans Affairs:

H-18-8-2013.....Seismic Design Handbook

H-18-10.....Plumbing Design Manual

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 22 11 00, FACILITY WATER DISTRIBUTIONS”, with applicable paragraph identification.

C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
   1. All items listed in Part 2 - Products.

D. Complete operating and maintenance manuals including wiring diagrams, technical data sheets and information for ordering replacement parts:
   1. Include complete list indicating all components of the systems.
   2. Include complete diagrams of the internal wiring for each item of equipment.
   3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

E. Completed System Readiness Checklist provided by the CxA and completed by the Contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

F. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

1.5 QUALITY ASSURANCE

A. A certificate shall be submitted prior to welding of steel piping showing the Welder’s certification. The certificate shall be current and no more than one year old. Welder’s qualifications shall be in accordance with ASME BPVC Section IX.

B. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be by the same manufacturer as the groove components.

C. All pipe, couplings, fittings, and specialties shall bear the identification of the manufacturer and any markings required by the applicable referenced standards.

D. Bio-Based Materials: For products designated by the USDA’s Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

1.6 SPARE PARTS – NOT USED

1.7 AS-BUILT DOCUMENTATION

A. Submit manufacturer’s literature and data updated to include submittal review comments and any equipment substitutions.

B. Submit operation and maintenance data updated to include submittal review comments, substitutions and construction revisions shall be in electronic version on compact disc or DVD and inserted into a three-ring binder. All aspects of system operation and maintenance procedures, including piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices shall be included. A list of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.

C. The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. As-built drawings are to be provided, and a copy of them in Auto-CAD version 2013 provided on compact disk or DVD. Should the installing contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement.

D. Certification documentation shall be provided to COR 10 working days prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and certificate if applicable that all results of tests were within limits specified. If a certificate is not available, all documentation shall be on the Certifier's letterhead.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Material or equipment containing a weighted average of greater than 0.25 percent lead are prohibited in any potable water system intended for human consumption and shall be certified in accordance with NSF 61 or NSF 372. Endpoint devices used to dispense water for drinking shall meet the requirements of NSF 61, Section 9.

B. Plastic pipe, fittings, and solvent cement shall meet NSF 14 and shall be NSF listed for the service intended.

2.2 UNDERGROUND WATER SERVICE CONNECTIONS TO BUILDINGS

A. From inside face of exterior wall to approximately 1500 mm (5 feet) outside of building and underground inside building, material to be the same for the size specified inside the building.

B. 75 mm (3 inch) Diameter and Greater: Ductile iron, AWWA C151, 2413 kPa (350 psig) pressure class, exterior bituminous coating, and cement lined. Bio-based materials shall be utilized when possible. Provide flanged and anchored connection to interior piping.

C. Under 75 mm (3 inch) Diameter: Copper tubing, ASTM B88, Type K, seamless, annealed. Fittings are as specified in paragraph "Above Ground (Interior) Water Piping". Use brazing alloys, AWS A5.8M/A5.8, Classification BCuP.

D. Flexible Expansion Joint: Ductile iron with ball joints rated for 1725 kPa (250 psig) working pressure conforming to AWWA C153, capable of deflecting a minimum of 20 degrees in each direction. Flexible expansion joint size shall match the pipe size it is connected to and shall have the expansion capability designed as an integral part of the ductile iron ball castings. Pressure containing parts shall be lined with a minimum of 15 mils of fusion bonded epoxy conforming to the applicable requirements of AWWA C213 and shall be factory tested with a 1500-volt spark test. Flexible expansion joint shall have flanged connections conforming to AWWA C110. Bolts and nuts shall be 316 stainless steel and gaskets shall be neoprene. The flexible expansion fitting shall not expand or exert an axial thrust under internal water pressure. Provide piping joint restraints at each mechanical joint end connection and piping restraints at the penetration of the building wall. The restraints shall be provided to address the developed thrust at the change of piping direction.

2.3 ABOVE GROUND (INTERIOR) WATER PIPING

A. Pipe: Copper tube, ASTM B88, Type K or L, drawn. For pipe 150 mm (6 inches) and larger, stainless steel, ASTM A312, schedule 10 shall be used.

B. Fittings for Copper Tube:
   1. Wrought copper or bronze castings conforming to ASME B16.18 and B16.22. Unions shall be bronze, MSS SP-72, MSS SP-110, solder or braze joints. Use 95/5 tin and antimony for all soldered joints.

2. Grooved fittings, 50 to 150 mm (2 to 6 inch) wrought copper ASTM B75/B75M C12200, 125 to 150 mm (5 to 6 inch) bronze casting ASTM B584, C84400. Mechanical grooved couplings, 2070 kPa (300 psig) minimum ductile iron, ASTM A536 Grade 448-310-12 (Grade 65-45-12), or malleable iron, ASTM A47/A47M Grade 22410 (Grade 32510) housing, with EPDM gasket, steel track head bolts, ASTM A183, coated with copper colored alkyd enamel.
3. Mechanical press-connect fittings for copper pipe and tube **are prohibited**. See Plumbing Design Manual for additional information.
4. Mechanically formed tee connection: Form mechanically extracted collars in a continuous operation by drilling pilot hole and drawing out tube surface to form collar, having a height of not less than three times the thickness of tube wall. Adjustable collaring device shall ensure proper tolerance and complete uniformity of the joint. Notch and dimple joining branch tube in a single process to provide free flow where the branch tube penetrates the fitting. Braze joints.
5. Flanged fittings, bronze, class 150, solder-joint ends conforming to ASME B16.24.

C. Fittings for Stainless Steel:
1. Stainless steel butt-welded fittings, Type 316, Schedule 10, conforming to ASME B16.9.
2. Grooved fittings, stainless steel, Type 316, Schedule 10, conforming to ASTM A403/A403M. Segmentally fabricated fittings are not allowed. Mechanical grooved couplings, ductile iron, 4138 kPa (600 psig), ASTM A536 Grade 448-310-12 (Grade 65-45-12), or malleable iron, ASTM A47/A47M Grade 22410 (Grade 32510) housing, with EPDM gasket, steel track head bolts, ASTM A183, coated with copper colored alkyd enamel.

D. Adapters: Provide adapters for joining pipe or tubing with dissimilar end connections.

E. Solder: ASTM B32 alloy type Sb5, HA or HB. Provide non-corrosive flux.

F. Brazing alloy: AWS A5.8M/A5.8, brazing filler metals shall be BCuP series for copper to copper joints and BAg series for copper to steel joints.

G. Re-agent Grade Water Piping and Dialysis Water Piping:
1. Dialysis equipment piping: Refer to current ANSI/AAMI/ISO 23500-1 standard.
2. Polypropylene, ASTM F2389, Schedule 80 pressure pipe without additions of modifiers, plasticizers, colorants, stabilizers or lubricants. Bio-based materials shall be utilized when possible. This virgin un-plasticized pipe and fittings shall transport 10 megohm water with no loss of purity. Provide socket or butt end fittings with ASTM D2657 heat fusion joints.
3. Polyethylene, ASTM F2769, Schedule 80, food and medical grade, capable of transporting 10 megohm water with no loss of purity. Processed by continuous compression molding without the addition of fillers, polymer modifiers or processing aids. Uniform color with no cracks, flaws, blisters or other imperfections in appearance. Provide ASTM D2657 or ASTM F2620 heat fusion butt welded joints. In accordance with manufacturer's recommendations, provide continuous channel support under all horizontal piping.
4. Reverse Osmosis (RO) Water Piping:
   a. Low Pressure Feed, Reject and Recycle Piping: Less than or equal to 520 kPa (75 psig): ASTM D1785, Schedule 80 PVC, ASTM D2855 socket welded and flanged.
   b. RO Product Tubing from each Membrane Housing: ASTM D1785, Schedule 80 PVC, ASTM D2855 socket welded and flanged.
   c. Low Pressure Control and Pressure Gage Tubing: Polyethylene.
   d. High Pressure Reject and Recycle Piping: Greater than 520 kPa (75 psig): ASTM A269/A269M, Type 304 schedule 10 stainless steel with butt welded joints.
   e. High Pressure Control and Pressure Gage Tubing: 6895 kPa (1000 psig) burst nylon.

2.4 EXPOSED WATER PIPING

A. Finished Room: Use full iron pipe size chrome plated brass piping for exposed water piping connecting fixtures, casework, cabinets, equipment, and reagent racks when not concealed by apron including those furnished by the Government or specified in other sections.
   1. Pipe: ASTM B43, standard weight.
   2. Fittings: ASME B16.15 cast bronze threaded fittings with chrome finish.
   3. Nipples: ASTM B687, Chromium-plated.
   4. Unions: MSS SP-72, MSS SP-110, brass or bronze with chrome finish. Unions 65 mm (2-1/2 inches) and larger shall be flange type with approved gaskets.

B. Unfinished Rooms, Mechanical Rooms and Kitchens: Chrome-plated brass piping is not required. Paint piping systems as specified in Section 09 91 00, PAINTING.

2.5 ETHYLENE OXIDE (ETO) STERILIZER WATER SUPPLY PIPING

A. Stainless steel, ASTM A312, Schedule 10 with stainless-steel butt-welded fittings. Provide on sterilizer water supply.

2.6 TRAP PRIMER WATER PIPING

A. Pipe: Copper tube, ASTM B88, type K, hard drawn.

B. Fittings: Bronze castings conforming to ASME B16.18 Solder joints.

C. Solder: ASTM B32 alloy type Sb5. Provide non-corrosive flux.

2.7 STRAINERS

A. Provide on high pressure side of pressure reducing valves, on suction side of pumps, on inlet side of indicating and control instruments and equipment subject to sediment damage and where shown on drawings. Strainer element shall be removable without disconnection of piping.

B. Water: Basket or "Y" type with easily removable cover and brass strainer basket.

C. Body: Less than 75 mm (3 inches), brass or bronze; 75 mm (3 inches) and greater, cast iron or semi-steel.

2.8 DIELECTRIC FITTINGS

A. Provide dielectric couplings or unions between pipe of dissimilar metals.

2.9 STERILIZATION CHEMICALS

A. Hypochlorite: ASTM E1229.

B. Liquid Chlorine: ASTM E1120.

2.10 WATER HAMMER ARRESTER

A. Closed copper tube chamber with permanently sealed 413 kPa (60 psig) air charge above a Double O-ring piston. Two high heat Buna-N 0-rings pressure packed and lubricated with FDA approved silicone compound. All units shall be designed in accordance with ASSE 1010. Access shall be provided where devices are concealed within partitions or above ceilings. Size and install in accordance with PDI-WH 201 requirements. Provide water hammer arrestors at:
   1. All solenoid valves.
   2. All groups of two or more flush valves.
   3. All quick opening or closing valves.
   4. All medical washing equipment.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with the International Plumbing Code and the following:

1. Install branch piping for water from the piping system and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by the Government or specified in other sections.
2. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe, except for plastic and glass, shall be reamed to remove burrs and a clean smooth finish restored to full pipe inside diameter.
3. All pipe runs shall be laid out to avoid interference with other work/trades.
4. Install union and shut-off valve on pressure piping at connections to equipment.
5. Pipe Hangers, Supports and Accessories:
    a. All piping shall be supported per the IPC, H-18-8 Seismic Design Handbook, MSS SP-58, and SMACNA as required.
    b. Shop Painting and Plating: Hangers, supports, rods, inserts and accessories used for pipe supports shall be shop coated with zinc chromate primer paint. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.
    c. Floor, Wall and Ceiling Plates, Supports, Hangers:
        1) Solid or split un-plated cast iron.
        2) All plates shall be provided with set screws.
        3) Pipe Hangers: Height adjustable clevis type.
        4) Adjustable Floor Rests and Base Flanges: Steel.
        5) Concrete Inserts: "Universal" or continuous slotted type.
        6) Hanger Rods: Mild, low carbon steel, fully threaded or Threaded at each end with two removable nuts at each end for positioning rod and hanger and locking each in place.
        7) Pipe Hangers and Riser Clamps: Malleable iron or carbon steel. Pipe Hangers and riser clamps shall have a copper finish when supporting bare copper pipe or tubing.
        8) Rollers: Cast iron.
        9) Self-drilling type expansion shields shall be "Phillips" type, with case hardened steel expander plugs.
        10) Hangers and supports utilized with insulated pipe and tubing shall have 180-degree (minimum) metal protection shield centered on and welded to the hanger and support. The shield thickness and length shall be engineered and sized for distribution of loads to preclude crushing of insulation without breaking the vapor barrier. The shield shall be sized for the insulation and have flared edges to protect vapor-retardant jacket facing. To prevent the shield from sliding out of the clevis hanger during pipe movement, center-ribbed shields shall be used.
        11) Miscellaneous Materials: As specified, required, directed or as noted on the drawings for proper installation of hangers, supports and accessories. If the vertical distance exceeds 6.1 m (20 feet) for cast iron pipe additional support shall be provided in the center of that span. Provide all necessary auxiliary steel to provide that support.
        12) With the installation of each flexible expansion joint, provide piping restraints for the upstream and downstream section of the piping at the flexible expansion joint. Provide calculations supporting the restraint length design and type of selected restraints. Restraint calculations shall be based on the criteria from the manufacturer regarding their restraint design.
6. Install chrome plated cast brass escutcheon with set screw at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
7. Penetrations:
    a. Firestopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke, and gases as specified in Section 07 84 00, FIRESTOPPING. Completely fill and seal clearances between raceways and openings with the firestopping materials.

b. Waterproofing: At floor penetrations, completely seal clearances around the pipe and make watertight with sealant as specified in Section 07 92 00, JOINT SEALANTS. Bio-based materials shall be utilized when possible.

c. Acoustical sealant: Where pipes pass through sound rated walls, seal around the pipe penetration with an acoustical sealant that is compliant with ASTM C919.

B. B. Domestic Water piping shall conform to the following:

1. Grade all lines to facilitate drainage. Provide drain valves at bottom of risers and all low points in system. Design domestic hot and cold water circulating lines with no traps.
2. Connect branch lines at bottom of main serving fixtures below and pitch down so that main may be drained through fixture. Connect branch lines to top of main serving only fixtures located on floor above.

3.2 TESTS

A. General: Test system either in its entirety or in sections. Submit testing plan to COR 10 working days prior to test date.

B. Potable Water System: Test after installation of piping and domestic water heaters, but before piping is concealed, before covering is applied, and before plumbing fixtures are connected. Fill systems with water and maintain hydrostatic pressure of 1035 kPa (150 psig) gage for two hours. No decrease in pressure is allowed. Provide a pressure gage with a shutoff and bleeder valve at the highest point of the piping being tested. Pressure gauge shall have 1 psig increments.

C. Re-agent Grade Water Systems: Fill system with water and maintain hydrostatic pressure of 1380 kPa (200 psig) gage during inspection and prove tight.

D. All Other Piping Tests: Test new installed piping under 1-1/2 times actual operating conditions and prove tight.

E. The test pressure shall hold for the minimum time duration required by the applicable plumbing code or authority having jurisdiction.

3.3 STERILIZATION

A. After tests have been successfully completed, thoroughly flush and sterilize the interior domestic water distribution system in accordance with AWWA C651.

B. Use liquid chlorine or hypochlorite for sterilization.

3.4 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

B. Components provided under this section of the specification will be tested as part of a larger system.

3.5 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative for 16 hours for large equipment and 4 hours for small equipment to instruct VA Personnel in operation and maintenance of the system.

B. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

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SECTION 22 13 00

FACILITY SANITARY AND VENT PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section pertains to sanitary sewer and vent systems, including piping, equipment and all necessary accessories as designated in this section.

B. A complete listing of common acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

E. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Seismic Restraint.

F. Section 07 84 00, FIRESTOPPING: Penetrations in rated enclosures.

G. Section 07 92 00, JOINT SEALANTS: Sealant products.

H. Section 09 91 00, PAINTING: Preparation and finish painting and identification of piping systems.

I. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING: Pipe Hangers and Supports, Materials Identification.

J. Section 22 07 11, PLUMBING INSULATION.

K. Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS

L. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

M. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standard will govern.

B. American Society of Mechanical Engineers (ASME):

A13.1-2007 ..... Identification of Piping Systems

A112.36.2M-1991 ..... Cleanouts

A112.6.3-2019 ..... Floor and Trench Drains

B1.20.1-2013 ..... Pipe Threads, General Purpose (Inch)

B16.1-2015 ..... Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250

B16.4-2016 ..... Grey Iron Threaded Fittings Classes 125 and 250

B16.15-2018 ..... Cast Copper Alloy Threaded Fittings, Classes 125 and 250

B16.18-2018 ..... Cast Copper Alloy Solder Joint Pressure Fittings

B16.21-2016 ..... Nonmetallic Flat Gaskets for Pipe Flanges

B16.22-2018 ..... Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings

B16.23-2016 ..... Cast Copper Alloy Solder Joint Drainage Fittings: DWV

B16.24-2016 ..... Cast Copper Alloy Pipe Flanges and Flanged Fittings, and Valves: Classes 150, 300, 600, 900, 1500, and 2500

B16.29-2017 ..... Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings: DWV

B16.39-2014 ..... Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300

B18.2.1-2012 ..... Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series)

C. American Society of Sanitary Engineers (ASSE):

1001-2017 ..... Performance Requirements for Atmospheric Type Vacuum Breakers

1018-2001 ..... Performance Requirements for Trap Seal Primer Valves – Potable Water Supplied

1044-2015 ..... Performance Requirements for Trap Seal Primer Devices – Drainage Types and Electronic Design Types

1079-2012 ..... Performance Requirements for Dielectric Pipe Unions

D. American Society for Testing and Materials (ASTM):

A53/A53M-2018 ..... Standard Specification for Pipe, Steel, Black And Hot-Dipped, Zinc-coated, Welded and Seamless

A74-2017 ..... Standard Specification for Cast Iron Soil Pipe and Fittings

A888-2018a ..... Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

B32-2008(R2014) ..... Standard Specification for Solder Metal

B43-2015 ..... Standard Specification for Seamless Red Brass Pipe, Standard Sizes

B88-2016 ..... Standard Specification for Seamless Copper Water Tube

B306-2013 ..... Standard Specification for Copper Drainage Tube (DWV)

B687-1999(R2016) ..... Standard Specification for Brass, Copper, and Chromium-Plated Pipe Nipples

B813-2016 ..... Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube

B828-2016 ..... Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings

C564-2014 ..... Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings

D2321-2018 ..... Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

D2564-2012(R3018) ..... Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems

D2665-2014 ..... Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings

D2855-2015 ..... Standard Practice for Two-Step (Primer and Solvent Cement) Method of Joining Poly(Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) CPVCP Pipe and Piping Components with Tapered Sockets

D5926-2015 ..... Standard Specification for Poly(Vinyl Chloride) (PVC) Gaskets for Drain, Waste, and Vent (DWV), Sewer, Sanitary, and Storm Plumbing Systems

F402-2018 ..... Standard Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings

F477-2014 ..... Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

F1545-2015e1 ..... Standard Specification for Plastic-Lined Ferrous Metal Pipe, Fittings, and Flanges

E. Cast Iron Soil Pipe Institute (CISPI):

2006 ..... Cast Iron Soil Pipe and Fittings Handbook

301-2012 ..... Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

310-2012 ..... Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

F. Copper Development Association, Inc. (CDA):

A4015-14/19 ..... Copper Tube Handbook

G. International Code Council (ICC):

IPC-2018 ..... International Plumbing Code

H. Manufacturers Standardization Society (MSS):

SP-123-2018 ..... Non-Ferrous Threaded and Solder-Joint Unions for Use with Copper Water Tube

I. National Fire Protection Association (NFPA):
70-2020 ..... National Electrical Code (NEC)

J. Underwriters' Laboratories, Inc. (UL):
508-99 (R2013) ..... Standard For Industrial Control Equipment

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 22 13 00, FACILITY SANITARY AND VENT PIPING”, with applicable paragraph identification.

C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
1. Piping.
2. Floor Drains.
3. Grease Removal Unit.
4. Cleanouts.
5. Trap Seal Protection.
6. Penetration Sleeves.
7. Pipe Fittings.
8. Traps.
9. Exposed Piping and Fittings.

D. Detailed shop drawing of clamping device and extensions when required in connection with the waterproofing membrane or the floor drain.

E. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts, and troubleshooting guide:
1. Include complete list indicating all components of the systems.
2. Include complete diagrams of the internal wiring for each item of equipment.
3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

F. Completed System Readiness Checklist provided by the CXA and completed by the Contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

G. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

1.5 QUALITY ASSURANCE

A. Bio-Based Materials: For products designated by the USDA’s bio-based Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

B. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

1.6 AS-BUILT DOCUMENTATION

A. Comply with requirements in Paragraph “AS-BUILT DOCUMENTATION” of Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

PART 2 - PRODUCTS

2.1 SANITARY WASTE, DRAIN, AND VENT PIPING

A. Cast iron waste, drain, and vent pipe and fittings.
   1. Cast iron waste, drain, and vent pipe and fittings shall be used for the following applications:
      a. Pipe buried in or in contact with earth.
      b. Sanitary pipe extensions to a distance of approximately 1500 mm (5 feet) outside of the building.
      c. Interior waste and vent piping above grade.
   2. Cast iron Pipe shall be bell and spigot or hubless (plain end or no-hub or hubless).
   3. The material for all pipe and fittings shall be cast iron soil pipe and fittings and shall conform to the requirements of CISPI 301, ASTM A888, or ASTM A74.
   4. Cast iron pipe and fittings shall be made from a minimum of 95 percent post-consumer recycled material.
   5. Joints for hubless pipe and fittings shall conform to the manufacturer's installation instructions. Couplings for hubless joints shall conform to CISPI 310. Joints for hub and spigot pipe shall be installed with compression gaskets conforming to the requirements of ASTM C564.

B. Copper Tube, (DWV):
   1. Copper DWV tube sanitary waste, drain and vent pipe may be used for piping above ground, except for urinal drains.
   2. The copper DWV tube shall be drainage type, drawn temper conforming to ASTM B306.
   3. The copper drainage fittings shall be cast copper or wrought copper conforming to ASME B16.23 or ASME B16.29.
   4. The joints shall be lead free, using a water flushable flux, and conforming to ASTM B32.

2.2 EXPOSED WASTE PIPING

A. Chrome plated brass piping of full iron pipe size shall be used in finished rooms for exposed waste piping connecting fixtures, casework, cabinets, equipment and reagent racks when not concealed by apron including those furnished by the Government or specified in other sections.
   1. The Pipe shall meet ASTM B43, regular weight.
   2. The Fittings shall conform to ASME B16.15 orASTM D2665.
   3. Nipples shall conform to ASTM B687, Chromium-plated.
   4. Unions shall be brass or bronze with chrome finish. Unions 65 mm (2-1/2 inches) and larger shall be flange type with approved gaskets.

B. In unfinished Rooms such as mechanical Rooms and Kitchens, Chrome-plated brass piping is not required. The pipe materials specified under the paragraph "Sanitary Waste, Drain, and Vent Piping" can be used. The sanitary pipe in unfinished rooms shall be painted as specified in Section 09 91 00, PAINTING.

2.3 SPECIALTY PIPE FITTINGS

A. Transition pipe couplings shall join piping with small differences in outside diameters or different materials. End connections shall be of the same size and compatible with the pipes being joined. The transition coupling shall be elastomeric, sleeve type reducing or transition pattern and include shear and corrosion resistant metal, tension band and tightening mechanism on each end. The transition coupling sleeve coupling shall be of the following material:
   1. For cast iron soil pipes, the sleeve material shall be rubber conforming to ASTM C564.
   2. For dissimilar pipes, the sleeve material shall be PVC conforming to ASTM D5926, or other material compatible with the pipe materials being joined.

B. The dielectric fittings shall conform to ASSE 1079 with a pressure rating of 861 kPa (125 psig) at a minimum temperature of 82 degrees C (180 degrees F). The end connection shall be solder joint copper alloy and threaded ferrous.

C. Dielectric flange insulating kits shall be of non-conducting materials for field assembly of companion flanges with a pressure rating of 1035 kPa (150 psig). The gasket shall be neoprene or phenolic. The bolt sleeves shall be phenolic or polyethylene. The washers shall be phenolic with steel backing washers.

D. The di-electric nipples shall be electroplated steel nipple complying with ASTM F1545 with a pressure rating of 2070 kPa (300 psig) at 107 degrees C (225 degrees F). The end connection shall be male threaded. The lining shall be inert and noncorrosive propylene.

2.4 CLEANOUTS

A. Cleanouts shall be the same size as the pipe, up to 100 mm (4 inches); and not less than 100 mm (4 inches) for larger pipe. Cleanouts shall be easily accessible and shall be gastight and watertight. Minimum clearance of 600 mm (24 inches) shall be provided for clearing a clogged sanitary line.

B. Floor cleanouts shall be gray iron housing with clamping device and round, secured, scoriated, gray iron cover conforming to ASME A112.36.2M. A gray iron ferrule with hubless, socket, inside calk or spigot connection and counter sunk, taper-thread, brass or bronze closure plug shall be included. The frame and cover material and finish shall be nickel-bronze copper alloy with a square shape. The cleanout shall be vertically adjustable for a minimum of 50 mm (2 inches). When a waterproof membrane is used in the floor system, clamping collars shall be provided on the cleanouts. Cleanouts shall consist of wye fittings and eighth bends with brass or bronze screw plugs. Cleanouts in the resilient tile floors, quarry tile and ceramic tile floors shall be provided with square top covers recessed for tile insertion. In the carpeted areas, carpet cleanout markers shall be provided. Two way cleanouts shall be provided where indicated in the contract document and at every building exit. The loading classification for cleanouts in sidewalk areas or subject to vehicular traffic shall be heavy duty type.

C. Cleanouts shall be provided at or near the base of the vertical stacks with the cleanout plug located approximately 600 mm (24 inches) above the floor. If there are no fixtures installed on the lowest floor, the cleanout shall be installed at the base of the stack. The cleanouts shall be extended to the wall access cover. Cleanout shall consist of sanitary tees. Nickel-bronze square frame and stainless steel cover with minimum opening of 150 by 150 mm (6 by 6 inches) shall be furnished at each wall cleanout. Where the piping is concealed, a fixture trap or a fixture with integral trap, readily removable without disturbing concealed pipe, shall be accepted as a cleanout equivalent providing the opening to be used as a cleanout opening is the size required.

D. In horizontal runs above grade, cleanouts shall consist of cast brass tapered screw plug in fitting or caulked/hubless cast iron ferrule. Plain end (hubless) piping in interstitial space or above ceiling may use plain end (hubless) blind plug and clamp.

2.5 FLOOR DRAINS

A. General Data: floor drain shall comply with ASME A112.6.3. A caulking flange, inside gasket, or hubless connection shall be provided for connection to cast iron pipe, screwed or no hub outlets for connection to steel pipe. The drain connection shall be bottom outlet. A membrane clamp and extensions shall be provided, if required, where installed in connection with waterproof membrane. Puncturing membrane other than for drain opening shall not be permitted. Double drainage pattern floor drains shall have integral seepage pan for embedding into floor construction, and weep holes to provide adequate drainage from pan to drain pipe. For drains not installed in connection with a waterproof membrane, a flashing membrane, 600 mm (24 inches) square or another approved waterproof membrane shall be provided.

B. Type C (FD-C) medium duty (non-traffic) floor drain shall comply with ASME A112.6.3. The type C floor drain shall have a cast iron body, double drainage pattern, clamping device, light duty nickel bronze adjustable strainer with round or square grate of 150 mm (6 inches) width or diameter minimum for toilet rooms, showers and kitchens.

C. Type S (FD-S) floor sink shall comply with ASME A112.6.3. The type S floor sink shall be constructed from type 304 stainless steel and shall be 300 mm (12 inches) square, and 200 mm

(8 inches deep). The interior surface shall be polished. The double drainage flange shall be provided with weep holes, internal dome strainer, and heavy duty non-tilting loose set grate. A clamping device shall be provided.

D. Type Z (FD-Z) trench drain shall comply with ASME A112.6.3. The type Z trench drain shall be suitable for shower thresholds and constructed of Type 304 stainless steel. The stainless steel slotted grate shall be not less than 100 mm (4 inches) wide with anchor supports, tile edge, bottom outlet and combination membrane flashing collar.

2.6 TRAPS

A. Traps shall be provided on all sanitary branch waste connections from fixtures or equipment not provided with traps. Exposed brass shall be polished brass chromium plated with nipple and set screw escutcheons. Concealed traps may be rough cast brass or same material as the piping they are connected to. Slip joints are prohibited on sewer side of trap. Traps shall correspond to fittings on cast iron soil pipe or steel pipe respectively, and size shall be as required by connected service or fixture.

2.7 PRIMER VALVES AND TRAP SEAL PRIMER SYSTEMS

A. Trap Guard (TG): Trap seal device shall be insertable into the drain outlet. Floor drain trap seal protection devices shall comply with all sections of the ASSE 1072 Standard. Required flow rates per ASSE 1072 Standard, Section I. All sizes must meet these flow rates. Do not use in application where the room/space has an atmospheric pressure less than the ambient pressure of the exterior of the room/space or building. The devices must function in compliance with ASME A112.6.3, providing a barrier that opens for drainage and closes to prevent evaporation. Device must meet floor designation/rating for floor types per ASSE 1072, Section II.

2.8 PENETRATION SLEEVES

A. A sleeve flashing device shall be provided at points where pipes pass through membrane waterproofed floors or walls. The sleeve flashing device shall be manufactured, cast iron fitting with clamping device that forms a sleeve for the pipe floor penetration of the floor membrane. A galvanized steel pipe extension shall be included in the top of the fitting that shall extend 50 mm (2 inches) above finished floor and galvanized steel pipe extension in the bottom of the fitting that shall extend through the floor slab. A waterproof caulked joint shall be provided at the top hub.

PART 3 - EXECUTION

3.1 PIPE INSTALLATION

A. The pipe installation shall comply with the requirements of the International Plumbing Code (IPC) and these specifications.

B. Branch piping shall be installed for waste from the respective piping systems and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by the Government or specified in other sections.

C. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe shall be reamed to full size after cutting.

D. All pipe runs shall be laid out to avoid interference with other work.

E. The piping shall be installed above accessible ceilings where possible.

F. The piping shall be installed to permit valve servicing or operation.

G. The piping shall be installed free of sags and bends.

H. Seismic restraint shall be installed where required by code.

I. Changes in direction for soil and waste drainage and vent piping shall be made using appropriate branches, bends and long sweep bends. Sanitary tees and short sweep quarter bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Long turn double wye branch and eighth bend fittings shall be used if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow greater than 90 degrees. Proper size of standard increaser and reducers shall be used if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

J. Buried soil and waste drainage and vent piping shall be laid beginning at the low point of each system. Piping shall be installed true to grades and alignment indicated with unbroken continuity of invert. Hub ends shall be placed upstream. Required gaskets shall be installed according to manufacturer's written instruction for use of lubricants, cements, and other installation requirements.

K. Cast iron piping shall be installed according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings"

L. Aboveground copper tubing shall be installed according to Copper Development Association's (CDA) "Copper Tube Handbook".

M. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no additional cost or time to the Government.

3.2 JOINT CONSTRUCTION

A. Hub and spigot, cast iron piping with gasket joints shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Hub and spigot, cast iron piping with calked joints shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.

C. Hubless or No-hub, cast iron piping shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless piping coupling joints.

D. For threaded joints, thread pipe with tapered pipe threads according to ASME B1.20.1. The threads shall be cut full and clean using sharp disc cutters. Threaded pipe ends shall be reamed to remove burrs and restored to full pipe inside diameter. Pipe fittings and valves shall be joined as follows:
   1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is required by the pipe service.
   2. Pipe sections with damaged threads shall be replaced with new sections of pipe.

E. Copper tube and fittings with soldered joints shall be joined according to ASTM B828. A water flushable, lead free flux conforming to ASTM B813 and a lead-free alloy solder conforming to ASTM B32 shall be used.

3.3 SPECIALTY PIPE FITTINGS

A. Transition coupling shall be installed at pipe joints with small differences in pipe outside diameters.

B. Dielectric fittings shall be installed at connections of dissimilar metal piping and tubing.

3.4 PIPE HANGERS, SUPPORTS AND ACCESSORIES

A. All piping shall be supported according to the International Plumbing Code (IPC), Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, and these specifications. Where conflicts arise between these the code and Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING the most restrictive or the requirement that specifies supports with highest loading or shortest spacing shall apply.

B. Hangers, supports, rods, inserts and accessories used for pipe supports shall be painted according to Section 09 91 00, PAINTING. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.

C. Horizontal piping and tubing shall be supported within 300 mm (12 inches) of each fitting or coupling.

D. Horizontal cast iron piping shall be supported with the following maximum horizontal spacing and minimum hanger rod diameters:
   1. 40 mm or DN40 to 50 mm or DN50 (NPS 1-1/2 inch to NPS 2 inch): 1500 mm (60 inches) with 10 mm (3/8 inch) rod.
   2. 75 mm or DN75 (NPS 3 inch): 1500 mm (60 inches) with 15 mm (1/2 inch) rod.
   3. 100 mm or DN100 to 125 mm or DN125 (NPS 4 inch to NPS 5 inch): 1500 mm (60 inches) with 18 mm (5/8 inch) rod.
   4. 150 mm or DN150 to 200 mm or DN200 (NPS 6 inch to NPS 8 inch): 1500 mm (60 inches) with 20 mm (3/4 inch) rod.
   5. 250 mm or DN250 to 300 mm or DN300 (NPS 10 inch to NPS 12 inch): 1500 mm (60 inch) with 23 mm (7/8 inch) rod.

E. Vertical piping and tubing shall be supported at the base, at each floor, and at intervals no greater than 4.6 m (15 feet).

F. In addition to the requirements in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, Floor, Wall and Ceiling Plates, Supports, Hangers shall have the following characteristics:
   1. Solid or split unplated cast iron.
   2. All plates shall be provided with set screws.
   3. Height adjustable clevis type pipe hangers.
   4. Adjustable floor rests and base flanges shall be steel.
   5. Hanger rods shall be low carbon steel, fully threaded or threaded at each end with two removable nuts at each end for positioning rod and hanger and locking each in place.
   6. Riser clamps shall be malleable iron or steel.
   7. Rollers shall be cast iron.
   8. See Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, for requirements on insulated pipe protective shields at hanger supports.

G. Miscellaneous materials shall be provided as specified, required, directed or as noted in the contract documents for proper installation of hangers, supports and accessories. If the vertical distance exceeds 6.1 m (20 feet) for cast iron pipe additional support shall be provided in the center of that span. All necessary auxiliary steel shall be provided to provide that support.

H. Cast escutcheon with set screw shall be provided at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.

I. Penetrations:
   1. Fire Stopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, a fire stop shall be installed that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING. Clearances between raceways and openings shall be completely filled and sealed with the fire stopping materials.
   2. Water proofing: At floor penetrations, clearances shall be completely sealed around the pipe and make watertight with sealant as specified in Section 07 92 00, JOINT SEALANTS.

J. Exhaust vents shall be extended separately through roof. Sanitary vents shall not connect to exhaust vents.

3.5 TESTS

A. Sanitary waste and drain systems shall be tested either in its entirety or in sections.

B. Waste System tests shall be conducted before trenches are backfilled or fixtures are connected. A water test or air test shall be conducted, as directed.
   1. If entire system is tested for a water test, tightly close all openings in pipes except highest opening, and fill system with water to point of overflow. If the waste system is tested in sections, tightly plug each opening except highest opening of section under test, fill each section with water and test with at least a 3 m (10 foot) head of water. In testing successive sections, test at least upper 3 m (10 feet) of next preceding section so that each joint or pipe except upper most 3 m (10 feet) of system has been submitted to a test of at least a 3 m (10 foot) head of water. Water shall be kept in the system, or in portion under test, for at least 15 minutes before inspection starts. System shall then be tight at all joints.
   2. For an air test, an air pressure of 34 kPa (5 psig) gauge shall be maintained for at least 15 minutes without leakage. A force pump and mercury column gauge shall be used for the air test.
   3. After installing all fixtures and equipment, open water supply so that all p-traps can be observed. For 15 minutes of operation, all p-traps shall be inspected for leaks and any leaks found shall be corrected.
   4. Final Tests: Either one of the following tests may be used.
      a. Smoke Test: After fixtures are permanently connected and traps are filled with water, fill entire drainage and vent systems with smoke under pressure of .25 kPa (1 inch of water) with a smoke machine. Chemical smoke is prohibited.
      b. Peppermint Test: Introduce 60 ml (2 ounces) of peppermint into each line or stack.

3.6 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

B. Components provided under this section of the specification shall be tested as part of a larger system.

3.7 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative for 4 hours to instruct each VA personnel responsible in operation and maintenance of the system.

B. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

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SECTION 22 13 23

SANITARY WASTE INTERCEPTORS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section pertains to concrete, polyethylene, and metal sanitary waste interceptors used for the removal of hair, oil, grease and sediment from waste streams for installations within the building envelope.

B. A complete listing of common acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

E. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

F. Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

G. Section 22 13 00, FACILITY SANITARY AND VENT PIPING.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards will govern.

B. American Society of Mechanical Engineers (ASME):
A112.14.3-2018.....Hydromechanical Grease Interceptors

C. American Society for Testing and Materials (ASTM):
A48/A48M-2003(R2016) .....Standards specification for Gray Iron Castings

A536-1984(R2019)e1.....Standard Specification for Ductile Iron Castings

A615/A615M-2018e1 .....Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

C890-2019.....Standard Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures

C891-2019.....Standard Practice for Installation of Underground Precast Concrete Utility Structures

C913-2018.....Standard Specification for Precast Concrete Water and Wastewater Structures

C923-2018.....Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals

C1613-2017.....Standard Specification for Precast Concrete Grease Interceptor Tanks

D. International Code Council (ICC)
IPC-2021 ..... International Plumbing Code

E. Plumbing and Drainage Institute (PDI):
PDI-G101-2017 ..... Testing and Rating Procedure for Hydro Mechanical Grease Interceptors

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22 13 23, SANITARY WASTE INTERCEPTORS", with applicable paragraph identification.

C. Manufacturer's Literature and Data Including: For each type of interceptor indicated, the submittal shall include materials of fabrication, dimensions, rated capacities, retention capacities, operating characteristics, size and location of each pipe connection, furnished specialties, and accessories.

D. Detailed shop drawing of clamping device and extensions when required in connection with the waterproofing membrane or the floor drain shall be submitted.

E. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts, and troubleshooting guide:
1. Include complete list indicating all components of the systems.
2. Include complete diagrams of the internal wiring for each item of equipment.
3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

F. Completed System Readiness Checklist provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

G. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

1.5 QUALITY ASSURANCE

A. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit https://www.biopreferred.gov.

B. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

1.6 AS-BUILT DOCUMENTATION

A. Comply with requirements in Paragraph, AS-BUILT DOCUMENTATION of Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

PART 2 - PRODUCTS

2.1 GREASE INTERCEPTOR

A. Plastic Grease Interceptors:
1. Standard: ASME A112.14.3 and PDI-G101, for intercepting and retaining fats, oils, and greases from food-preparation or processing wastewater.
2. Body Material: Plastic.

3. Body Extension: Not required.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Interceptors and grease/oil removal units shall be set level and plumb.

B. Install interceptor and grease/oil removal unit, including trapping, venting, and flow-control fittings according to the manufacture's installation instructions and with recommended service clearances.

C. Install interceptor and grease/oil removal unit with cleanout immediately downstream from unit that do not have integral cleanout on the unit.

D. Interceptor and grease/oil removal unit covers shall be set flush with finished surface in pavements and the tops shall be traffic-rated. Set tops 75 mm (3 inches) above finished surface elsewhere unless otherwise indicated.

E. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no cost or time to the Government.

3.2 CONNECTIONS

A. Pipe installation requirements are specified in Section 22 13 00, FACILITY SANITARY AND VENT PIPING.

B. Piping connections shall be made between interceptor/grease/oil removal units and piping systems in accordance with manufacturer's written guidelines.

3.3 WARNING TAPE

A. Warning tape shall be placed over ferrous piping.

B. Detectable warning tape shall be used over nonferrous pipe and over the edges of underground structures.

3.4 STARTUP AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. The tests shall include system capacity, control function, and alarm functions.

C. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

3.5 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

3.6 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer's technical representative for 4 hours to instruct VA Personnel responsible in operation and maintenance of the system.

B. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

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SECTION 22 14 00

FACILITY STORM DRAINAGE

PART 1 - GENERAL

1.1 DESCRIPTION

1. This section describes the requirements for storm drainage systems, including piping and all necessary accessories as designated in this section.
2. A complete listing of all acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.2 RELATED WORK

1. Section 01 00 00, GENERAL REQUIREMENTS.
2. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
3. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.
4. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.
5. Section 07 84 00, FIRESTOPPING: Penetrations in rated enclosures.
6. Section 07 92 00, JOINT SEALANTS.
7. Section 09 91 00, PAINTING: Preparation and finish painting and identification of piping systems.
8. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Seismic Restraint.
9. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING: Pipe Hangers and Supports, Materials Identification.
10. Section 22 07 11, PLUMBING INSULATION.
11. SECTION 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society of Mechanical Engineers (ASME):

A112.6.4-2003 (R2012) .....Roof, Deck, and Balcony Drains

A13.1-2007 (R2013).....Scheme for Identification of Piping Systems

B1.20.1-2013.....Pipe Threads, General Purpose, Inch

B16.3-2011.....Malleable Iron Threaded Fittings: Classes 150 and 300

B16.9-2012.....Factory-Made Wrought Buttwelding Fittings

B16.11-2011.....Forged Fittings, Socket-Welding and Threaded

B16.12-2009 (R2014).....Cast Iron Threaded Drainage Fittings

B16.15-2013.....Cast Copper Alloy Threaded Fittings: Classes 125 and 250

B16.18-2012.....Cast Copper Alloy Solder-Joint Pressure Fittings

B16.22-2013.....Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings

B16.23-2011.....Cast Copper Alloy Solder Joint Drainage Fittings - DWV

B16.29-2012.....Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings – DWV

C. American Society of Sanitary Engineering (ASSE)

1079-2012 .....Performance Requirements for Dielectric Pipe Unions

D. American Society for Testing and Materials (ASTM):

A47/A47M-1999 (R2014) ..... Standard Specification for Ferritic Malleable Iron Castings

A53/A53M-2012 ..... Standard Specification for Pipe, Steel, Black And Hot-Dipped, Zinc-coated Welded and Seamless

A74-2013a ..... Standard Specification for Cast Iron Soil Pipe and Fittings

A183-2014 ..... Standard Specification for Carbon Steel Track Bolts and Nuts

A312/A312M-2015 ..... Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes

A536-1984(R2014)..... Standard Specification for Ductile Iron Castings

A733-2013 ..... Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples

A888-2013a ..... Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

B32-2008 (R2014)..... Standard Specification for Solder Metal

B61-2008 (R2013)..... Standard Specification for Steam or Valve Bronze Castings

B62-2009 ..... Standard Specification for Composition Bronze or Ounce Metal Castings

B75/B75M-2011 ..... Standard Specification for Seamless Copper Tube

B88-2014 ..... Standard Specification for Seamless Copper Water Tube

B306-2013 ..... Standard Specification for Copper Drainage Tube (DWV)

B584-2014 ..... Standard Specification for Copper Alloy Sand Castings for General Applications

B687-1999 (R2011)..... Standard Specification for Brass, Copper, and Chromium-Plated Pipe Nipples

B828-2002 (R2010)..... Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings

B813-2010 ..... Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube

C564-2014 ..... Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings

C1173-2010 (R2014) ..... Standard Specification for Flexible Transition Couplings for Underground Piping Systems

D1785-2012 ..... Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120

D2000-2012 ..... Standard Classification System for Rubber Products in Automotive Applications

D2321-2014e1 ..... Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

D2564-2012 ..... Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems

D2665-2014 ..... Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings

D2855-1996 (R2010) ..... Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings

D4101-2014..... Standard Specification for Polypropylene Injection and Extrusion Materials

D5926-2011..... Standard for Poly (Vinyl Chloride) (PVC) Gaskets for Drain, Waste, and Vent (DWV), Sewer, Sanitary, and Storm Plumbing Systems

F477-2014 ..... Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

F656-2010 ..... Standard Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings

F1545-2015 ..... Standard Specification for Plastic-Lined Ferrous Metal Pipe, Fittings, and Flanges

E. American Welding Society (AWS):
A5.8M/A5.8 AMD1-2011 ..... Specification for Filler Metals for Brazing and Braze Welding

F. Copper Development Association (CDA):
A4015-2011 ..... Copper Tube Handbook

G. Cast Iron Soil Pipe Institute (CISPI):
301-2012 ..... Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

310-2012 ..... Standard Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

H. International Code Council (ICC):
IPC-2021 ..... International Plumbing Code

I. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS):
SP-72-2010a ..... Ball Valves with Flanged or Butt-Welding Ends for General Service

SP-110-2010 ..... Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 22 14 00, FACILITY STORM DRAINAGE”, with applicable paragraph identification.

C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
1. Pipe and Fittings.
2. Specialty Pipe Fittings.
3. Cleanouts.
4. Roof Drains.
5. Expansion Joints.
6. Downspout Nozzles.
7. Sleeve Flashing Devices.

D. Detailed shop drawing of clamping device and extensions when required in connection with the waterproofing membrane.

E. Completed System Readiness Checklist provided by the CxA and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

F. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

1.5 QUALITY ASSURANCE

A. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

1.6 AS-BUILT DOCUMENTATION

1. Submit manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.
2. Submit operation and maintenance data updated to include submittal review comments, substitutions and construction revisions shall be in electronic version on compact disc or DVD and inserted into a three ring binder. All aspects of system operation and maintenance procedures, including piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices such as damper and door closure interlocks shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.
3. The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. As-built drawings are to be provided, and a copy of them in Auto-CAD version 2013 provided on compact disk or DVD. Should the installing contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement.
4. Certification documentation shall be provided to COR 10 working days prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and certification that all results of tests were within limits specified.

PART 2 - PRODUCTS

2.1 STORM WATER DRAIN PIPING

A. Cast Iron Storm Pipe and Fittings:
1. Cast iron storm pipe and fittings shall be used for the following applications:
   a. Pipe buried in or in contact with earth.
   b. Extension of pipe to a distance of approximately 1500 mm (5 feet) outside of building walls.
   c. Interior storm piping above grade.
   d. All mechanical equipment rooms or other areas containing mechanical air handling equipment.

2. The cast iron storm pipe shall be bell and spigot, or hubless (plain end or no-hub) as required by selected jointing method.
3. The material for all pipe and fittings shall be cast iron soil pipe and fittings and shall conform to the requirements of CISPI 301, ASTM A888, or ASTM A74.
4. Joints for hubless pipe and fittings shall conform to the manufacturer's installation instructions. Couplings for hubless joints shall conform to CISPI 310. Joints for hub and spigot pipe shall be installed with compression gaskets conforming to the requirements of ASTM C564.

B. Copper Tube, (DWV): May be used for piping above ground.
1. The copper DWV tube shall be drainage type, drawn temper conforming to ASTM B306.
2. The copper drainage fittings shall be cast copper or wrought copper conforming to ASME B16.23 or ASME 16.29.
3. The joints shall be lead free, using a water flushable flux, and conforming to ASTM B32.

C. Polyvinyl Chloride (PVC):
1. PVC storm sewer pipe and fittings are permitted for single story structures except for mechanical equipment rooms and other areas containing air handling equipment or hot water generation equipment.
2. PVC storm sewer pipe and fittings shall be schedule 40 solid core piping conforming to ASTM D1785 and ASTM D2665, Sewer and Drain Series, with ends for solvent cemented joints.
3. PVC joints shall be solvent welded socket type using solvent cement conforming to ASTM D2564 and adhesive primer conforming to ASTM F656. Bio-based materials shall be utilized when possible.

D. Roof drain piping and body of drain in locations where the outdoor conditions are subject to freezing shall be insulated.

2.2 PUMPED DRAIN PIPING

A. Pumped drain piping 75 mm (3 inches) and less shall be copper tube conforming to ASTM B88, type K or L. For pumped drain piping 100 mm (4 inches) and greater, galvanized steel conforming to ASTM A53/A53M, seamless, schedule 40 may be used.

B. Pumped drain pipe fittings shall comply with the following:
1. Wrought copper or bronze castings for use with copper tube conforming to ASME B16.18 and B16.22.
2. Unions, for use with copper tube up to 50 mm (2 inches) shall be cast with bronze, conforming to ASME B16.18 and ASTM B584 with solder or braze joints.
3. Grooved fittings, for use with copper tube 65 mm to 100 mm (2-1/2 to 4 inch) shall be wrought copper conforming to ASTM B75/B75M, alloy C12200, 125 to 150 mm (5 to 6 inch) bronze castings conforming to ASTM B584.
4. Mechanical grooved couplings shall have a ductile iron housing conforming to ASTM A536 (Grade 65-45-12) elastomer gasket suitable for potable water service and process temperature and steel track head bolts conforming to ASTM A183, housing shall be coated with colored alkyd enamel paint.

C. Adapters shall be provided for joining pipe with different end connections.

D. The solder shall be lead free using a water flushable, non-corrosive flux conforming to ASTM B32.

E. Dielectric fittings and specialties shall be provided when joining pipe of dissimilar metals.

2.3 SPECIALTY PIPE FITTINGS

A. Transition pipe couplings shall join piping with small differences in outside diameters or be of different materials. End connections shall be of the same size and compatible with the pipes being joined. The transition coupling shall be unshielded, elastomeric, sleeve type reducing or transition pattern conforming with ASTM C1173 and include shear ring and corrosion resistant

metal tension band and tightening mechanism on each end. The transition coupling sleeve coupling shall be of the following material:

1. For cast iron soil pipes, the sleeve material shall be rubber conforming to ASTM C564.
2. For PVC soil pipes, the sleeve material shall be elastomeric seal conforming to ASTM F477 or PVC conforming to ASTM D5926.
3. dissimilar pipes, the sleeve material shall be PVC conforming to ASTM D5926, or other material compatible with the pipe materials being joined.

B. Dielectric fittings shall conform to ASSE 1079 with a pressure rating of 1725 kPa (250 psig) at a minimum temperature of 82 degrees C (180 degrees F). The end connection shall be solder joint copper alloy and threaded ferrous.

C. Dielectric flanges shall conform to ASSE 1079 with a pressure rating of 2070 kPa (300 psig). The flange shall be a factory fabricated, bolted, companion flange assembly. The end connection shall be threaded or solder-joint copper alloy and threaded ferrous.

D. Dielectric flange insulating kits shall be of non-conducting materials for field assembly of companion flanges with a pressure rating of 1035 kPa (150 psig). The gasket shall be neoprene or phenolic. The bolt sleeves shall be phenolic or polyethylene. The washers shall be phenolic with steel backing washers.

E. Dielectric nipples shall be electroplated steel and shall conform with ASTM F1545 with a pressure ratings of 2070 kPa (300 psig) at 107 degrees C (225 degrees F). The end connection shall be male threaded. The lining shall be inert and noncorrosive propylene. Bio-based materials shall be utilized when possible.

2.4 CLEANOUTS

A. Cleanouts shall be the same size as the pipe, up to 100 mm (4 inches); not less than 100 mm (4 inches) for larger pipe. Cleanouts shall be easily accessible and shall be gastight and watertight. A minimum clearance of 600 mm (24 inches) shall be provided for clearing a clogged storm sewer line.

B. Floor cleanouts shall be gray iron housing with clamping device and round, secured, scoriated, gray iron cover conforming to ASME A112.36.2M. A gray iron ferrule with hubless, socket, inside caulk or spigot connection and counter sunk, taper-thread, brass or bronze closure plug shall be included. The frame and cover material and finish shall be nickel-bronze copper alloy with a square shape. The cleanout shall be vertically adjustable for a minimum of 50 mm (2 inches). When a waterproof membrane is used in the floor system, clamping collars shall be provided on the cleanouts. Cleanouts shall consist of wye fittings and eighth bends with brass or bronze screw plugs. Cleanouts in the resilient tile floors, quarry tile and ceramic tile floors shall be provided with square top covers recessed for tile insertion. In the carpeted areas, carpet cleanout markers shall be provided. Two way cleanouts shall be provided where indicated on the drawings and at each building exit. The loading classification for cleanouts in sidewalk areas or subject to vehicular traffic shall be heavy duty.

C. Cleanouts shall be provided at or near the base of the vertical stacks with the cleanout plug located approximately 600 mm (24 inches) above the floor. The cleanouts shall be extended to the wall access cover. Cleanout shall consist of sanitary tees. Nickel bronze square frame and stainless steel cover with minimum opening of 150 mm by 150 mm (6 inch by 6 inch) shall be provided at each wall cleanout.

D. In horizontal runs above grade, cleanouts shall consist of cast brass tapered screw plug in fitting or caulked/no hub cast iron ferrule. Plain end (no-hub) piping in interstitial space or above ceiling may use plain end (no-hub) blind plug and clamp.

2.5 ROOF DRAINS AND CONNECTIONS

A. Roof Drains: Roof Drains (RD) shall be cast iron with clamping device for making watertight connection and shall conform with ASME A112.6.4. Free openings through strainer shall be twice area of drain outlet. For roof drains not installed in connection with a waterproof

membrane, a soft copper membrane shall be provided 300 mm (12 inches) in diameter greater than outside diameter of drain collar. An integral gravel stop shall be provided for drains installed on roofs having built up roofing covered with gravel or slag. Integral no-hub, soil pipe gasket or threaded outlet connection shall be provided.

1. Flat Roofs: The roof drain shall have a beehive or dome shaped strainer with integral flange not less than 300 mm (12 inches) in diameter. For an insulated roof, a roof drain with an adjustable drainage collar shall be provided, which can be raised or lowered to meet required insulation heights, sump receiver and deck clamp. The bottom section shall serve as roof drain during construction before insulation is installed.
2. Canopy Roofs: The roof drain shall have a beehive or dome shaped strainer with the integral flange no greater than 200 mm (8 inches) in diameter. For an insulated roof, the roof drain shall be provided with an adjustable drainage collar, which can be raised or lowered to meet the required insulation heights, sump receiver and deck clamp. Bottom section shall serve as roof drain during construction before insulation is installed.
3. Promenade Decks: the roof drain shall be the same as for canopy roofs, except decks shall have flat, round, loose, non-slip, bronze grate set in square, non-slip, bronze frame.
4. Portico Roofs and Gutters: Roof drains shall be horizontal angle type drain with flat bottom and horizontal outlet at the same elevation as the pipe to which it is connected. Strainer shall be removable angle grate type.
5. Protective Roof Membrane Insulation Assembly: The roof drain shall have a perforated stainless steel extension filter, non-puncturing clamp ring, large sump with extra wide roof flange and deck clamp.
   a. Non pedestrian Roofs: The roof drain shall have large polypropylene or aluminum locking dome.
   b. Pedestrian Roof: The roof drain shall have a bronze promenade top 356 mm (14 inches) square, set in square secured frame support collar.
6. Roof Drains, Overflow or Secondary (Emergency): Roof Drains identified as overflow or secondary (emergency) drains shall have a 50 mm (2 inch) water dam integral to the drain body.
7. Roof drains in areas subject to freezing shall have heat tape and shall be insulated.

B. Expansion Joints: Expansions joints shall be heavy cast iron with cast brass or PVC expansion sleeve having smooth bearing surface working freely against a packing ring held in place and under pressure of a bolted gland ring, forming a water and air tight flexible joint. Asbestos packing is prohibited.

C. Interior Downspouts: An expansion joint shall be provided, specified above, at top of run on straight, vertical runs of downspout piping 12 m (40 feet) long or greater.

D. Downspout Nozzle: The downspout nozzle fitting shall be of brass, unfinished, with internal pipe thread for connection to downspout.

2.6 WATERPROOFING

A. A sleeve flashing device shall be provided at points where pipes pass through membrane waterproofed floors or walls. The sleeve flashing device shall be manufactured, cast iron fitting with clamping device that forms a sleeve for the pipe floor penetration of the floor membrane. A galvanized steel pipe extension shall be included in the top of the fitting that will extend 50 mm (2 inches) above finished floor and galvanized steel pipe extension in the bottom of the fitting that will extend through the floor slab. A waterproofed caulked joint shall be provided at the top hub.

PART 3 - EXECUTION

3.1 PIPE INSTALLATION

A. The pipe installation shall comply with the requirements of the IPC and these specifications.

B. Branch piping shall be installed from the piping system and connect to all drains and outlets.

C. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe, except for glass, shall be reamed to remove burrs and a clean smooth finish restored to full pipe inside diameter.

D. All pipe runs shall be laid out to avoid interference with other work/trades.

E. The piping shall be installed above accessible ceilings to allow for ceiling panel removal.

F. Unless otherwise stated on the documents, minimum horizontal slope shall be one inch for every 2.44 m (8 feet) (1 percent slope) of pipe length.

G. The piping shall be installed free of sags and bends.

H. Seismic restraint shall be installed where required by code.

I. Changes in direction for storm drainage piping shall be made using appropriate branches, bends and long sweep bends. Sanitary tees and short sweep ¼ bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Long turn double wye branch and 1/8 bend fittings shall be used if two drains are installed back to back or side by side with common drain pipe. Do not change direction of flow more than 90 degrees. Proper size of standard increaser and reducers shall be used if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

J. Buried storm drainage piping shall be laid beginning at the low point of each system. Piping shall be installed true to grades and alignment indicated with unbroken continuity of invert. Hub ends shall be placed upstream. Required gaskets shall be installed according to manufacturer's written instruction for use of lubricants, cements, and other installation requirements. Bio-based materials shall be utilized when possible.

K. Cast iron piping shall be installed according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings"

L. Aboveground copper tubing shall be installed according to CDA A4015.

M. Aboveground PVC piping shall be installed according to ASTM D2665. Underground PVC piping shall be installed according to ASTM D2321.

3.2 JOINT CONSTRUCTION

A. Hub and spigot, cast iron piping with gasket joints shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Hub and spigot, cast iron piping with calked joints shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.

C. Hubless, cast iron piping shall be joined in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless piping coupling joints.

D. For threaded joints, thread pipe with tapered pipe threads according to ASME B1.20.1. The threads shall be cut full and clean using sharp disc cutters. Threaded pipe ends shall be reamed to remove burrs and restored to full pipe inside diameter. Pipe fittings and valves shall be joined as follows:
   1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is required by the pipe service
   2. Pipe sections with damaged threads shall be replaced with new undamaged sections of pipe at no additional time or cost to Government.

E. Copper tube and fittings with soldered joints shall be joined according to ASTM B828. A water flushable, lead free flux conforming to ASTM B813 and a lead free alloy solder conforming to ASTM B32 shall be used.

F. For PVC piping, solvent cement joints shall be used for joints. All surfaces shall be cleaned and dry prior to applying the primer and solvent cement. Installation practices shall comply with ASTM F402. The joint shall conform to ASTM D2855 and ASTM D2665 appendices.

3.3 SPECIALTY PIPE FITTINGS

A. Transition coupling shall be installed at pipe joints with small differences in pipe outside diameters.

B. Dielectric fittings shall be installed at connections of dissimilar metal piping and tubing.

3.4 PIPE HANGERS, SUPPORTS AND ACCESSORIES

A. All piping shall be supported according to the IPC, Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, and these specifications.

B. Hangers, supports, rods, inserts and accessories used for Pipe supports shall be shop coated with zinc Chromate primer paint. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.

C. Horizontal piping and tubing shall be supported within 300 mm (12 inches) of each fitting or coupling.

D. Horizontal cast iron piping shall be supported with the following maximum horizontal spacing and minimum hanger rod diameters:
   1. NPS 1-1/2 to NPS 2 (DN 40 to DN 50): 1500 mm (60 inches) with 10 mm (3/8 inch) rod.
   2. NPS 3 (DN 80): 1500 mm (60 inches) with 15 mm (1/2 inch) rod.
   3. NPS 4 to NPS 5 (DN 100 to DN 125): 1500 mm (60 inches) with 18 mm (5/8 inch) rod.
   4. NPS 6 to NPS 8 (DN 150 to DN 200): 1500 mm (60 inches) with 20 mm (3/4 inch) rod.
   5. NPS 10 to NPS 12 (DN 250 to DN 300): 1500 mm (60 inches) with 23 mm (7/8 inch) rod.

E. The maximum support spacing for horizontal plastic shall be 1.22 m (4 feet).

F. Vertical piping and tubing shall be supported at the base, at each floor, and at intervals no greater than 4.6 m (15 feet).

G. In addition to the requirements in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, floor, wall and ceiling plates shall have the following characteristics:
   1. Solid or split unplated cast iron.
   2. All plates shall be provided with set screws.
   3. Height adjustable clevis type pipe hangers.
   4. Adjustable Floor Rests and Base Flanges shall be steel.
   5. Hanger Rods shall be low carbon steel, fully threaded or threaded at each end with two removable nuts at each end for positioning rod and hanger and locking each in place.
   6. Riser Clamps shall be malleable iron or steel.
   7. Roller shall be cast iron.
   8. Hangers and supports utilized with insulated pipe and tubing shall have 180 degree (minimum) metal protection shield centered on and welded to the hanger and support. The shield shall be 100 mm (4 inches) in length and be 1.6 mm (16 gage) steel. The shield shall be sized for the insulation.

H. Miscellaneous materials shall be provided as specified, required, directed or as noted on the drawings for proper installation of hangers, supports and accessories. If the vertical distance exceeds 6.1 m (20 feet) for cast iron pipe additional support shall be provided in the center of that span. All necessary auxiliary steel shall be provided to provide that support.

I. Cast escutcheon with set screw shall be installed at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.

J. Penetrations:
   1. Fire Stopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, a fire stop shall be installed that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING. Clearances between raceways and openings shall be completely filled and sealed with the fire stopping materials.

2. Water proofing: At floor penetrations, Clearances around the pipe shall be completely sealed and made watertight with sealant as specified in Section 07 92 00, JOINT SEALANTS. Bio-based materials shall be utilized when possible.

3.5 INSULATION

A. Insulate horizontal sections and 600 mm (2 feet) past changes of direction to vertical sections for interior section of roof drains. Install insulation in accordance with the requirements of Section 22 07 11, PLUMBING INSULATION.

3.6 TESTS

A. Storm sewer system shall be tested either in its entirety or in sections.

B. Storm Water Drain tests shall be conducted before trenches are backfilled or fixtures are connected. A water test or air test shall be conducted, as directed.
   1. If entire system is tested with water, tightly close all openings in pipes except the highest opening, and fill system with water to point of overflow. If system is tested in sections, tightly plug each opening except highest opening of section under test, fill each section with water and test with at least a 3 m (10 foot) head of water. In testing successive sections, test at least upper 3 m (10 feet) of next preceding section so that each joint or pipe except upper most 3 m (10 feet) of system has been submitted to a test of at least a 3 m (10 foot) head of water. Water shall be kept in the system, or in portion under test, for at least 15 minutes before inspection starts. System shall then be tight at all joints.
   2. For an air test, an air pressure of 34 kPa (5 psig) gage shall be maintained for at least 15 minutes without leakage. A force pump and mercury column gage shall be used for the test.
   3. Final Tests: While either one of the following tests may be used, Contractor shall check with VA as to which test will be performed.
      a. Smoke Test: After fixtures are permanently connected and traps are filled with water, fill entire drainage and vent systems with smoke under pressure of 0.25 kPa (1 inch of water) with a smoke machine. **Chemical smoke is prohibited.**
      b. Peppermint Test: Introduce .06 liters (2 ounces) of peppermint into each line or stack.

C. COR shall witness all tests. Contractor shall coordinate schedules with the COR and CxA. Contractor shall provide a minimum of 10 working days prior to flushing, disinfection/sterilization, startup, and testing.

3.7 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

B. Components provided under this section of the specification will be tested as part of a larger system.

3.8 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer's technical representative for 16 hours for large equipment and 4 hours for smaller equipment to instruct VA Personnel in operation and maintenance of the system.

B. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

- - - E N D - - -

SECTION 22 40 00
PLUMBING FIXTURES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Plumbing fixtures, associated trim and fittings necessary to make a complete installation from wall or floor connections to rough piping, and certain accessories.

B. A complete listing of all acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

E. Section 07 92 00, JOINT SEALANTS: Sealing between fixtures and other finish surfaces.

F. Section 08 31 13, ACCESS DOORS AND FRAMES: Flush panel access doors.

G. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

H. Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS: Requirements for commissioning, systems readiness checklist, and training.

I. Section 22 13 00, FACILITY SANITARY AND VENT PIPING.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. The American Society of Mechanical Engineers (ASME):
A112.6.1M-1997 (R2012).....Supports for Off-the-Floor Plumbing Fixtures for Public Use
A112.19.1-2013.....Enameled Cast Iron and Enameled Steel Plumbing Fixtures
A112.19.2-2013.....Ceramic Plumbing Fixtures
A112.19.3-2008.....Stainless Steel Plumbing Fixtures

C. American Society for Testing and Materials (ASTM):
A276-2013a.....Standard Specification for Stainless Steel Bars and Shapes
B584-2008.....Standard Specification for Copper Alloy Sand Castings for General Applications

D. CSA Group:
B45.4-2008 (R2013).....Stainless Steel Plumbing Fixtures

E. National Association of Architectural Metal Manufacturers (NAAMM):
AMP 500-2006 .....Metal Finishes Manual

F. American Society of Sanitary Engineering (ASSE):
1016-2011 .....Automatic Compensating Valves for Individual Showers and Tub/Shower Combinations

G. NSF International (NSF):

14-2013 .....Plastics Piping System Components and Related Materials

61-2013 .....Drinking Water System Components – Health Effects

372-2011 .....Drinking Water System Components – Lead Content

H. American with Disabilities Act (A.D.A)

I. International Code Council (ICC):
IPC-2015 .....International Plumbing Code

1.4 SUBMITTALS

A. Submittals, including number of required copies, will be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section will be marked “SUBMITTED UNDER SECTION 22 40 00, PLUMBING FIXTURES”, with applicable paragraph identification.

C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, connections, and capacity.

D. Operating Instructions: Comply with requirements in Section 01 00 00, GENERAL REQUIREMENTS.

E. Completed System Readiness Checklist provided by the CxA and completed by the Contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

F. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

1.5 QUALITY ASSURANCE

A. Bio-Based Materials: For products designated by the USDA’s Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

1.6 AS-BUILT DOCUMENTATION

A. Submit manufacturer’s literature and data updated to include submittal review comments and any equipment substitutions.

B. Submit operation and maintenance data updated to include submittal review comments, substitutions and construction revisions will be in electronic version on compact disc or DVD and inserted into a three-ring binder. All aspects of system operation and maintenance procedures, including piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation will be included in the operation and maintenance manual. The operations and maintenance manual will include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices such as damper and door closure interlocks will be included. A List of recommended spare parts (manufacturer, model number, and quantity) will be furnished. Information explaining any special knowledge or tools the owner will be required to employ will be inserted into the As-Built documentation.

C. The installing contractor will maintain as-built drawings of each completed phase for verification; and will provide the complete set at the time of final systems certification testing. As-built drawings are to be provided, and a copy of them in AutoCAD version 2020 provided on compact disk or DVD. Should the installing contractor engage the testing company to provide as-built or any portion thereof, it will not be deemed a conflict of interest or breach of the ‘third party testing company’ requirement.

D. Certification documentation will be provided to COR 10 working days prior to submitting the request for final inspection. The documentation will include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and certification that all results of tests were within limits specified.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Material or equipment containing a weighted average of greater than 0.25 percent lead is prohibited in any potable water system intended for human consumption and will be certified in accordance with NSF 61 or NSF 372. Endpoint devices used to dispense water for drinking will meet the requirements of NSF 61.

B. Plastic pipe, fittings, and solvent cement will meet NSF 14 and will be NSF listed for the service intended.

2.2 STAINLESS STEEL

A. Corrosion-resistant Steel (CRS):
   1. Plate, Sheet and Strip: CRS flat products will conform to chemical composition requirements of any 300 series steel specified in ASTM A276.
   2. Finish: Exposed surfaces will have standard polish (ground and polished) equal to NAAMM finish Number 4.

B. Die-cast zinc alloy products are prohibited.

2.3 STOPS

A. Provide lock-shield loose key or screw driver pattern angle stops, straight stops or stops integral with faucet, with each compression type faucet whether specifically called for or not, including sinks in solid-surface, wood and metal casework, laboratory furniture and pharmacy furniture. Locate stops centrally above or below fixture in accessible location.

B. Furnish keys for lock shield stops to the COR.

C. Supply from stops not integral with faucet will be chrome plated copper flexible tubing or flexible stainless steel with inner core of non-toxic polymer.

D. Supply pipe from wall to valve stop will be rigid threaded IPS copper alloy pipe, i.e. red brass pipe nipple, chrome plated where exposed.

E. Mental Health Area: Provide stainless steel drain guard for all lavatories not installed in casework.

2.4 ESCUTCHEONS

A. Heavy type, chrome plated, with set screws. Provide for piping serving plumbing fixtures and at each wall, ceiling and floor penetrations in exposed finished locations and within cabinets and millwork.

2.5 LAMINAR FLOW CONTROL DEVICE

A. Smooth, bright stainless steel or satin finish, chrome plated metal laminar flow device will provide non-aeration, clear, coherent laminar flow that will not splash in basin. Device will also have a flow control restrictor and have vandal resistant housing. **Aerators are prohibited.**

B. Flow Control Restrictor:
   1. Capable of restricting flow from 32 ml/s (0.35) for public lavatories; 1.5 gpm for private lavatories; 2.0 gpm to 2.2 gpm for sinks P-505 through P-520, P-524 and P-528; and 2.75 gpm to 3.0 gpm for dietary food preparation and rinse sinks or as specified.
   2. Compensates for pressure fluctuation maintaining flow rate specified above within 10 percent between 25 psig and 80 psig.

3. Operates by expansion and contraction, eliminates mineral/sediment build-up with self-cleaning action, and is capable of easy manual cleaning.

2.6 CARRIERS

A. ASME A112.6.1M, with adjustable gasket faceplate chair carriers for wall hung closets with auxiliary anchor foot assembly, hanger rod support feet, and rear anchor tie down.

B. ASME A112.6.1M, lavatory, concealed arm support. All lavatory chair carriers will be capable of supporting the lavatory with a 250-pound vertical load applied at the front of the fixture. Carriers for bariatric lavatories shall be rated for bariatric use and support up to 1000 pounds.

C. Where water closets, lavatories or sinks are installed back-to-back and carriers are specified, provide one carrier to serve both fixtures in lieu of individual carriers. The drainage fitting of the back-to-back carrier will be so constructed that it prevents the discharge from one fixture from flowing into the opposite fixture.

2.7 WATER CLOSETS

A. (P-111) Water Closet (Wall Hung, ASME A112.19.2) elongated bowl, siphon jet, wall outlet, top inlet spud, 1.28 gallons per flush with maximum 10 percent variance. Top of seat will be 18 inches above finished floor.
   1. Seat: Institutional/Industrial, solid plastic, extra heavy duty, chemical resistant, posture contoured body open front design less cover for elongated bowls, integrally molded bumpers, concealed check hinge with stainless steel post. Color will be white.
   2. Fittings and Accessories: Gaskets-neoprene; bolts with chrome plated cap nuts and washers and carrier.
   3. Flush valve: Large chloramines resistant diaphragm, semi-red brass body, dual flush non-hold open ADA approved side oscillating handle 25 mm (1 inch) IPS wheel handle back check angle stop valve, adjustable tailpiece, high pressure vacuum breaker, elbow flush connection, spud coupling for 40 mm (1-1/2 inches) top spud, and cast set screw wall and spud flanges
   4. (P-114)

B. (P-114) Bariatric Floor Mounted Water Closet ASME A112.19.2, Fully enclosed floor mounted with integral seat , siphon jet, white-powder-coated, 14 gage type 304 stainless steel construction with white powder coating and hinged seat with cover, flush valve operated, top of seat 450 mm (18 inches) above floor. Bio-based materials will be utilized when possible. Rated for bariatric use – 1000-pound minimum capacity.
   1. Fittings and Accessories: Gaskets-neoprene, bolts with chromium plated cap nuts and washers, and extra heavy-duty carrier.
   2. Flush Valve: exposed chrome plated diaphragm type with low force ADA compliant 6 L (1.6 gallon) push button operated minimum 40 mm (1-1/2 inches) diameter button,and escutcheon. Provide 300 mm by 300 mm (12 inches by 12 inches) stainless steel access door with key operated cylinder lock specified in Section 08 31 13, ACCESS DOORS AND FRAMES.
   3.

2.8 LAVATORIES

A. Dimensions for lavatories are specified, Length by width (distance from wall) and depth.

B. Brass components in contact with water will contain no more than 0.25 percent lead content by dry weight. Faucet flow rates will be 3.9 L/m (1.5 gpm) for private lavatories and 1.9 L/m (0.5 gpm) per cycle for public lavatories.

C. (P-401) Lavatory (Single Lever Handle Control ASME A112.19.2) straight back, approximately 508 mm by 457 mm (20 inches by 18 inches) and a 102 mm (4 inches) maximum apron, first quality vitreous china. Punching for faucet on 102 mm (4 inches) centers. Set with rim 864 mm (34 inches) above finished floor.

1. Faucet: Solid cast brass construction, vandal resistant, heavy-duty single lever handle, center set. Control will be washerless ceramic disc cartridge type. Provide laminar flow control device, adjustable hot water limit stop, and vandal proof screws. Flow will be limited to 5.7 L/m (1.5 gpm).
2. Drain: Cast or wrought brass with flat grid strainer offset tailpiece, chrome plated. Provide cover per A.D.A 4-19.4.
3. Stops: Angle type, see paragraph “Stops”. Provide cover per A.D.A 4-19.4.
4. Trap: Cast copper alloy, 38 mm by 32 mm (1 1/2 inches by 1 1/4 inches) P-trap. Adjustable with connected elbow and 1.4 mm thick (17 gauge) tubing extensions to wall. Exposed metal trap surface and connection hardware will be chrome plated with a smooth bright finish. Set trap parallel to wall. Provide cover per A.D.A 4-19.4.
5. Provide with ASSE-1070 Thermostatic Anti-Scald Mixing Valve rated for thermal eradication with override button. Basis of Design: Chicago Faucet 131-FMAB.

D. (P-408) Lavatory (ASME A112.19.2) straight back, approximately 20 inches by 18 inches and a 102 mm (4 inches) maximum apron, first quality vitreous china. Punching for faucet on 102 mm (4 inches) centers. Support lavatory to wall with steel wall plate. Set with rim 864 mm (34 inches) above finished floor:
1. Faucet: Solid cast brass construction with washerless ceramic disc mixing cartridge type and centrally exposed rigid gooseneck spout with outlet 127-152 mm (5-6 inches) above rim. Provide laminar flow control device. One hundred two millimeters (4-inch) wrist blade type handles on faucets will be cast, formed or drop forged copper alloy. Faucet, wall and floor escutcheons will be either copper alloy or CRS. Exposed metal parts, including exposed part under valve handle when in open position, will be chrome plated with a smooth bright finish.
2. Drain: Cast or wrought brass with flat grid strainer and offset tailpiece, chrome plated finish.
3. Stops: Angle type. See paragraph “Stops”.
4. Trap: Cast copper alloy, 38 mm by 32 mm (1 1/2 inches by 1 1/4 inches) P-trap. Adjustable with connected elbow and 1.4 mm thick (17 gauge) tubing extension to wall. Exposed metal trap surface, and connection hardware will be chrome plated with a smooth bright finish. Set trap parallel to wall.
5. Provide cover for exposed piping, drain, stops and trap per A.D.A.
6. Provide with ASSE-1070 Thermostatic Anti-Scald Mixing Valve rated for thermal eradication with override button. Basis of Design: Chicago Faucet 131-FMAB.

E. (P-421) Bariatric Floor Mounted Pedestal Lavatory (Sensor controlled ASME A112.19.2), 14 gage type 304 stainless steel construction with white powder coating of lavatory deck. Bio-based materials will be utilized when possible. Rated for bariatric use – 1000-pound minimum capacity.
1. Faucet: Brass, chrome plated, gooseneck spout with outlet 102 mm to 127 mm (4 inches to 5 inches) above rim. Electronic sensor operated, 102 mm (4 inches) center set mounting, 120/24-volt solenoid and inline filter. Provide laminar flow control device. Breaking the light beam will activate the water flow. Flow will stop when user moves away from light beam. All connecting wiring between transformer, solenoid valve and sensor will be cut to length with no excess hanging or wrapped up wiring allowed.
2. Provide with ASSE-1070 Thermostatic Anti-Scald Mixing Valve rated for thermal eradication with override button. Basis of Design: Chicago Faucet 131-FMAB.

2.9 SINKS AND LAUNDRY TUBS

A. Dimensions for sinks and laundry tubs are specified, length by width (distance from wall) and depth.

B. (P-501) Service Sink (Regular, ASME A112.19.1) service sink, class 1, single bowl, acid resistant enameled cast iron, approximately 610 mm by 508 mm (24 inches by 20 inches) with a 229 to 305 mm (9 to 12 inches) raised back without faucet holes. Equip sink with CRS rim guard and mounted on trap standard. Set sinks rim 711 mm (28 inches) above finished floor.

1. Faucet: Part B, Type II, solid brass construction, 9.5 L/m (2.5 gpm) combination faucet with replaceable Monel seat, removable replacement unit containing all parts subject to wear, integral check/stops, mounted on wall above sink. Spout will have a pail hook, 19 mm (3/4 inch) hose coupling threads, vacuum breaker, and top or bottom brace to wall. Four-arm handles on faucets will be cast, formed, or drop forged copper alloy. Escutcheons will be either forged copper alloy or CRS. Exposed metal parts, including exposed part under valve handle when in open position, will have a smooth bright finish.
2. Drain: Grid.
3. Trap: Trap standard, painted outside and enameled inside with acid-resistant enamel, drain through adjoining wall.
4. Provide with ASSE-1070 Thermostatic Anti-Scald Mixing Valve rated for thermal eradication with override button.

C. (P-505) Clinic Service Sink (Flushing Rim, Wall Hung) approximately 508 mm by 635 mm (20 inches by 25 inches) by 203 mm (8 inches) deep. Support with ASME A112.6.1M chair carrier and secure with 10 mm (3/8 inch) bracket studs and nuts. Set sink with rim 762 mm (30 inches) above finished floor. Provide 762 mm (30 inches) CRS drainboard where required, without corrugations and with heavy duty CRS brackets.
1. Faucet: Elbow control, wall hung, integral check/stops, single spout with 19 mm (3/4 inch) hose threaded outlet and pail hook, vacuum breaker and brace to wall. Outlet 356 mm to 381 mm (14 inches to 15 inches) from wall. Exposed metal parts will be chromium plated with a smooth bright finish. Provide 9.5 L/m (2.5 gpm) laminar flow control device.
2. Flush valve: Large diaphragm, semi-red brass body, Foot pedal operated, exposed chromium plated flush valve with screwdriver back check straight stop with cap, union outlet, street ells, elevated high pressure vacuum breaker, casing cover, 32 mm (1 1/4 inches) elbow flush connection from finished wall to 38 mm (1 1/2 inches) top spud. Spud coupling, wall and spud flanges.
3. Bed Pan Washer: Mechanical pedal mixing valve, wall hung, with double self-closing pedal valve with loose key stops, renewable seats and supply from valve to nozzle with wall hook hose connection; 1219 mm (48 inches) of heavy duty rubber hose, with extended spray outlet elevated vacuum breaker, indexed lift up pedals having clearance of not more than 13 mm (1/2 inch) above the floor and not less than 356 mm (14 inches) from wall when in operation. Supply pipe from wall to valve stop will be rigid, threaded, IPS copper alloy pipe. Exposed metal parts will be chromium plated with a smooth bright finish. Provide valve plate for foot control. Provide inline laminar flow control device.
4. Provide with ASSE-1070 Thermostatic Anti-Scald Mixing Valve rated for thermal eradication with override button.

D. (P-524) Sink, (CRS, Double Compartment, Counter Top, ASME A112.19.3, Kitchen Sinks) self-rimming, approximately 838 mm by 559 mm (33 inches by 22 inches) with two compartments inside dimensions approximately 343 mm by 406 mm by 191 mm (13 1/2 inches by 16 inches by 7 1/2 inches), minimum 20 gage CRS. Corners and edges will be well rounded.
1. Faucet: Kitchen sink, solid brass construction, 8.3 L/m (2.2 gpm) swing spout, chrome plated copper alloy with spray and hose.
2. Drain: Drain plug with cup strainer, stainless steel.
3. Trap: Cast copper alloy, 38 mm (1 1/2 inches) P-trap with cleanout plug, continuous drain with wall connection and escutcheon.
4. Provide cover for exposed piping, drain, stops and trap per A.D.A.
5. Provide with ASSE-1070 Thermostatic Anti-Scald Mixing Valve rated for thermal eradication with override button. Basis of Design: Chicago Faucet 131-FMAB.

E. (P-529) Sink (CRS, Single Compartment, Countertop ASME A112.19.2, Kitchen Sinks) self-rimming, back faucet ledge, approximately 22 inches by 19 inches by 6 ½" deep with single compartment. Will be minimum of 18 gauge CRS. Corners and edges will be well rounded:
1. Faucet: Solid brass construction, 1.5 gpm deck mounted combination faucet with Monel or ceramic seats, removable replacement unit containing all parts subject to ware, swivel gooseneck spout with approximately 203 mm (8 inches) reach with spout outlet 152 mm

(6 inches above deck and 102 mm (4 inches) wrist blades. Faucet will be polished chrome plated.
2. Drain: Drain plug with cup strainer, stainless steel.
3. Trap: Cast copper alloy 38 mm (1 1/2 inches) P-trap with cleanout plug. Provide wall connection and escutcheon.
4. Provide cover for exposed piping, drain, stops and trap per A.D.A.
5. Provide with ASSE-1070 Thermostatic Anti-Scald Mixing Valve rated for thermal eradication with override button. Basis of Design: Chicago Faucet 131-FMAB.

2.10 SHOWER BATH FIXTURE

A. (P-701) Shower Bath Fixture (Detachable, Wall Mounted, Concealed Supplies, Type T/P Combination Valve):
1. Shower Installation: Wall mounted detachable spray assembly, 600 mm (24 inch) wall bar, elevated vacuum breaker, supply elbow and flange and valve. All external trim, chrome plated metal.
2. Shower Head Assembly: Metallic shower head with flow control to limit discharge to 1.5 gpm, 1524 mm (60 inches) length of rubber lined CRS, chrome plated metal flexible, or white vinyl reinforced hose and supply wall elbow. Design showerhead to fit in palm of hand. Provide CRS or chrome plated metal wall bar with an adjustable swivel hanger for showerhead. Fasten wall bar securely to wall for hand support.
3. Valves: Type T/P combination thermostatic and pressure balancing, with chrome plated metal lever type operating handle adjustable for rough-in variations and chrome plated metal or CRS face plate. Valve body will be any suitable copper alloy. Internal parts will be copper, nickel alloy, CRS or thermoplastic material. Valve inlet and outlet will be 13 mm (1/2 inch) IPS. Provide external screwdriver check stops, vacuum breaker and temperature limit stops. Set stops for a maximum temperature of 50 degrees C (122 degrees F). All exposed fasteners will be vandal resistant. Valve will provide a minimum of 1.5 gpm at 310 kPa (45 psig) pressure drop. Provide with drain back functionality.
4. Basis of Design: Chicago Faucet 1921-VOCCP

2.11 EMERGENCY FIXTURES

A. (P-708) Emergency Eye and Face Wash (Wall Mounted): CRS, wall mounted, foot pedal control. Mount eye and face wash spray heads 1067 mm (42 inches) above finished floor. Pedal will be wall mounted, entirely clear of floor, and be hinged to permit turning up. Receptor will be complete with drain plug with perforated strainer, P-trap and waste connection to wall with escutcheon. Provide with thermostatic mixing valve to provide tepid water from 30 to 35 degrees C (85 to 95 degrees F). Flow rate will be 11.4 L/m (3 gpm).

2.12 HYDRANT, HOSE BIBB AND MISCELLANEOUS DEVICES

A. (P-801) Wall Hydrant: Cast bronze non-freeze hydrant with detachable T-handle. Brass operating rod within casing of bronze pipe of sufficient length to extend through wall and place valve inside building. Brass valve with coupling and union elbow having metal-to-metal seat. Valve rod and seat washer removable through face of hydrant; 19 mm (3/4 inch) hose thread on spout; 19 mm (3/4 inch) pipe thread on inlet. Finish may be rough; exposed surfaces will be chrome plated. Set not less than 457 mm (18 inches) nor more than 914 mm (36 inches) above grade. On porches and platforms, set approximately 762 mm (30 inches) above finished floor. Provide integral vacuum breaker which automatically drains when shut off.

B. (P-808) Washing Machine Supply and Drain Units: Fabricate of 16-gage steel with highly corrosion resistant epoxy finish. Unit to have 51 mm (2 inches) drain connection, 13 mm (1/2 inch) combination MPT brass sweat connection, ball type shut-off valve, 51 mm (2 inches) cast brass P-trap. Size 229 mm by 375 mm (9 inches by 14 3/4 inches) rough wall opening 203 mm by 330 mm by 92 mm (8 inches by 13 inches by 3 5/8 inches). Centerline of box will be 1118 mm (44 inches) above finished floor.

C. (P-812) Water Supply Box Units: Fabricate of 16-gage steel with highly corrosion resistant epoxy finish. Unit to have 13 mm (1/2 inch) combination MPT brass sweat connection, ball type

shut-off valve. Size 229 mm by 298 mm (9 inches by 11 3/4 inches) rough wall opening 203 mm by 254 mm by 92 mm (8 inches by 10 inches by 3 5/8 inches). Bottom of box will be 457 mm (18 inches) above finished floor.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fixture Setting: Opening between fixture and floor and wall finish will be sealed as specified under Section 07 92 00, JOINT SEALANTS. Bio-based materials will be utilized when possible.

B. Supports and Fastening: Secure all fixtures, equipment and trimmings to partitions, walls and related finish surfaces. Exposed heads of bolts and nuts in finished rooms will be hexagonal, polished chrome plated brass with rounded tops.

C. Toggle Bolts: For hollow masonry units, finished or unfinished.

D. Expansion Bolts: For brick or concrete or other solid masonry. Will be 6 mm (1/4 inch) diameter bolts, and to extend at least 76 mm (3 inches) into masonry and be fitted with loose tubing or sleeves extending into masonry. Wood plugs, fiber plugs, lead or other soft metal shields are prohibited.

E. Power Set Fasteners: May be used for concrete walls, will be 6 mm (1/4 inch) threaded studs, and will extend at least 32 mm (1 1/4 inches) into wall.

F. Tightly cover and protect fixtures and equipment against dirt, water and chemical or mechanical injury.

G. Where water closet waste pipe has to be offset due to beam interference, provide correct and additional piping necessary to eliminate relocation of water closet.

H. Aerators are prohibited on lavatories and sinks.

I. If an installation is unsatisfactory to the COR, the Contractor will correct the installation at no cost or additional time to the Government.

3.2 CLEANING

A. At completion of all work, fixtures, exposed materials and equipment will be thoroughly cleaned.

3.3 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

B. Components provided under this section of the specification will be tested as part of a larger system.

3.4 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative for 4 hours for smaller equipment and 16 hours for larger equipment to instruct VA Personnel in operation and maintenance of the system.

B. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

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SECTION 23 05 11
COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION

A. The requirements of this Section apply to all sections of Division 23, HEATING, VENTILATING, AND AIR CONDITIONING (HVAC).

B. Definitions:
1. Exposed: Piping, ductwork, and equipment exposed to view in finished rooms.
2. Exterior: Piping, ductwork, and equipment exposed to weather be it temperature, humidity, precipitation, wind, or solar radiation.

C. Abbreviations/Acronyms:
1. ac: Alternating Current
2. AC: Air Conditioning
3. ACU: Air Conditioning Unit
4. ACR: Air Conditioning and Refrigeration
5. AI: Analog Input
6. AISI: American Iron and Steel Institute
7. AO: Analog Output
8. ASJ: All Service Jacket
9. AWG: American Wire Gauge
10. BACnet: Building Automation and Control Networking Protocol
11. BAg: Silver-Copper-Zinc Brazing Alloy
12. BAS: Building Automation System
13. BCuP: Silver-Copper-Phosphorus Brazing Alloy
14. bhp: Brake Horsepower
15. Btu: British Thermal Unit
16. Btu/h: British Thermal Unit Per Hour
17. CDA: Copper Development Association
18. C: Celsius
19. CD: Compact Disk
20. CFM: Cubic Foot Per Minute
21. CH: Chilled Water Supply
22. CHR: Chilled Water Return
23. CLR: Color
24. CO: Carbon Monoxide
25. COR: Contracting Officer’s Representative
26. CPD: Condensate Pump Discharge
27. CPM: Cycles Per Minute
28. CPVC: Chlorinated Polyvinyl Chloride
29. CRS: Corrosion Resistant Steel
30. CTPD: Condensate Transfer Pump Discharge
31. CTPS: Condensate Transfer Pump Suction
32. CW: Cold Water
33. CWP: Cold Working Pressure
34. CxA: Commissioning Agent
35. dB: Decibels
36. dB(A): Decibels (A weighted)
37. DDC: Direct Digital Control
38. DI: Digital Input
39. DO: Digital Output

40. DVD: Digital Video Disc
41. DN: Diameter Nominal
42. DWV: Drainage, Waste and Vent
43. EPDM: Ethylene Propylene Diene Monomer
44. EPT: Ethylene Propylene Terpolymer
45. ETO: Ethylene Oxide
46. F: Fahrenheit
47. FAR: Federal Acquisition Regulations
48. FD: Floor Drain
49. FED: Federal
50. FG: Fiberglass
51. FGR: Flue Gas Recirculation
52. FOS: Fuel Oil Supply
53. FOR: Fuel Oil Return
54. FSK: Foil-Scrim-Kraft facing
55. FWPD: Feedwater Pump Discharge
56. FWPS: Feedwater Pump Suction
57. GC: Chilled Glycol Water Supply
58. GCR: Chilled Glycol Water Return
59. GH: Hot Glycol Water Heating Supply
60. GHR: Hot Glycol Water Heating Return
61. gpm: Gallons Per Minute
62. HDPE: High Density Polyethylene
63. Hg: Mercury
64. HOA: Hands-Off-Automatic
65. hp: Horsepower
66. HPS: High Pressure Steam (414 kPa (60 psig) and above)
67. HPR: High Pressure Steam Condensate Return
68. HW: Hot Water
69. HWH: Hot Water Heating Supply
70. HWHR: Hot Water Heating Return
71. Hz: Hertz
72. ID: Inside Diameter
73. IPS: Iron Pipe Size
74. kg: Kilogram
75. klb: 1000 lb
76. kPa: Kilopascal
77. lb: Pound
78. lb/hr: Pounds Per Hour
79. L/s: Liters Per Second
80. L/min: Liters Per Minute
81. LPS: Low Pressure Steam (103 kPa (15 psig) and below)
82. LPR: Low Pressure Steam Condensate Gravity Return
83. MAWP: Maximum Allowable Working Pressure
84. MAX: Maximum
85. MBtu/h: 1000 Btu/h
86. MBtu: 1000 Btu
87. MED: Medical
88. m: Meter
89. MFG: Manufacturer
90. mg: Milligram
91. mg/L: Milligrams Per Liter
92. MIN: Minimum
93. MJ: Megajoules
94. ml: Milliliter
95. mm: Millimeter

96. MPS: Medium Pressure Steam (110 kPa (16 psig) through 414 kPa (60 psig))
97. MPR: Medium Pressure Steam Condensate Return
98. MW: Megawatt
99. NC: Normally Closed
100. NF: Oil Free Dry (Nitrogen)
101. Nm: Newton Meter
102. NO: Normally Open
103. NOx: Nitrous Oxide
104. NPT: National Pipe Thread
105. NPS: Nominal Pipe Size
106. OD: Outside Diameter
107. OSD: Open Sight Drain
108. OS&Y: Outside Stem and Yoke
109. PC: Pumped Condensate
110. PID: Proportional-Integral-Differential
111. PLC: Programmable Logic Controllers
112. PP: Polypropylene
113. PPE: Personal Protection Equipment
114. ppb: Parts Per Billion
115. ppm: Parts Per Million
116. PRV: Pressure Reducing Valve \
117. PSIA: Pounds Per Square Inch Absolute
118. psig: Pounds Per Square Inch Gauge
119. PTFE: Polytetrafluoroethylene
120. PVC: Polyvinyl Chloride
121. PVDC: Polyvinylidene Chloride Vapor Retarder Jacketing, White
122. PVDF: Polyvinylidene Fluoride
123. rad: Radians
124. RH: Relative Humidity
125. RO: Reverse Osmosis
126. rms: Root Mean Square
127. RPM: Revolutions Per Minute
128. RS: Refrigerant Suction
129. RTD: Resistance Temperature Detectors
130. RTRF: Reinforced Thermosetting Resin Fittings
131. RTRP: Reinforced Thermosetting Resin Pipe
132. SCFM: Standard Cubic Feet Per Minute
133. SPEC: Specification
134. SPS: Sterile Processing Services
135. STD: Standard
136. SDR: Standard Dimension Ratio
137. SUS: Saybolt Universal Second
138. SW: Soft water
139. SWP: Steam Working Pressure
140. TAB: Testing, Adjusting, and Balancing
141. TDH: Total Dynamic Head
142. TEFC: Totally Enclosed Fan-Cooled
143. TFE: Tetrafluoroethylene
144. THERM: 100,000 Btu
145. THHN: Thermoplastic High-Heat Resistant Nylon Coated Wire
146. THWN: Thermoplastic Heat & Water-Resistant Nylon Coated Wire
147. T/P: Temperature and Pressure
148. USDA: U.S. Department of Agriculture
149. V: Volt
150. VAC: Vacuum
151. VA: Veterans Administration

152. VAC: Voltage in Alternating Current
153. VA CFM: VA Construction & Facilities Management
154. VA CFM CSS: VA Construction & Facilities Management, Consulting Support Service
155. VAMC: Veterans Administration Medical Center
156. VHA OCAMES: Veterans Health Administration – Office of Capital Asset Management Engineering and Support
157. VR: Vacuum condensate return
158. WCB: Wrought Carbon Steel, Grade B
159. WG: Water Gauge or Water Column
160. WOG: Water, Oil, Gas

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.

D. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

E. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

F. Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT.

G. Section 03 30 00, CAST-IN-PLACE CONCRETE.

H. Section 05 50 00, METAL FABRICATIONS.

I. Section 07 84 00, FIRESTOPPING.

J. Section 07 92 00, JOINT SEALANTS.

K. Section 09 91 00, PAINTING.

L. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

M. Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC and STEAM GENERATION EQUIPMENT.

N. Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.

O. Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

P. Section 23 07 11, HVAC AND BOILER PLANT INSULATION.

Q. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

R. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

S. Section 23 36 00, AIR TERMINAL UNITS.

T. Section 23 82 00, CONVECTION HEATING AND COOLING UNITS.

U. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

V. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.

W. Section 26 29 11, MOTOR CONTROLLERS.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standard will govern. The latest edition as of the specification issue date shall govern,

B. Air-Conditioning, Heating, and Refrigeration Institute (AHRI):

430 ..... Performance Rating of Central Station Air-Handling Unit Supply Fans

C. Air Movement and Control Association (AMCA):
410 ..... Recommended Safety Practices for Users and Installers of Industrial and Commercial Fans

D. American Society of Mechanical Engineers (ASME):
B31.1 ..... Power Piping

B31.9 ..... Building Services Piping

ASME Boiler and Pressure Vessel Code:

BPVC Section IX Welding, Brazing, and Fusing Qualifications

E. American Society for Testing and Materials (ASTM):
A36/A36M..... Standard Specification for Carbon Structural Steel

A575 ..... Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades

F. Association for Rubber Products Manufacturers (ARPM):
IP-20 ..... Specifications for Drives Using Classical V-Belts and Sheaves

IP-21 ..... Specifications for Drives Using Double-V (Hexagonal) Belts

IP-24 ..... Specifications for Drives Using Synchronous Belts

IP-27 ..... Specifications for Drives Using Curvilinear Toothed Synchronous Belts

G. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.(MSS):
SP-58 ..... Pipe Hangers and Supports-Materials, Design, Manufacture, Selection, Application, and Installation

SP-127 ..... Bracing for Piping Systems: Seismic–Wind–Dynamic Design, Selection, and Application

H. Military Specifications (MIL):
MIL-P-21035B ..... Paint High Zinc Dust Content, Galvanizing Repair (Metric)

I. National Fire Protection Association (NFPA):
70 ..... National Electrical Code (NEC)

101 ..... Life Safety Code

J. Department of Veterans Affairs (VA):
PG-18-10..... Physical Security and Resiliency Design Manual

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 23 05 11, COMMON WORK RESULTS FOR HVAC”, with applicable paragraph identification.

C. If the project is phased submit complete phasing plan/schedule with manpower levels prior to commencing work. The phasing plan shall be detailed enough to provide milestones in the process that can be verified.

D. Contractor shall make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements, and all equipment that requires regular maintenance, calibration, etc are accessable from the floor or permanent work platform.

It is the Contractor's responsibility to ensure all submittals meet the VA specifications and requirements and it is assumed by the VA that all submittals do meet the VA specifications unless the Contractor has requested a variance in writing and approved by COR prior to the submittal. If at any time during the project it is found that any item does not meet the VA specifications and there was no variance approval the Contractor shall correct at no additional cost or time to the Government even if a submittal was approved.

E. If equipment is submitted which differs in arrangement from that shown, provide documentation proving equivalent performance, design standards and drawings that show the rearrangement of all associated systems. Additionally, any impacts on ancillary equipment or services such as foundations, piping, and electrical shall be the Contractor's responsibility to design, supply, and install at no additional cost or time to the Government. VA approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.

F. Prior to submitting shop drawings for approval, Contractor shall certify in writing that manufacturers of all major items of equipment have each reviewed contract documents, and have jointly coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.

G. Submittals and shop drawings for interdependent items, containing applicable descriptive information, shall be furnished together. Coordinate and properly integrate materials and equipment to provide a completely compatible and efficient installation.

H. Samples: Samples will not be required, except for insulation or where materials offered differ from specification requirements. Samples shall be accompanied by full description of characteristics different from specification. The Government, at the Government's expense, will perform evaluation and testing if necessary. The Contractor may submit samples of additional material at the Contractor's option; however, if additional samples of materials are submitted later, pursuant to Government request, adjustment in contract price and time will be made.

I. Coordination/Shop Drawings:
   1. Submit complete consolidated and coordinated shop drawings for all new systems, and for existing systems that are in the same areas.
   2. The coordination/shop drawings shall include plan views, elevations and sections of all systems and shall be on a scale of not less than 1:32 (3/8 inch equal to one foot). Clearly identify and dimension the proposed locations of the principal items of equipment. The drawings shall clearly show locations and adequate clearance for all equipment, piping, valves, control panels and other items. Show the access means for all items requiring access for operations and maintenance. Provide detailed coordination/shop drawings of all piping and duct systems. The drawings should include all lockout/tagout points for all energy/hazard sources for each piece of equipment. Coordinate lockout/tagout procedures and practices with local VA requirements.
   3. Do not install equipment foundations, equipment or piping until coordination/shop drawings have been approved.
   4. In addition, for HVAC systems, provide details of the following:
      a. Mechanical equipment rooms.
      b. Hangers, inserts, supports, and bracing.
      c. Pipe sleeves.
      d. Duct or equipment penetrations of floors, walls, ceilings, or roofs.

J. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity. Submit under the pertinent section rather than under this section.
   1. Submit belt drive with the driven equipment. Submit selection data for specific drives when requested by the COR.
   2. Submit electric motor data and variable speed drive data with the driven equipment.
   3. Equipment and materials identification.
   4. Fire-stopping materials.

5. Hangers, inserts, supports and bracing. Provide complete stress analysis for variable spring and constant support hangers.
6. Wall, floor, and ceiling plates.

K. Rigging Plan: Provide documentation of the capacity and weight of the rigging and equipment intended to be used. The plan shall include the path of travel of the load, the staging area and intended access, and qualifications of the operator and signal person.

L. HVAC Maintenance Data and Operating Instructions:
1. Maintenance and operating manuals in accordance with Section 01 00 00, GENERAL REQUIREMENTS, paragraph INSTRUCTIONS for systems and equipment.
2. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replacement parts, and troubleshooting guide:
   a. Include complete list indicating all components of the systems.
   b. Include complete diagrams of the internal wiring for each item of equipment.
   c. Diagrams shall have their terminals identified to facilitate installation, operation, and maintenance.
3. Provide a listing of recommended replacement parts for keeping in stock supply, including sources of supply for equipment. Include in the listing for belts: Belt manufacturer, model number, size and style, and distinguished whether of multiple belt sets.

M. Provide copies of approved HVAC equipment submittals to the TAB and Commissioning Subcontractor.

N. Completed System Readiness Checklist provided by the CxA and completed by the Contractor, signed by a qualified technician, and dated on the date of completion, in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

O. //Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

1.5 QUALITY ASSURANCE

A. Mechanical, electrical and associated systems shall be safe, reliable, efficient, durable, easily and safely operable and maintainable, easily and safely accessible, and in compliance with applicable codes as specified. The systems shall be comprised of high quality institutional-class and industrial-class products of manufacturers that are experienced specialists in the required product lines. All construction firms and personnel shall be experienced and qualified specialists in industrial and institutional HVAC.

B. Flow Rate Tolerance for HVAC Equipment: Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

C. Equipment Vibration Tolerance:
1. Refer to Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT. Equipment shall be factory-balanced to this tolerance and re-balanced onsite, as necessary.
2. After HVAC air balance work is completed and permanent drive sheaves are in place, perform field mechanical balancing and adjustments required to meet the specified vibration tolerance.

D. Products Criteria:
1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 3 years (or longer as specified elsewhere). The design, model and size of each item shall have been in satisfactory and efficient operation on at least three installations for approximately three years. However, digital electronics devices, software and systems such as controls, instruments, computer work station, shall be the current generation of technology and basic design that has a proven satisfactory service record of at least

three years. See other specification sections for any exceptions and/or additional requirements.

2. Refer to all other sections for quality assurance requirements for systems and equipment specified therein.
3. All items furnished shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.
4. The products and execution of work specified in Division 23 sections shall conform to the referenced codes and standards as required by the specifications. Local codes and amendments shall be enforced, along with requirements of local utility companies. The most stringent requirements of these specifications, local codes, or utility company requirements shall always apply. Any conflicts shall be brought to the attention of the COR.
5. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be of the same manufacturer and model number, or if different models are required they shall be of the same manufacturer and identical to the greatest extent possible (i.e., same model series).
6. Assembled Units: Performance and warranty of all components that make up an assembled unit shall be the responsibility of the manufacturer of the completed assembly.
7. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
8. Use of asbestos products or equipment or materials containing asbestos is prohibited.

E. HVAC Equipment Service Providers: Service providers shall be authorized and trained by the manufacturers of the equipment supplied. These providers shall be capable of responding onsite and provide acceptable service to restore equipment operations within 4 hours of receipt of notification by phone, e-mail or fax in event of an emergency, such as the shutdown of equipment; or within 24 hours in a non-emergency. Submit names, mail and e-mail addresses and phone numbers of service personnel and companies providing service under these conditions for (as applicable to the project): fans, air handling units, chillers, cooling towers, control systems, pumps, critical instrumentation, computer workstation and programming.

F. HVAC Mechanical Systems Welding: Before any welding is performed, Contractor shall submit a certificate certifying that welders comply with the following requirements:
1. HVAC mechanical systems welding shall meet ASME BPVC Section IX. Provide proof of current certification.
2. Comply with provisions of ASME B31 series "Code for Pressure Piping".
3. Certify that each welder and welding operator has passed American Welding Society (AWS) qualification tests for the welding processes involved, and that certification is current.
4. All welds shall be stamped according to the provisions of the AWS or ASME as required herein and by the associated code.

G. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the COR with submittals. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material and removal by the Contractor and no additional cost or time to the Government.

H. Execution (Installation, Construction) Quality:
1. Apply and install all items in accordance with manufacturer's written instructions. Refer conflicts between the manufacturer's instructions and the contract documents to the COR for resolution. Provide written hard copies and computer files on CD or DVD of manufacturer’s installation instructions to the COR with submittals prior to commencing installation of any item. Installation of the item will not be allowed to proceed until the

recommendations are received and approved by the VA. Failure to furnish these recommendations is a cause for rejection of the material.

2. All items that require access, such as for operating, cleaning, servicing, maintenance, and calibration, shall be easily and safely accessible by persons standing at floor level, or standing on permanent platforms, without the use of portable ladders. Examples of these items include, but are not limited to, all types of valves, filters and strainers, transmitters, control devices. Prior to commencing installation work, refer conflicts between this requirement and contract documents to the COR for resolution. Failure of the Contractor to resolve, or point out any issues will result in the Contractor correcting at no additional cost or time to the Government.
3. Complete coordination/shop drawings shall be required in accordance with paragraph SUBMITTALS. Construction work shall not start on any system until the coordination/shop drawings have been approved by VA.
4. Workmanship/craftsmanship will be of the highest quality and standards. The VA reserves the right to reject any work based on poor quality of workmanship this work shall be removed and done again at no additional cost or time to the Government.

I. Upon request by Government, provide lists of previous installations for selected items of equipment. Include contact persons who will serve as references, with current telephone numbers and e-mail addresses.

J. Guaranty: Warranty of Construction, FAR Clause 52.246-21.

K. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specification section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

L. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

1.6 DELIVERY, STORAGE AND HANDLING

A. Protection of Equipment:
1. Equipment and material placed on the job site shall remain in the custody of the Contractor until phased acceptance, whether or not the Government has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for the protection of such equipment and material against any damage or theft.
2. Large equipment such as boilers, chillers, cooling towers, fans, and air handling units if shipped on open trailer trucks shall be covered with shrink on plastics or water proof tarpaulins that provide protection from exposure to rain, road salts and other transit hazards. Protection shall be kept in place until equipment is moved into a building or installed as designed.
3. Repair damaged equipment in first class, new operating condition and appearance; or, replace same as determined and directed by the COR. Such repair or replacement shall be at no additional cost or time to the Government.
4. Protect interiors of new equipment and piping systems against entry of foreign matter. Clean both inside and outside before painting or placing equipment in operation.
5. Existing equipment and piping being worked on by the Contractor shall be under the custody and responsibility of the Contractor and shall be protected as required for new work.
6. Protect plastic piping and tanks from ultraviolet light (sunlight).

B. Cleanliness of Piping and Equipment Systems:
1. Exercise care in storage and handling of equipment and piping material to be incorporated in the work. Remove debris arising from cutting, threading and welding of piping.
2. Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.

3. Clean interior of all tanks prior to delivery for beneficial use by the Government.
4. Contractor shall be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

1.7 AS-BUILT DOCUMENTATION

A. Submit manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.

B. Submit operation and maintenance data updated to include submittal review comments, VA approved substitutions and construction revisions shall be in electronic version on CD or DVD and also inserted into a three-ring binder. All aspects of system operation and maintenance procedures, including applicable piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.

C. The installing Contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. Should the installing Contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement. Provide record drawings as follows:
   1. Red-lined, hand-marked drawings are to be provided, with one paper copy and a scanned PDF version of the hand-marked drawings provided on CD or DVD.
   2. As-built drawings are to be provided, with a copy of them on AutoCAD version 2020 provided on CD or DVD. The CAD drawings shall use multiple line layers with a separate individual layer for each system.

D. The as-built drawings shall indicate the location and type of all lockout/tagout points for all energy sources for all equipment and pumps to include breaker location and numbers, valve tag numbers, etc. Coordinate lockout/tagout procedures and practices with local VA requirements.

E. Certification documentation shall be provided to COR 21 working days prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and provide documentation/certification that all results of tests were within limits specified. Test results shall contain written sequence of test procedure with written test results annotated at each step along with the expected outcome or setpoint. The results shall include all readings, including but not limited to data on device (make, model and performance characteristics), normal pressures, switch ranges, trip points, amp readings, and calibration data to include equipment serial numbers or individual identifications, etc.

1.8 JOB CONDITIONS – WORK IN EXISTING BUILDING

A. Building Operation: Government employees will be continuously operating and managing all facilities, including temporary facilities that serve the VAMC.

B. Maintenance of Service: Schedule all work to permit continuous service as required by the VAMC.

C. Steam and Condensate Service Interruptions: Limited steam and condensate service interruptions, as required for interconnections of new and existing systems, will be permitted by the COR during periods when the demands are not critical to the operation of the VAMC. These non-critical periods are limited to between 8 pm and 5 am in the appropriate off-season (if applicable). Provide at least 10 working days advance notice to the COR. The request shall include a detailed plan on the proposed shutdown and the intended work to be done along with manpower levels. All equipment and materials shall be onsite and verified with plan 5 days prior to the shutdown or it will need to be rescheduled.

D. Phasing of Work: Comply with all requirements shown on contract documents. Contractor shall submit a complete detailed phasing plan/schedule with manpower levels prior to commencing work. The phasing plan shall be detailed enough to provide milestones in the process that can be verified.

E. Building Working Environment: Maintain the architectural and structural integrity of the building and the working environment at all times. Maintain the interior of building at 18 degrees C (65 degrees F) minimum. Limit the opening of doors, windows or other access openings to brief periods as necessary for rigging purposes. Storm water or ground water leakage is prohibited. Provide daily clean-up of construction and demolition debris on all floor surfaces and on all equipment being operated by VA. Maintain all egress routes and safety systems/devices.

F. Acceptance of Work for Government Operation: As new equipment, systems and facilities are made available for operation and these items are deemed of beneficial use to the Government, inspections will be made and tests will be performed. Based on the inspections, a list of contract deficiencies will be issued to the Contractor. After correction of deficiencies as necessary for beneficial use, the Contracting Officer will process necessary acceptance and the equipment will then be under the control and operation of Government personnel.

G. Temporary Facilities: Refer to paragraph TEMPORARY PIPING AND EQUIPMENT in this section.

PART 2 - PRODUCTS

2.1 FACTORY ASSEMBLED PRODUCTS

A. Provide maximum standardization of components to reduce spare part requirements.

B. Performance and warranty of all components that make up an assembled unit shall be the responsibility of the manufacturer of the completed assembly.
   1. All components of an assembled unit need not be products of same manufacturer.
   2. Constituent parts that are alike shall be products of a single manufacturer.
   3. Components shall be compatible with each other and with the total assembly for intended service.
   4. Contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.

C. Equipment and components of equipment shall bear manufacturer's name and trademark, model number, serial number and performance data on a nameplate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.

D. Major items of equipment, which serve the same function, shall be the same make and model. Exceptions must be approved by the VA, but may be permitted if performance requirements cannot be met.

2.2 COMPATIBILITY OF RELATED EQUIPMENT

A. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that the result will be a complete and fully operational plant that conforms to contract requirements.

2.3 V-BELT DRIVES

A. Type: ARPM standard V-belts with proper motor pulley and driven sheave. Belts shall be constructed of reinforced cord and rubber.

B. Dimensions, Rating and Selection Standards: ARPM IP-20 and ARPM IP-21.

C. Minimum Horsepower Rating: Motor horsepower plus recommended ARPM service factor (not less than 20 percent) in addition to the ARPM allowances for pitch diameter, center distance, and arc of contact.

D. Maximum Speed: 25 m/s (5000 feet per minute).

E. Adjustment Provisions: For alignment and ARPM standard allowances for installation and take-up.

F. Drives may utilize a single V-Belt (any cross section) when it is the manufacturer's standard.

G. Multiple Belts: Matched to ARPM specified limits by measurement on a belt measuring fixture. Seal matched sets together to prevent mixing or partial loss of sets. Replacement, when necessary, shall be an entire set of new matched belts.

H. Sheaves and Pulleys:
   1. Material: Pressed steel, or close-grained cast-iron.
   2. Bore: Fixed or bushing type for securing to shaft with keys.
   3. Balanced: Statically and dynamically.
   4. Groove spacing for driving and driven pulleys shall be the same.

I. Drive Types, Based on AHRI 430:
   1. Provide adjustable-pitch //or fixed-pitch// drive as follows:
      a. Fan Speeds Up To 1800 RPM: 7.5 kW (10 horsepower) and smaller.
      b. Fan Speeds Over 1800 RPM: 2.2 kW (3 horsepower) and smaller.
   2. Provide fixed-pitch drives for drives larger than those listed above.
   3. The final fan speeds required to just meet the system CFM and pressure requirements, without throttling the design air flow branch, shall be determined by adjustment of a temporary adjustable-pitch motor sheave or by fan law calculation if a fixed-pitch drive is used initially.

J. Final Drive Set: If adjustment is required beyond the capabilities of the factory drive set, the final drive set shall be provided as part of this contract at no additional cost or time to the Government.

2.4 SYNCHRONOUS BELT DRIVES

A. Type: ARPM synchronous belts with proper motor pulley and driven sheave. Belts shall be constructed of reinforced cord and rubber.

B. Dimensions, Rating and Selection Standards: ARPM IP-24 and ARPM IP-27.

C. Minimum Horsepower Rating: Motor horsepower plus recommended ARPM service factor (not less than 20 percent) in addition to the ARPM allowances for pitch diameter, center distance, and arc of contact.

D. Maximum Speed: 25 m/s (5000 feet per minute).

E. Adjustment Provisions: For alignment and ARPM standard allowances for installation and take-up.

F. Drives may utilize a single belt of manufacturer’s standard width for the application.

G. Multiple Belts: Matched to ARPM specified limits by measurement on a belt measuring fixture. Seal matched sets together to prevent mixing or partial loss of sets. Replacement, when necessary, shall be an entire set of new matched belts.

H. Sheaves and Pulleys:
   1. Material: Pressed steel, or close-grained cast-iron.
   2. Bore: Fixed or bushing type for securing to shaft with keys.
   3. Balanced: Statically and dynamically.

I. Final Drive Set: The final fan speeds required to just meet the system CFM and pressure requirements, without throttling the design air flow branch, shall be determined by fan law

calculation. If adjustment is required beyond the capabilities of the factory drive set, the final drive set shall be provided as part of this contract at no additional cost or time to the Government.

2.5 DRIVE GUARDS

A. For machinery and equipment, provide guards as shown in AMCA 410 for belts, chains, couplings, pulleys, sheaves, shafts, gears and other moving parts regardless of height above the floor to prevent damage to equipment and injury to personnel. Drive guards may be excluded where motors and drives are inside factory-fabricated air handling unit casings.

B. Pump shafts and couplings shall be fully guarded by a sheet steel guard, covering coupling and shaft but not bearings. Material shall be minimum 16-gauge sheet steel; all edges shall be hemmed and ends shall be bent into flanges and the flanges shall be drilled and attached to pump base with minimum of four 6 mm (1/4 inch) bolts. Reinforce guard as necessary to prevent side play forcing guard onto couplings.

C. V-belt and sheave assemblies shall be totally enclosed, firmly mounted, non-resonant. Guard shall be an assembly of minimum 22-gauge sheet steel and expanded or perforated metal to permit observation of belts. 25 mm (1 inch) diameter hole shall be provided at each shaft centerline to permit speed measurement.

D. Materials: Sheet steel, expanded metal or wire mesh rigidly secured so as to be removable without disassembling pipe, duct, or electrical connections to equipment.

E. Access for Speed Measurement: 25 mm (1 inch) diameter hole at each shaft center.

2.6 LIFTING ATTACHMENTS

A. Provide equipment with suitable lifting attachments to enable equipment to be lifted in its normal position. Lifting attachments shall withstand any handling conditions that might be encountered, without bending or distortion of shape, such as rapid lowering and braking of load.

2.7 ELECTRIC MOTORS

A. All material and equipment furnished, and installation methods shall conform to the requirements of Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT; Section 26 29 11, MOTOR CONTROLLERS; and, Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES. Provide all electrical wiring, conduit, and devices necessary for the proper connection, protection and operation of the systems. Provide special energy efficient premium efficiency type motors as scheduled.

2.8 VARIABLE SPEED MOTOR CONTROLLERS

A. Refer to Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS and Section 26 29 11, MOTOR CONTROLLERS for specifications.

B. Coordinate variable speed motor controller communication protocol with Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

C. Provide variable speed motor controllers with or without a bypass contactor as indicated in the contract documents.

D. The combination of controller and motor shall be provided by the manufacturer of the driven equipment, such as pumps and fans, and shall be rated for 100 percent output performance. Multiple units of the same class of equipment, i.e., air handlers, fans, pumps, shall be product of a single manufacturer.

E. Motors shall be premium efficiency type and be approved by the motor controller manufacturer. The controller-motor combination shall be guaranteed to provide full motor nameplate horsepower in variable frequency operation. Both driving and driven motor/fan sheaves shall be fixed pitch.

F. Controller shall not add any current or voltage transients to the input ac power distribution system, DDC controls, sensitive medical equipment, etc., nor shall be affected from other devices on the ac power system.

2.9 EQUIPMENT AND MATERIALS IDENTIFICATION

A. Use symbols, nomenclature and equipment numbers specified, shown in the contract documents, and shown in the maintenance manuals. Identification for piping is specified in Section 09 91 00, PAINTING.

B. Interior (Indoor) Equipment: Engraved nameplates, with letters not less than 5 mm (3/16 inch) high of brass with black-filled letters, or rigid black plastic with white letters specified in Section 09 91 00, PAINTING permanently fastened to the equipment. Identify unit components such as coils, filters, fans, etc.

C. Exterior (Outdoor) Equipment: Brass nameplates, with engraved black filled letters, not less than 5 mm (3/16 inch) high riveted or bolted to the equipment.

D. Control Items: Label all instrumentation, temperature and humidity sensors, controllers and control dampers. Identify and label each item as they appear on the control diagrams.

E. Valve Tags and Lists:
1. HVAC and Mechanical Rooms: Provide for all valves other than for equipment in Section 23 82 00, CONVECTION HEATING AND COOLING UNITS and Section 23 36 00, AIR TERMNAL UNITS.
2. Valve Tags: Engraved black filled numbers and letters not less than 13 mm (1/2 inch) high for number designation, and not less than 6 mm (1/4 inch) for service designation on 19-gauge 38 mm (1-1/2 inches) round brass disc, attached with brass "S" hook or brass chain.
3. Valve Lists: Typed or printed plastic coated card(s), sized 216 mm (8-1/2 inches) by 279 mm (11 inches) showing tag number, valve function and area of control, for each service or system. Punch sheets for a 3-ring notebook.
4. Provide detailed plan for each floor of the building indicating the location and valve number for each valve. Identify location of each valve with a color-coded thumb tack in ceiling.

F. Ceiling Grid Labels:
1. 50 mm (2 inch) long by 13 mm (1/2 inch) wide by 0.025 mm (1 mil) thick UV resistant metalized polyester label with red border color and black custom lettering on white background interior. Peel and stick adhesive backing. Label and adhesive manufactured specifically for use in equipment inventory tagging.
2. Custom print labels with above ceiling HVAC equipment numbers.

2.10 FIRESTOPPING

A. Section 07 84 00, FIRESTOPPING specifies an effective barrier against the spread of fire, smoke and gases where penetrations occur for piping and ductwork. Refer to Section 23 07 11, HVAC AND BOILER PLANT INSULATION, for firestop pipe and duct insulation.

2.11 GALVANIZED REPAIR COMPOUND

A. Mil-P-21035B, paint form.

2.12 HVAC PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS

A. Vibration Isolators: Refer to Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.

B. Supports for Roof Mounted Items:
1. Equipment: Equipment rails shall be galvanized steel, minimum 1.3 mm (18 gauge), with integral baseplate, continuous welded corner seams, factory-installed 50 by 100 mm (2 by 4 inches) treated wood nailer, 1.3 mm (18 gauge) galvanized steel counter flashing cap with screws, built-in cant strip, (except for gypsum or tectum deck), minimum height

279 mm (11 inches). For surface insulated roof deck, provide raised cant strip to start at the upper surface of the insulation.

2. Pipe/Duct Pedestals: Provide a galvanized Unistrut channel welded to U-shaped mounting brackets which are secured to side of rail with galvanized lag bolts.

C. Pipe Supports: Comply with MSS SP-58. Type Numbers specified refer to this standard. For selection and application comply with MSS SP-58. Refer to Section 05 50 00, METAL FABRICATIONS, for miscellaneous metal support materials and prime coat painting requirements.

D. Attachment to Concrete Building Construction:
1. Concrete Insert: MSS SP-58, Type 18.
2. Self-Drilling Expansion Shields and Machine Bolt Expansion Anchors: Permitted in concrete not less than 100 mm (4 inches) thick when approved by the COR for each job condition.
3. Power-Driven Fasteners: Permitted in existing concrete or masonry not less than 100 mm (4 inches) thick when approved by the COR for each job condition.

E. Attachment to Steel Building Construction:
1. Welded Attachment: MSS SP-58, Type 22.
2. Beam Clamps: MSS SP-58, Types 20, 21, 28 or 29. Type 23 C-clamp shall be used for individual copper tubing up to 22 mm (7/8 inch) outside diameter.

F. Attachment to Existing Structure: Support from existing floor/roof frame.

G. Attachment to Wood Construction: Wood screws or lag bolts.

H. Hanger Rods: Hot-rolled steel, ASTM A36/A36M or ASTM A575 for allowable load listed in MSS SP-58. For piping, provide adjustment means for controlling level or slope. Types 13 or 15 turn-buckles shall provide 38 mm (1-1/2 inches) minimum of adjustment and incorporate locknuts. All-thread rods are acceptable.

I. Hangers Supporting Multiple Pipes (Trapeze Hangers): Galvanized, cold formed, lipped steel channel horizontal member, not less than 41 by 41 mm (1-5/8 by 1-5/8 inches), 2.7 mm (12 gauge), designed to accept special spring held, hardened steel nuts. Trapeze hangers are prohibited for use for steam supply and condensate piping.
1. Allowable Hanger Load: Manufacturers rating less 91 kg (200 pounds).
2. Guide individual pipes on the horizontal member of every other trapeze hanger with 6 mm (1/4 inch) U-bolt fabricated from steel rod. Provide Type 40 insulation shield, secured by two 13 mm (1/2 inch) galvanized steel bands, or preinsulated calcium silicate shield for insulated piping at each hanger.

J. Supports for Piping Systems:
1. Select hangers sized to encircle insulation on insulated piping. Refer to Section 23 07 11, HVAC AND BOILER PLANT INSULATION for insulation thickness. To protect insulation, provide Type 39 saddles for roller type supports or preinsulated calcium silicate shields. Provide Type 40 insulation shield or preinsulated calcium silicate shield at all other types of supports and hangers including those for preinsulated piping.
2. Piping Systems Except High and Medium Pressure Steam (MSS SP-58):
   a. Standard Clevis Hanger: Type 1; provide locknut.
   b. Riser Clamps: Type 8.
   c. Wall Brackets: Types 31, 32 or 33.
   d. Roller Supports: Type 41, 43, 44 and 46.
   e. Saddle Support: Type 36, 37 or 38.
   f. Turnbuckle: Types 13 or 15. Preinsulate.
   g. U-bolt Clamp: Type 24.
   h. Copper Tube:
      1) Hangers, clamps and other support material in contact with tubing shall be painted with copper colored epoxy paint, plastic coated or taped with non-adhesive isolation tape to prevent electrolysis.

2) For vertical runs use epoxy painted or plastic-coated riser clamps.
3) For Supporting Tube to Strut: Provide epoxy painted pipe straps for copper tube or plastic inserted vibration isolation clamps.
4) Insulated Lines: Provide pre-insulated calcium silicate shields sized for copper tube.

i. Supports for Plastic Piping: As recommended by the pipe manufacturer with black rubber tape extending one inch beyond steel support or clamp.

3. High and Medium Pressure Steam (MSS SP-58):
   a. Provide eye rod or Type 17 eye nut near the upper attachment.
   b. Piping 50 mm (2 inches) and Greater: Type 43 roller hanger. For roller hangers requiring seismic bracing provide a Type 1 clevis hanger with Type 41 roller attached by flat side bars.
   c. //Piping with Vertical Expansion and Contraction:
      1) Movement Up To 19 mm (3/4 inch): Type 51 or 52 variable spring unit with integral turn buckle and load indicator.
      2) Movement More Than 19 mm (3/4 inch): Type 54 or 55 constant support unit with integral adjusting nut, turn buckle and travel position indicator.
4. Convertor and Expansion Tank Hangers: May be Type 1 sized for the shell diameter. Insulation where required will cover the hangers.

K. Pre-Insulated Calcium Silicate Shields:
1. Provide 360-degree water resistant high density 965 kPa (140 psig) compressive strength calcium silicate shields encased in galvanized metal.
2. Pre-insulated calcium silicate shields to be installed at the point of support during erection.
3. Shield thickness shall match the pipe insulation.
4. The type of shield is selected by the temperature of the pipe, the load it must carry, and the type of support it will be used with.
   a. Shields for supporting chilled or cold water shall have insulation that extends a minimum of 25 mm (1 inch) past the sheet metal. Provide for an adequate vapor barrier in chilled lines.
   b. The pre-insulated calcium silicate shield shall support the maximum allowable water filled span as indicated in MSS SP-58. To support the load, the shields may have one or more of the following features: structural inserts 4138 kPa (600 psig) compressive strength, an extra bottom metal shield, or formed structural steel (ASTM A36/A36M) wear plates welded to the bottom sheet metal jacket.
5. Shields may be used on steel clevis hanger type supports, roller supports or flat surfaces.

L. Seismic Restraint and Bracing of Piping and Ductwork: Refer to Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS. Comply with MSS SP-127. Refer to Seismic Design Requirements VA Handbook 18-8.

2.13 PIPE PENETRATIONS

A. Install sleeves during construction for other than blocked out floor openings for risers in mechanical bays.

B. To prevent accidental liquid spills from passing to a lower level, provide the following:
1. For Sleeves: Extend sleeve 25 mm (1 inch) above finished floor and provide sealant for watertight joint.
2. For Blocked Out Floor Openings: Provide 38 mm (1-1/2 inch) angle set in silicone adhesive around opening.
3. For Drilled Penetrations: Provide 38 mm (1-1/2 inch) angle ring or square set in silicone adhesive around penetration.

C. Penetrations through beams or ribs are prohibited but may be installed in concrete beam flanges. Any deviation from these requirements shall receive prior approval of COR.

D. Sheet Metal, Plastic, or Moisture-Resistant Fiber Sleeves: Provide for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.

E. Cast-Iron or Zinc Coated Pipe Sleeves: Provide for pipe passing through exterior walls below grade. Make space between sleeve and pipe watertight with a modular or link rubber seal. Seal shall be applied at both ends of sleeve.

F. Galvanized Steel or an Alternate Black Iron Pipe with Asphalt Coating Sleeves: Provide for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. Provide sleeve for pipe passing through floor of mechanical rooms, laundry work rooms, and animal rooms above basement. Except in mechanical rooms, connect sleeve with floor plate.

G. Brass Pipe Sleeves: Provide for pipe passing through quarry tile, terrazzo or ceramic tile floors. Connect sleeve with floor plate.

H. Sleeves are not required for wall hydrants for fire department connections or in drywall construction.

I. Sleeve Clearance: Sleeve through floors, walls, partitions, and beam flanges shall be one inch greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to accommodate the insulation. Interior openings shall be caulked tight with fire stopping material and sealant to prevent the spread of fire, smoke, and gases.

J. Sealant and Adhesives: Shall be as specified in Section 07 92 00, JOINT SEALANTS.

2.14 DUCT PENETRATIONS

A. Provide curbs for roof mounted piping, ductwork and equipment. Curbs shall be 457 mm (18 inches) high with continuously welded seams, built-in cant strip, interior baffle with acoustic insulation, curb bottom, hinged curb adapter.

B. Provide firestopping for openings through fire and smoke barriers, maintaining minimum required rating of floor, ceiling or wall assembly. See section 07 84 00, FIRESTOPPING.

2.15 SPECIAL TOOLS AND LUBRICANTS

A. Furnish, and turn over to the COR, tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.

B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.

C. Refrigerant Tools: Provide system charging/Evacuation equipment, gauges, fittings, and tools required for maintenance of furnished equipment.

D. Tool Containers: Hardwood or metal, permanently identified for intended service and mounted, or located, where directed by the COR.

E. Lubricants: A minimum of 0.95 L (1 quart) of oil, and 0.45 kg (1 pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

2.16 WALL, FLOOR AND CEILING PLATES

A. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.

B. Thickness: Not less than 2.4 mm (3/32 inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025 inch) for up to 75 mm (3 inch pipe), 0.89 mm (0.035 inch) for larger pipe.

C. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Provide a watertight joint in spaces where brass or steel pipe sleeves are specified.

2.17 ASBESTOS

A. Materials containing asbestos are prohibited.

PART 3 - EXECUTION

3.1 GENERAL

A. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no additional cost or time to the Government.

3.2 ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING

A. Location of piping, sleeves, inserts, hangers, and equipment, access provisions shall be coordinated with the work of all trades. The coordination/shop drawings shall be submitted for review. Locate piping, sleeves, inserts, hangers, ductwork and equipment clear of windows, doors, openings, light outlets, and other services and utilities. Equipment coordination/shop drawings shall be prepared to coordinate proper location and personnel access of all facilities. The drawings shall be submitted for review. Follow manufacturer's published recommendations for installation methods not otherwise specified.

B. Operating Personnel Access and Observation Provisions: Select and arrange all equipment and systems to provide clear view and easy access, without use of portable ladders, for maintenance and operation of all devices including, but not limited to, all equipment items, valves, filters, strainers, transmitters, sensors, control devices. All gauges and indicators shall be clearly visible by personnel standing on the floor or on permanent platforms. Do not reduce or change maintenance and operating space and access provisions that are shown in the contract documents.

C. Equipment and Piping Support: Coordinate structural systems necessary for pipe and equipment support with pipe and equipment locations to permit proper installation.

D. Location of pipe sleeves, trenches and chases shall be accurately coordinated with equipment and piping locations.

E. Cutting Holes:
   1. Cut holes through concrete and masonry by rotary core drill. Pneumatic hammer, impact electric, and hand or manual hammer type drill is prohibited, except as permitted by COR where working area space is limited.
   2. Locate holes to avoid interference with structural members such as slabs, columns, ribs, beams or reinforcing. Holes shall be laid out in advance and drilling done only after approval by COR. If the Contractor considers it necessary to drill through structural members, this matter shall be referred to COR for approval.
   3. Do not penetrate membrane waterproofing.

F. Minor Piping: Generally, small diameter pipe runs from drips and drains, water cooling, and other service are not shown but shall be provided.

G. Electrical Interconnection of Instrumentation or Controls: This generally not shown but shall be provided. This includes interconnections of sensors, transmitters, transducers, control devices, control and instrumentation panels, instruments and computer workstations. Devices shall be located so they are easily accessible for testing, maintenance, calibration, etc. The COR has the final determination on what is accessible and what is not. Comply with NFPA 70.

H. Protection and Cleaning:
   1. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the COR. Damaged or defective items in the opinion of the COR, shall be replaced.
   2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close

pipe openings with caps or plugs during installation. Tightly cover and protect fixtures and equipment against dirt, water chemical, or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.

I. Concrete and Grout: Use concrete and non-shrink grout 20 MPa (3000 psig) minimum, specified in Section 03 30 00, CAST-IN-PLACE CONCRETE.

J. Install gauges, thermometers, valves and other devices with due regard for ease in reading or operating and maintaining said devices. Locate and position thermometers and gauges to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.

K. Install steam piping expansion joints as per manufacturer's recommendations.

L. Work in Existing Building:
   1. Perform as specified in paragraphs OPERATIONS AND STORAGE AREAS, paragraph ALTERATIONS, and paragraph RESTORATION of the Section 01 00 00, GENERAL REQUIREMENTS for relocation of existing equipment, alterations and restoration of existing building(s).
   2. As specified in Section 01 00 00, GENERAL REQUIREMENTS, paragraph OPERATIONS AND STORAGE AREAS, make alterations to existing service piping at times that will least interfere with normal operation of the facility.

M. Switchgear/Electrical Equipment Drip Protection: Every effort shall be made to eliminate the installation of pipe above electrical and data/telephone switchgear. If this is not possible, encase pipe in a second pipe with a minimum of joints. Installation of piping, ductwork, leak protection apparatus or other installations foreign to the electrical installation shall not be located in the space equal to the width and depth of the equipment and extending from to a height of 1.8 m (6 feet) above the equipment or to ceiling structure, whichever is lower (NFPA 70).

N. Inaccessible Equipment:
   1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance or inspections, equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost or time to the Government.
   2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to motors, fans, pumps, belt guards, transformers, high voltage lines, conduit and raceways, piping, hot surfaces, and ductwork. The COR has final determination on whether an installation meets this requirement or not.

3.3 TEMPORARY PIPING AND EQUIPMENT

A. Continuity of operation of existing facilities will generally require temporary installation or relocation of equipment, ducts, and piping.

B. The Contractor shall provide all required facilities in accordance with the requirements of phased construction and maintenance of service. All piping and equipment shall be properly supported, sloped to drain, operate without excessive stress, and shall be insulated where injury can occur to personnel by contact with operating facilities. The requirements of paragraph ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING apply.

C. Temporary facilities and piping shall be completely removed and any openings in structures sealed. Provide necessary blind flanges and caps to seal open piping remaining in service.

3.4 RIGGING

A. Design is based on application of available equipment. Openings in building structures are planned to accommodate design scheme.

B. Alternative methods of equipment delivery may be offered by Contractor and will be considered by Government under specified restrictions of phasing and maintenance of service requirements as well as structural integrity of the building.

C. Close all openings in the building when not required for rigging operations to maintain proper environment in the facility for Government operation and maintenance of service.

D. Contractor shall provide all facilities required to deliver specified equipment and place on foundations. Attachments to structures for rigging purposes and support of equipment on structures shall be Contractor's full responsibility. Upon request, the Government will check structure adequacy and advise Contractor of recommended restrictions.

E. Contractor shall check all clearances, weight limitations and shall offer a rigging plan designed by a Registered Professional Engineer. All modifications to structures, including reinforcement thereof, shall be at Contractor's cost, time and responsibility.

F. Follow approved rigging plan.

G. Restore building to original condition upon completion of rigging work.

3.5 PIPE AND EQUIPMENT SUPPORTS

A. Where hanger spacing does not correspond with joist or rib spacing, use structural steel channels designed by a structural engineer, secured directly to joist and rib structure that will correspond to the required hanger spacing, and then suspend the equipment and piping from the channels. Drill or burn holes in structural steel only with the prior approval of the COR.

B. Use of chain pipe supports; wire or strap hangers; wood for blocking, stays and bracing; or, hangers suspended from piping above are prohibited. Replace or thoroughly clean rusty products and paint with zinc primer.

C. Hanger rods shall be used that are straight and vertical. Turnbuckles for vertical adjustments may be omitted where limited space prevents use. Provide a minimum of 13 mm (1/2 inch) clearance between pipe or piping covering and adjacent work.

D. HVAC Horizontal Pipe Support Spacing: Refer to MSS SP-58. Provide additional supports at valves, strainers, inline pumps and other heavy components. Provide a support within one foot of each elbow.

E. HVAC Vertical Pipe Supports:
   1. Up to 152 mm (6 inch pipe), 9 m (30 feet) long, bolt riser clamps to the pipe below couplings, or welded to the pipe and rests supports securely on the building structure.
   2. Vertical pipe larger than the foregoing, support on base elbows or tees, or substantial pipe legs extending to the building structure.

F. Overhead Supports:
   1. The basic structural system of the building is designed to sustain the loads imposed by equipment and piping to be supported overhead.
   2. Provide steel structural members, in addition to those shown, of adequate capability to support the imposed loads, located in accordance with the final approved layout of equipment and piping.
   3. Tubing and capillary systems shall be supported in channel troughs.

G. Floor Supports:
   1. Provide concrete bases, concrete anchor blocks and pedestals, and structural steel systems for support of equipment and piping. Concrete bases and structural systems shall be anchored and doweled to resist forces under operating and seismic conditions (if applicable) without excessive displacement or structural failure.
   2. Bases and supports shall not be located and installed until equipment mounted thereon has been approved. Bases shall be sized to match equipment mounted thereon plus 50 mm (2 inch) excess on all edges. Chiller foundations shall have horizontal dimensions that exceed chiller base frame dimensions by at least 152 mm (6 inches) on all sides.

Structural contract documents shall be reviewed for additional requirements. Bases shall be neatly finished and smoothed, shall have chamfered edges at the top, and shall be suitable for painting.

3. All equipment shall be shimmed, leveled, firmly anchored, and grouted with epoxy grout. Anchor bolts shall be placed in sleeves, anchored to the bases. Fill the annular space between sleeves and bolts with a granular material to permit alignment and realignment.
4. For seismic anchoring, refer to Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

3.6 MECHANICAL DEMOLITION

A. Rigging access, other than indicated in the contract documents, shall be provided by the Contractor after approval for structural integrity by the COR. Such access shall be provided without additional cost or time to the Government.

B. In an operating facility, maintain the operation, cleanliness and safety. Government personnel will be carrying on their normal duties of operating, cleaning and maintaining equipment and plant operation. Confine the work to the immediate area concerned; maintain cleanliness and wet down demolished materials to eliminate dust. Debris accumulated in the area to the detriment of plant operation is prohibited. Perform all flame cutting to maintain the fire safety integrity of this plant. Adequate fire extinguishing facilities shall be available at all times. Perform all work in accordance with recognized fire protection standards. Inspection will be made by personnel of the VAMC, and Contractor shall follow all directives of the COR with regard to rigging, safety, fire safety, and maintenance of operations.

C. Unless specified otherwise, all piping, wiring, conduit, and other devices associated with the equipment not re-used in the new work shall be completely removed from Government property per Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT. This includes all concrete pads, pipe, valves, fittings, insulation, and all hangers including the top connection and any fastenings to building structural systems. All openings shall be sealed after removal of equipment, pipes, ducts, and other penetrations in roof, walls, floors, in an approved manner and in accordance with contract documents where specifically covered. Structural integrity of the building system shall be maintained. Reference shall also be made to the contract documents of the other disciplines in the project for additional facilities to be demolished or handled.

D. All indicated valves including gate, globe, ball, butterfly and check, all pressure gauges and thermometers with wells shall remain Government property and shall be removed and delivered to COR and stored as directed. The Contractor shall remove all other material and equipment, devices and demolition debris under these contract documents. Such material shall be removed from Government property expeditiously and shall not be allowed to accumulate.

E. Asbestos Insulation Removal: Conform to Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT.

3.7 CLEANING AND PAINTING

A. Prior to final inspection and acceptance of the plant and facilities for beneficial use by the Government, the plant facilities, equipment and systems shall be thoroughly cleaned and painted. Refer to Section 09 91 00, PAINTING.

B. In addition, the following special conditions apply:
1. Cleaning shall be thorough. Solvents, cleaning materials and methods recommended by the manufacturers shall be used for the specific tasks. All rust shall be removed prior to painting and from surfaces to remain unpainted. Repair scratches, scuffs, and abrasions prior to applying prime and finish coats.
2. The following material and equipment shall not be painted:
   a. Motors, controllers, control switches, and safety switches.
   b. Control and interlock devices.
   c. Regulators.

d. Pressure reducing valves.
e. Control valves and thermostatic elements.
f. Lubrication devices and grease fittings.
g. Copper, brass, aluminum, stainless-steel and bronze surfaces.
h. Valve stems and rotating shafts.
i. Pressure gauges and thermometers.
j. Glass.
k. Nameplates.

3. Control and instrument panels shall be cleaned, damaged surfaces repaired, and shall be touched-up with matching paint obtained from panel manufacturer.
4. Pumps, fans, motors, steel and cast-iron bases, and coupling guards shall be cleaned, and shall be touched-up with the same paint type and color as utilized by the pump and fan manufacturer.
5. Temporary Facilities: Apply paint to surfaces that do not have existing finish coats. This may include painting exposed metals where hangers were removed or where equipment was moved or removed.
6. Paint shall withstand the following temperatures without peeling or discoloration:
   a. Condensate and Feedwater: 38 degrees C (100 degrees F) on insulation jacket surface and 121 degrees C (250 degrees F) on metal pipe surface.
   b. Steam: 52 degrees C (125 degrees F) on insulation jacket surface and 190 degrees C (374 degrees F) on metal pipe surface.
7. Final result shall be smooth, even-colored, even-textured factory finish on all items. Completely repaint the entire piece of equipment if necessary to achieve this.
8. Lead based paints are prohibited.

3.8 IDENTIFICATION SIGNS

A. Provide laminated plastic signs, with engraved lettering not less than 5 mm (3/16 inch) high, designating functions, for all equipment, switches, motor controllers, relays, meters, control devices, including automatic control valves. Nomenclature and identification symbols shall correspond to that used in maintenance manual, and in diagrams specified elsewhere. Attach by chain, adhesive, or screws.

B. Factory Built Equipment: Metal plate, securely attached, with name and address of manufacturer, serial number, model number, size, performance.

C. Pipe Identification: Refer to Section 09 91 00, PAINTING.

D. Attach ceiling grid label on ceiling grid location directly underneath above ceiling air terminal, control system component, valve, filter unit, fan etc.

3.9 MOTOR AND DRIVES

A. Use synchronous belt drives only on equipment controlled by soft starters or variable frequency drive motor controllers without a bypass contactor. Use V-belt drives on all other applications.

B. Alignment of V-Belt Drives: Set driving and driven shafts parallel and align so that the corresponding grooves are in the same plane.

C. Alignment of Synchronous Belt Drives: Set driving and driven shafts parallel and align so that the corresponding pulley flanges are in the same plane.

D. Alignment of Direct-Connect Drives: Securely mount motor in accurate alignment so that shafts are per coupling manufacturer’s tolerances when both motor and driven machine are operating at normal temperatures.

3.10 LUBRICATION

A. All equipment and devices requiring lubrication shall be lubricated prior to initial operation. Field-check all devices for proper lubrication.

B. All devices and equipment shall be equipped with required lubrication fittings or devices. A minimum of 0.95 liter (1 quart) of oil and 0.45 kg (1 pound) of grease of manufacturer's recommended grade and type for each different application shall be provided; also provide 12 grease sticks for lubricated plug valves. Deliver all materials to COR in unopened containers that are properly identified as to application.

C. All lubrication points shall be accessible without disassembling equipment, except to remove access plates.

D. All lubrication points shall be extended to one side of the equipment.

3.11 STARTUP, TEMPORARY OPERATION AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

C. The CxA will observe startup and Contractor testing of selected equipment. Coordinate the startup and Contractor testing schedules with COR and CxA. Provide a minimum notice of 10 working days prior to startup and testing.

D. Startup of equipment shall be performed as described in equipment specifications. Vibration within specified tolerance shall be verified prior to extended operation. Temporary use of equipment is specified in Section 01 00 00, GENERAL REQUIREMENTS, paragraph TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT.

3.12 OPERATING AND PERFORMANCE TESTS

A. Prior to the final inspection, perform required tests as specified in Section 01 00 00, GENERAL REQUIREMENTS paragraph TESTS, and in individual Division 23 sections and submit the test reports and records to the COR.

B. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost or time to the Government.

C. When completion of certain work or system occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then conduct such performance tests and finalize control settings for heating systems and for cooling systems respectively during first actual seasonal use of respective systems following completion of work. Rescheduling of these tests shall be requested in writing to COR for approval.

D. No adjustments shall be made during the acceptance inspection. All adjustments shall have been made by this point.

E. Perform tests as required for commissioning provisions in accordance with Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS and Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

3.13 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

B. Components provided under this section of the specification will be tested as part of a larger system.

3.14 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer's technical representative for 40 hours to instruct each VA personnel responsible in operation and maintenance of the system.

B. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

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SECTION 23 05 12
GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation and connection of motors for HVAC and steam generation equipment.

B. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

E. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

F. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

G. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

H. Section 26 29 11, MOTOR CONTROLLERS.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards will govern. The latest edition as of the specification issue date shall govern.

B. American Bearing Manufacturers Association (ABMA):
9 .....Load Ratings and Fatigue Life for Ball Bearings
11 .....Load Ratings and Fatigue Life for Roller Bearings

C. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
90.1 .....Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings

D. Institute of Electrical and Electronics Engineers (IEEE):
112 .....Standard Test Procedure for Polyphase Induction Motors and Generators
841 .....IEEE Standard for Petroleum and Chemical Industry-Premium-Efficiency, Severe-Duty, Totally Enclosed Fan-Cooled (TEFC) Squirrel Cage Induction Motors--Up to and Including 370 kW (500 hp)

E. National Electrical Manufacturers Association (NEMA):
MG 1.....Motors and Generators
MG 2.....Safety Standard for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators
250 .....Enclosures for Electrical Equipment (1000 Volts Maximum)

F. National Fire Protection Association (NFPA):
70 .....National Electrical Code (NEC)

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT”, with applicable paragraph identification.

C. Submit motor submittals with driven equipment.

D. Shop Drawings:
1. Provide documentation to demonstrate compliance with contract documents.
2. Motor nameplate information shall be submitted including electrical ratings, efficiency, bearing data, power factor, frame size, dimensions, mounting details, materials, horsepower, voltage, phase, speed (RPM), enclosure, starting characteristics, torque characteristics, code letter, full load and locked rotor current, service factor, and lubrication method.

E. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

F. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replacement parts, and troubleshooting guide:
1. Include complete list indicating all components of the systems.
2. Include complete diagrams of the internal wiring for each item of equipment.
3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

G. Certification: Two weeks prior to final inspection, unless otherwise noted, certification shall be submitted to the COR stating that the motors have been properly applied, installed, adjusted, lubricated, and tested.

H. Completed System Readiness Checklist provided by the CxA and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

I. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

1.5 AS-BUILT DOCUMENTATION

A. Comply with requirements in Paragraph “AS-BUILT DOCUMENTATION” in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

PART 2 - PRODUCTS

2.1 MOTORS

A. For alternating current, fractional and integral horsepower motors, NEMA MG 1 and NEMA MG 2 shall apply.

B. For severe duty TEFC motors, IEEE 841 shall apply.

C. All material and equipment furnished and installation methods shall conform to the requirements of Section 26 29 11, MOTOR CONTROLLERS; and Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES. Provide all electrical wiring, conduit, and devices necessary for the proper connection, protection and operation of the systems.

Provide premium efficiency type motors. Unless otherwise specified for a particular application, use electric motors with the following requirements.

D. Single-phase Motors:
   1. Motors for centrifugal fans and pumps may be split phase or permanent split capacitor (PSC) type. Provide capacitor-start type for hard starting applications.
      a. In order to meet ASHRAE 90.1 requirements, motors for small packaged HVAC equipment may be Electrically Commutated motor (EC type). Motor shall be brushless DC type specifically designed for applications with heavy duty ball bearings and electronic communication. The motor shall be speed controllable down to 20 percent of full speed and 85 percent efficient at all speeds.

E. Poly-phase Motors: NEMA Design B, Squirrel cage, induction type.
   1. Two Speed Motors: Each two-speed motor shall have two separate windings. Provide a time- delay (20 seconds minimum) relay for switching from high to low speed.

F. Voltage ratings shall be as follows:
   1. Single phase:
      a. Motors connected to 120-volt systems: 115 volts.
      b. Motors connected to 208-volt systems: 200 volts.
      c. Motors connected to 240-volt or 480-volt systems: 230/460 volts, dual connection.
   2. Three phase:
      a. Motors connected to 208-volt systems: 200 volts.
      b. Motors, less than 74.6 kW (100 hp), connected to 240-volt or 480-volt systems: 208-230/460 volts, dual connection.
      c. Motors, 74.6 kW (100 hp) or greater, connected to 240-volt systems: 230 volts.
      d. Motors, 74.6 kW (100 hp) or greater, connected to 480-volt systems: 460 volts.
      e. Motors connected to high voltage systems (Over 600V): Shall conform to NEMA MG 1 for connection to the nominal system voltage shown in the contract documents.

G. Number of phases shall be as follows:
   1. Motors, less than 373 W (1/2 hp): Single phase.
   2. Motors, 373 W (1/2 hp) and greater: 3 phase.
   3. Exceptions:
      a. Hermetically sealed motors.
      b. Motors for equipment assemblies, less than 746 W (1 hp), shall be single phase provided the manufacturer of the proposed assemblies cannot supply the assemblies with three phase motors.

H. Horsepower ratings shall be adequate for operating the connected loads continuously in the prevailing ambient temperatures in areas where the motors are installed, without exceeding the NEMA standard temperature rises for the motor insulation.

I. Motor designs, as indicated by the NEMA code letters, shall be coordinated with the connected loads to assure adequate starting, acceleration, and running torque without exceeding nameplate ratings or considering service factor.

J. Motor Enclosures:
   1. Shall be the NEMA types as specified and/or shown in the contract documents.
   2. Where the types of motor enclosures are not shown in the contract documents, they shall be the NEMA types per NEMA 250, which are most suitable for the environmental conditions where the motors are being installed. Enclosure requirements for certain conditions are as follows:
      a. Motors located outdoors, indoors in wet or high humidity locations, or in unfiltered airstreams shall be totally enclosed type.
      b. Where motors are located in an NEC 511 classified area, provide TEFC explosion proof motor enclosures.

c. Where motors are located in a corrosive environment, provide TEFC enclosures with corrosion resistant finish.

3. Enclosures shall be primed and finish coated at the factory with manufacturer's prime coat and standard finish.

K. Electrical Design Requirements:

1. Motors shall be continuous duty.
2. The insulation system shall be rated minimum of Class B, 130 degrees C (266 degrees F).
3. The maximum temperature rise by resistance at rated power shall not exceed Class B limits, 80 degrees C (176 degrees F).
4. The speed/torque and speed/current characteristics shall comply with NEMA Design A or B, as specified.
5. Motors shall be suitable for full voltage starting, unless otherwise noted. Coordinate motor features with applicable motor controllers.
6. Motors for variable frequency drive applications shall adhere to NEMA MG 1, Part 30, Application Considerations for Constant Speed Motors Used on a Sinusoidal Bus with Harmonic Content and General-Purpose Motors Used with Adjustable-Voltage or Adjustable-Frequency Controls or Both, or NEMA MG 1, Part 31, Definite-Purpose Inverter-Fed Polyphase Motors.

L. Mechanical Design Requirements:

1. Bearings shall be rated in accordance with ABMA 9 or ABMA 11 for a minimum fatigue life of 26,280 hours for belt-driven loads and 100,000 hours for direct-drive loads based on L10 (Basic Rating Life) at full load direct coupled, except vertical high thrust motors which require a 40,000 hours rating. A minimum fatigue life of 40,000 hours is required for VFD drives.
2. Vertical motors shall be capable of withstanding a momentary up thrust of at least 30 percent of normal down thrust.
3. Grease lubricated bearings shall be designed for electric motor use. Grease shall be capable of the temperatures associated with electric motors and shall be compatible with Polyurea based greases.
4. Grease fittings, if provided, shall be Alemite type or equivalent.
5. Oil lubricated bearings, when specified, shall have an externally visible sight glass to view oil level.
6. Vibration shall not exceed 3.8 mm (0.15 inch) per second, unfiltered peak.
7. Noise level shall meet the requirements of the application.
8. Motors on 180 frames and greater shall have provisions for lifting eyes or lugs capable of a safety factor of 5.
9. All external fasteners shall be corrosion resistant.
10. Condensation heaters, when specified, shall keep motor windings at least 5 degrees C (9 degrees F) above ambient temperature.
11. Winding thermostats, when specified shall be normally closed, connected in series.
12. Grounding provisions shall be in the main terminal box.

M. Special Requirements:

1. Where motor power requirements of equipment furnished deviate from power shown on plans, provide electrical service designed under the requirements of NFPA 70 without additional cost or time to the Government.
2. Assemblies of motors, starters, controls and interlocks on factory assembled and wired devices shall be in accordance with the requirements of this specification.
3. Wire and cable materials specified in the electrical division of the specifications shall be modified as follows:
   a. Wiring material located where temperatures can exceed 71 degrees C (160 degrees F) shall be stranded copper with Teflon FEP insulation with jacket. This includes wiring on the boilers.
   b. Other wiring at boilers and to control panels shall be NFPA 70 designation THWN.

c. Provide shielded conductors or wiring in separate conduits for all instrumentation and control systems where recommended by manufacturer of equipment.

4. Select motor sizes so that the motors do not operate into the service factor at maximum required loads on the driven equipment. Motors on pumps shall be sized for non-overloading at all points on the pump performance curves.

5. Motors utilized with variable frequency drives shall be rated “inverter-duty” per NEMA MG 1, Part 31, Definite-Purpose Inverter-Fed Polyphase Motors. Provide motor shaft grounding apparatus that shall protect bearings from damage from stray currents.

N. Additional requirements for specific motors, as indicated in the other sections listed in Article, RELATED SECTIONS shall also apply.

O. NEMA Premium Efficiency Electric Motors (Motor Efficiencies): All permanently wired polyphase motors of 746 W (1 hp) or more shall meet the minimum full-load efficiencies as indicated in the following table. Motors of 746 W (1 hp) or more with open, drip-proof, or TEFC enclosures shall be NEMA premium efficiency type, unless otherwise indicated. Motors provided as an integral part of motor driven equipment are excluded from this requirement if a minimum seasonal or overall efficiency requirement is indicated for that equipment by the provisions of another section.

Minimum Premium Efficiencies Open Drip-Proof				**Minimum Premium Efficiencies Totally Enclosed Fan-Cooled (TEFC)**			
Rating kW (hp)	**1200 RPM**	**1800 RPM**	**3600 RPM**	**Rating kW (hp)**	**1200 RPM**	**1800 RPM**	**3600 RPM**
0.746 (1)	82.5%	85.5%	77.0%	0.746 (1)	82.5%	85.5%	77.0%
1.12 (1.5)	86.5%	86.5%	84.0%	1.12 (1.5)	87.5%	86.5%	84.0%
1.49 (2)	87.5%	86.5%	85.5%	1.49 (2)	88.5%	86.5%	85.5%
2.24 (3)	88.5%	89.5%	85.5%	2.24 (3)	89.5%	89.5%	86.5%
3.73 (5)	89.5%	89.5%	86.5%	3.73 (5)	89.5%	89.5%	88.5%
5.60 (7.5)	90.2%	91.0%	88.5%	5.60 (7.5)	91.0%	91.7%	89.5%
7.46 (10)	91.7%	91.7%	89.5%	7.46 (10)	91.0%	91.7%	90.2%
11.2 (15)	91.7%	93.0%	90.2%	11.2 (15)	91.7%	92.4%	91.0%
14.9 (20)	92.4%	93.0%	91.0%	14.9 (20)	91.7%	93.0%	91.0%
18.7 (25)	93.0%	93.6%	91.7%	18.7 (25)	93.0%	93.6%	91.7%
22.4 (30)	93.6%	94.1%	91.7%	22.4 (30)	93.0%	93.6%	91.7%
29.8 (40)	94.1%	94.1%	92.4%	29.8 (40)	94.1%	94.1%	92.4%
37.3 (50)	94.1%	94.5%	93.0%	37.3 (50)	94.1%	94.5%	93.0%
44.8 (60)	94.5%	95.0%	93.6%	44.8 (60)	94.5%	95.0%	93.6%
56.9 (75)	94.5%	95.0%	93.6%	56.9 (75)	94.5%	95.4%	93.6%
74.6 (100)	95.0%	95.4%	93.6%	74.6 (100)	95.0%	95.4%	94.1%
93.3 (125)	95.0%	95.4%	94.1%	93.3 (125)	95.0%	95.4%	95.0%
112 (150)	95.4%	95.8%	94.1%	112 (150)	95.8%	95.8%	95.0%
149.2 (200)	95.4%	95.8%	95.0%	149.2 (200)	95.8%	96.2%	95.4%

P. Minimum Power Factor at Full Load and Rated Voltage: 90 percent at 1200 RPM, 1800 RPM, and 3600 RPM. Power factor correction capacitors shall be provided unless the motor meets the 0.90 requirement without it or if the motor is controlled by a variable frequency drive. The power factor correction capacitors shall be able to withstand high voltage transients and power line variations without breakdown.

Q. Energy Efficiency of Small Motors (Motor Efficiencies): All motors under 746 W (1 hp) shall meet the requirements of the DOE Small Motor Regulation.

Polyphase Open Motors Average full load efficiency				**Capacitor-start capacitor-run and capacitor-start induction run open motors Average full load efficiency**			
Rating kW (hp)	**6 poles**	**4 poles**	**2 poles**	**Rating kW (hp)**	**6 poles**	**4 poles**	**2 poles**
0.18 (0.25)	67.5	69.5	65.6	0.18 (0.25)	62.2	68.5	66.6
0.25 (0.33)	71.4	73.4	69.5	0.25 (0.33)	66.6	72.4	70.5
0.37 (0.5)	75.3	78.2	73.4	0.37 (0.5)	76.2	76.2	72.4
0.55 (0.75)	81.7	81.1	76.8	0.55 (0.75)	80.2	81.8	76.2

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install motors in accordance with manufacturer's recommendations, the NEC, NEMA, as shown in the contract documents and/or as required by other sections of these specifications.

B. If in the substantiated evaluation of the COR, the installation fails to meet the requirements of the construction documents with respect to function and maintainability, an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no additional cost or time to the Government.

3.2 FIELD TESTS

A. All tests shall be witnessed by the CxA or by the COR.

B. Perform an electric insulation resistance Test using a megohmmeter on all motors after installation, before startup. All shall test free from grounds.

C. Perform Load test in accordance with IEEE 112, Test Method B, to determine freedom from electrical or mechanical defects and compliance with performance data.

D. Insulation Resistance: Not less than one-half meg-ohm between stator conductors and frame, to be determined at the time of final inspection.

E. All test data shall be complied into a report form for each motor and provided to the contracting officer or their representative.

3.3 STARTUP AND TESTING

A. Perform tests as recommended by product manufacturers and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

C. The CxA shall observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with COR and CxA. Provide a minimum notice of 10 working days prior to startup and testing.

3.4 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

B. Components provided under this section of the specification shall be tested as part of a greater system.

3.5 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer's technical representative for 16 hours to instruct each VA personnel responsible in operation and maintenance of the system.

B. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

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SECTION 23 05 41
NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the application of noise control measures, seismic restraints for equipment, tolerance and vibration isolation for HVAC work, and vibration control techniques to boiler plant rotating equipment and parts including chillers, cooling towers, boilers, pumps, fans, compressors, motors, and steam turbines.

B. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA and SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

E. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

F. Section 23 31 00, HVAC DUCTS and CASINGS.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards will govern. The latest edition as of the specification issue date shall govern.

B. American Society of Civil Engineers (ASCE):
ASCE 7 ..... Minimum Design Loads for Buildings and Other Structures

C. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
Handbook ..... ASHRAE Handbook – HVAC Applications

Handbook ..... ASHRAE Handbook - Fundamentals, Chapter 8, Sound and Vibration

D. American Society for Testing and Materials (ASTM):
A123/A123M ..... Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

A307 ..... Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength

B117 ..... Standard Practice for Operating Salt Spray (Fog) Apparatus

D2240 ..... Standard Test Method for Rubber Property - Durometer Hardness

E. International Code Council (ICC):
IBC ..... International Building Code

F. Manufacturers Standardization Society (MSS):
SP-58 ..... Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation

G. Occupational Safety and Health Administration (OSHA):
29 CFR 1910.95 ..... Occupational Noise Exposure

H. Sheet Metal and Air Conditioning Contractor's National Association (SMACNA):
001 ..... Seismic Restraint Manual: Guidelines for Mechanical Systems, 3rd Edition

I. Department of Veterans Affairs (VA):
H-18-8 ..... Seismic Design Requirements

PG-18-10 ..... HVAC Design Manual

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 23 XX XX, SECTION TITLE", with applicable paragraph identification.

C. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
1. Vibration isolators:
   a. Floor mountings
   b. Hangers
   c. Snubbers
   d. Thrust restraints
2. Bases.
3. Seismic restraint provisions and bolting.
4. Acoustical enclosures.

D. Isolator manufacturer shall furnish with submittal load calculations for selection of isolators, including supplemental bases, based on lowest operating speed of equipment supported.

E. Seismic Requirements: Submittals are required for all equipment anchors, supports and seismic restraints. Submittals shall include weights, dimensions, standard connections, and manufacturer's certification that all specified equipment will withstand seismic Lateral Force requirements as shown in the contract documents.

1.5 QUALITY ASSURANCE

A. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

B. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

C. Noise Criteria:
1. Perform an acoustic analysis to demonstrate that the specified room noise levels are achieved in all octave bands for all air-handling units, heating and ventilating units, fans, chillers, boilers, generators, and outdoor noise producing equipment, such as cooling towers and chillers. Refer to VA HVAC Design Manual Chapter 6 Room Data Sheets for the required Noise Criteria (NC) levels. If the necessary room type is not listed in Chapter 6 of VA HVAC Design Manual then consult the ASHRAE Handbook - HVAC Applications. The analysis shall consider both air duct borne noise and noise transmission through walls, floors and roofs and shall be completed for all duct systems and all HVAC equipment.

2. For equipment which has no sound power ratings scheduled on the plans, the contractor shall select equipment such that the foregoing noise criteria, local ordinance noise levels, and OSHA 29 CFR 1910.95 requirements are not exceeded. Selection procedure shall be in accordance with ASHRAE Handbook - Fundamentals, Chapter 8, Sound and Vibration.
3. An allowance, not to exceed 5 db, may be added to the measured value to compensate for the variation of the room attenuating effect between room test condition prior to occupancy and design condition after occupancy which may include the addition of sound absorbing material, such as, furniture. This allowance may not be taken after occupancy. The room attenuating effect is defined as the difference between sound power level emitted to room and sound pressure level in room.
4. In absence of specified measurement requirements, measure equipment noise levels three feet from equipment and at an elevation of maximum noise generation.

D. Seismic Restraint Requirements:
1. Equipment:
   a. All mechanical equipment not supported with isolators external to the unit shall be securely anchored to the structure. Such mechanical equipment shall be properly supported to resist a horizontal force of 50 percent of the weight of the equipment furnished.
   b. All mechanical equipment mounted on vibration isolators shall be provided with seismic restraints capable of resisting a horizontal force of 100 percent of the weight of the equipment furnished.
2. Piping: Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
3. Ductwork: Refer to Section 23 31 00, HVAC DUCTS AND CASINGS.

E. Allowable Vibration Tolerances for Rotating, Non-reciprocating Equipment: Not to exceed a self-excited vibration maximum velocity of 5 mm per second (0.20 inch per second) RMS, filter in, when measured with a vibration meter on bearing caps of machine in vertical, horizontal, and axial directions or measured at equipment mounting feet if bearings are concealed. Measurements for internally isolated fans and motors may be made at the mounting feet.

1.6 AS-BUILT DOCUMENTATION

A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Type of isolator, base, and minimum static deflection shall be as required for each specific equipment application as recommended by isolator or equipment manufacturer. Refer to ASHRAE Handbook - HVAC Applications Chapter 49, Noise and Vibration Control, Table 47 for selection guide for Vibration Isolation.

B. Elastomeric isolators shall comply with ASTM D2240 and be oil resistant neoprene with a maximum stiffness of 60 durometer and have a straight-line deflection curve.

C. Exposure to Weather: Isolator housings to be either hot dipped galvanized or powder coated to ASTM B117 salt spray testing standards. Springs to be powder coated or electro galvanized. All hardware to be electro galvanized. In addition, provide limit stops to resist wind velocity. Velocity pressure established by wind shall be calculated in accordance with Section 1609 of the International Building Code. A minimum wind velocity of 75 mph shall be employed.

D. Uniform Loading: Select and locate isolators to produce uniform loading and deflection even when equipment weight is not evenly distributed.

E. Color code isolators by type and size for easy identification of capacity.

2.2 SEISMIC RESTRAINT REQUIREMENTS FOR EQUIPMENT

A. Bolt pad mounted equipment, without vibration isolators, to the floor or other support using ASTM A307 standard bolting material.

B. Provide floor mounted equipment with Type SS vibration Isolators. Where Type N isolators are used provide channel frame base horizontal restraints bolted to the floor, or other support, on all sides of the equipment. Size and material required for the base shall be as recommended by the isolator manufacturer.

C. On all sides of suspended equipment, provide bracing for rigid supports and provide restraints for resiliently supported equipment.

2.3 VIBRATION ISOLATORS

A. Floor Mountings:
   1. Double Deflection Neoprene (Type N): Shall include neoprene covered steel support plated (top and bottom), friction pads, and necessary bolt holes.
   2. Spring Isolators (Type S): Shall be free-standing, laterally stable and include acoustical friction pads and leveling bolts. Isolators shall have a minimum ratio of spring diameter-to-operating spring height of 1.0 and an additional travel to solid equal to 50 percent of rated deflection.
   3. Captive Spring Mount for Seismic Restraint (Type SS):
      a. Design mounts to resiliently resist seismic forces in all directions. Snubbing shall take place in all modes with adjustment to limit upward, downward, and horizontal travel to a maximum of 6 mm (1/4 inch) before contacting snubbers. Mountings shall have a minimum rating of one G coefficient of gravity as calculated and certified by a registered structural engineer.
      b. All mountings shall have leveling bolts that are rigidly bolted to the equipment. Spring diameters shall be no less than 0.8 of the compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid equal to 50 percent of the rated deflection. Mountings shall have ports for spring inspection. Provide an all directional neoprene cushion collar around the equipment bolt.
   4. Spring Isolators with Vertical Limit Stops (Type SP): Similar to spring isolators noted above, except include a vertical limit stop to limit upward travel if weight is removed and also to reduce movement and spring extension due to wind loads. Provide clearance around restraining bolts to prevent mechanical short circuiting. Isolators shall have a minimum seismic rating of one G.
   5. Pads (Type D), Washers (Type W), and Bushings (Type L): Pads shall be natural rubber or neoprene waffle, neoprene and steel waffle, or reinforced duck and neoprene. Washers and bushings shall be reinforced duck and neoprene. Size pads for a maximum load of 345 kPa (50 pounds per square inch).

B. Hangers: Shall be combination neoprene and springs unless otherwise noted and shall allow for expansion of pipe.
   1. Combination Neoprene and Spring (Type H): Vibration hanger shall contain a spring and double deflection neoprene element in series. Spring shall have a diameter not less than 0.8 of compressed operating spring height. Spring shall have a minimum additional travel of 50 percent between design height and solid height. Spring shall permit a 15 degree angular misalignment without rubbing on hanger box.
   2. Hanger supports for piping 50 mm (2 inches) and greater shall have a pointer and scale deflection indicator.

C. Snubbers: Each spring mounted base shall have a minimum of four all-directional or eight two directional (two per side) seismic snubbers that are double acting. Elastomeric materials shall be shock absorbent neoprene bridge quality bearing pads, maximum 60 durometer, replaceable and have a minimum thickness of 6 mm (1/4 inch). Air gap between hard and resilient material shall be not less than 3.2 mm (1/8 inch) nor greater than 6 mm (1/4 inch). Restraints shall be capable of withstanding design load without permanent deformation.

D. Thrust Restraints (Type THR): Restraints shall provide a spring element contained in a steel frame with neoprene pads at each end attachment. Restraints shall have factory preset thrust and be field adjustable to allow a maximum movement of 6 mm (1/4 inch) when the fan starts and stops. Restraint assemblies shall include rods, angle brackets and other hardware for field installation.

2.4 BASES

A. Rails (Type R): Design rails with isolator brackets to reduce mounting height of equipment and cradle machines having legs or bases that do not require a complete supplementary base. To assure adequate stiffness, height of members shall be a minimum of 1/12 of longest base dimension but not less than 100 mm (4 inches). Where rails are used with neoprene mounts for small fans or close coupled pumps, extend rails to compensate overhang of housing.

B. Inertia Base (Type I): Base shall be a reinforced concrete inertia base. Pour concrete into a welded steel channel frame, incorporating prelocated equipment anchor bolts and pipe sleeves. Level the concrete to provide a smooth uniform bearing surface for equipment mounting. Provide grout under uneven supports. Channel depth shall be a minimum of 1/12 of longest dimension of base but not less than 152 mm (6 inches). Form shall include 13 mm (1/2 inch) reinforcing bars welded in place on minimum of 203 mm (8 inch) centers running both ways in a layer 38 mm (1-1/2 inches) above bottom. Use height saving brackets in all mounting locations. Weight of inertia base shall be equal to or greater than weight of equipment supported to provide a maximum peak-to-peak displacement of 1.6 mm (1/16 inch).

C. Curb Mounted Isolation Base (Type CB): Fabricate from aluminum to fit on top of standard curb with overlap to allow water run-off and have wind and water seals which shall not interfere with spring action. Provide resilient snubbers with 6 mm (1/4 inch) clearance for wind resistance. Top and bottom bearing surfaces shall have sponge type weather seals. Integral spring isolators shall comply with Spring Isolator (Type S) requirements.

2.5 SOUND ATTENUATING UNITS

A. Refer to Section 23 31 00, HVAC DUCTS and CASINGS.

PART 3 - EXECUTION

3.1 INSTALLATION

A. If an installation is unsatisfactory to the COR, the contractor shall correct the installation at no additional cost or time to the Government.

B. Vibration Isolation:
   1. No metal-to-metal contact will be permitted between fixed and floating parts.
   2. Connections to Equipment: Allow for deflections equal to or greater than equipment deflections. Electrical, drain, piping connections, and other items made to rotating or reciprocating equipment (pumps, compressors, etc.) which rests on vibration isolators, shall be isolated from building structure for first three hangers or supports with a deflection equal to that used on the corresponding equipment.
   3. Common Foundation: Mount each electric motor on same foundation as driven machine. Hold driving motor and driven machine in positive rigid alignment with provision for adjusting motor alignment and belt tension. Bases shall be level throughout length and width. Provide shims to facilitate pipe connections, leveling, and bolting.
   4. Provide heat shields where elastomers are subject to temperatures over 38 degrees C (l00 degrees F).
   5. Extend bases for pipe elbow supports at discharge and suction connections at pumps. Pipe elbow supports shall not short circuit pump vibration to structure.
   6. Non-rotating equipment such as heat exchangers and convertors shall be mounted on isolation units having the same static deflection as the isolation hangers or support of the pipe connected to the equipment.

C. Inspection and Adjustments: Check for vibration and noise transmission through connections, piping, ductwork, foundations, and walls. Adjust, repair, or replace isolators as required to reduce vibration and noise transmissions to specified levels.

3.2 ADJUSTING

A. Adjust vibration isolators after piping systems are filled and equipment is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Attach thrust limits at centerline of thrust and adjust to a maximum of 6 mm (1/4 inch) movement during start and stop.

D. Adjust active height of spring isolators.

E. Adjust snubbers according to manufacturer's recommendations.

F. Adjust seismic restraints to permit free movement of equipment within normal mode of operation.

G. Torque anchor bolts according to equipment manufacturer's recommendations to resist seismic forces.

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SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION

A. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. Testing, adjusting, and balancing (TAB) of heating, ventilating and air conditioning (HVAC) systems. TAB includes the following:
   1. Planning systematic TAB procedures.
   2. Design Review Report.
   3. Systems Inspection Report.
   4. Duct Air Leakage Test Report.
   5. Systems Readiness Report.
   6. Balancing air and water distribution systems; adjustment of total system to provide design performance; and testing performance of equipment and automatic controls.
   7. Vibration and sound measurements.
   8. Recording and reporting results.
   9. Document critical paths of flow on reports.

C. Definitions:
   1. Basic TAB used in this Section: Chapter 39, "Testing, Adjusting and Balancing" of ASHRAE Handbook "HVAC Applications".
   2. TAB: Testing, Adjusting and Balancing; the process of checking and adjusting HVAC systems to meet design objectives.
   3. AABC: Associated Air Balance Council.
   4. NEBB: National Environmental Balancing Bureau.
   5. TABB: Testing Adjusting and Balancing Bureau.
   6. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.
   7. Hydronic Systems: Includes chilled water, heating hot water, and glycol-water systems.
   8. Air Systems: Includes all outside air, supply air, return air, exhaust air and relief air systems.
   9. Flow Rate Tolerance: The allowable percentage variation, minus to plus, of actual flow rate from values (design) in the contract documents.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

D. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

E. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

F. Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.

G. Section 23 07 11, HVAC AND BOILER PLANT INSULATION.

H. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

I. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

J. Section 23 31 00, HVAC DUCTS AND CASINGS.

K. Section 23 36 00, AIR TERMINAL UNITS.

L. Section 23 64 00, PACKAGED WATER CHILLERS.

1.3 APPLICABLE PUBLICATIONS

A. The following publications form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards will govern. The latest edition as of the specification issue date shall govern.

B. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE):
.....ASHRAE Handbook – HVAC Applications, Chapter 39, Testing, Adjusting, and Balancing and Chapter 49, Noise and Vibration Control

C. Associated Air Balance Council (AABC):
.....National Standards for Total System Balance, 7th Edition

D. National Environmental Balancing Bureau (NEBB):
.....Procedural Standard for Testing, Adjusting, and Balancing of Environmental Systems, 9th Edition

.....Procedural Standard for the Measurement of Sound and Vibration, 2nd Edition

S110 .....Whole Building Technical Commissioning of New Construction, 2nd Edition

E. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
.....HVAC Systems Testing, Adjusting and Balancing, 3rd Edition

.....TAB Procedural Guide 1st Edition

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION XX XX XX, SECTION TITLE”, with applicable paragraph identification.

C. Submit names and qualifications of TAB agency and TAB Specialists within 60 days after the notice to proceed. Submit information on three recently completed projects and a list of proposed test equipment.

D. For use by the COR staff, submit one complete set of applicable AABC, NEBB or TABB publications that will be the basis of TAB work.

E. Submit the following for review and approval:
1. Design Review Report within 90 days for conventional design projects after the system layout on air and water side is completed by the Contractor.
2. Systems inspection report on equipment and installation for conformance with design.
3. Duct Air Leakage Test Report.
4. Systems Readiness Report.
5. Intermediate and Final TAB reports covering flow balance and adjustments, performance tests, vibration tests and sound tests.
6. Include in final reports uncorrected installation deficiencies noted during TAB and applicable explanatory comments on test results that differ from design requirements.
7. Include in each report the critical path for each balanced branch (air and hydronic). Every branch shall have at least one terminal device damper 100 percent open.

F. Prior to request for Final or Partial Final inspection, submit completed Test and Balance report for the area with noted critical paths.

1.5 QUALITY ASSURANCE

A. Refer to paragraphs QUALITY ASSURANCE and SUBMITTALS, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC and Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

B. Qualifications:
   1. TAB Agency: The TAB agency shall be a subcontractor of the General Contractor and shall report to and be paid by the General Contractor.
   2. The TAB agency shall be either a certified member of AABC, NEBB, or TABB to perform TAB service for HVAC, water balancing and vibrations and sound testing of equipment. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the agency loses subject certification during this period, the General Contractor shall immediately notify the COR and submit another qualified TAB firm for approval. Any agency that has been the subject of disciplinary action by either the AABC, TABB or NEBB within the five (5) years preceding Contract Award shall not be eligible to perform any work related to the TAB. All work performed in this Section and in other related Sections by the TAB agency shall be considered invalid if the TAB agency loses its certification prior to Contract completion, and the successor agency's review shows unsatisfactory work performed by the predecessor agency.
   3. TAB Specialist: The TAB Specialist shall be either a member of AABC or TABB or an experienced technician of the Agency certified by NEBB. The certification shall be maintained for the entire duration of duties specified herein. If, for any reason, the Specialist loses subject certification during this period, the General Contractor shall immediately notify the COR and submit another TAB Specialist for approval. Any individual that has been the subject of disciplinary action by either the AABC or the NEBB within the five (5) years preceding Contract Award shall not be eligible to perform any duties related to the HVAC systems, including TAB. All work specified in this Section and in other related Sections performed by the TAB Specialist shall be considered invalid if the TAB Specialist loses its certification prior to Contract completion and shall be performed by an approved successor.
   4. TAB Specialist shall be identified by the General Contractor within sixty (60) days after the Notice to Proceed. The TAB Specialist will be coordinating, scheduling, and reporting all TAB work and related activities and will provide necessary information as required by the COR. The responsibilities shall specifically include:
      a. Directly supervising all TAB work.
      b. Sign the TAB reports that bear the seal of the TAB standard. The reports shall be accompanied by report forms and schematic drawings required by the TAB standard, AABC, TABB or NEBB.
      c. Following all TAB work through its satisfactory completion.
      d. Providing final markings of settings of all HVAC adjustment devices.
      e. Permanently mark location of duct test ports.
      f. Documenting critical paths from the fan or pump. These critical paths are ones in which are 100 percent open from the fan or pump to the terminal device. This will show the least amount of restriction is being imposed on the system by the TAB firm.
   5. All TAB technicians performing actual TAB work shall be experienced and shall have done satisfactory work on a minimum of three (3) projects comparable in size and complexity to this project. Qualifications shall be certified by the TAB agency in writing. The lead technician shall be certified by AABC, TABB or NEBB.

C. Test Equipment Criteria: The instrumentation shall meet the accuracy/calibration requirements established by AABC National Standards, TABB/SMACNA International Standards, or by NEBB Procedural Standard for Testing, Adjusting and Balancing of Environmental Systems and instrument manufacturer. Provide calibration history of the instruments to be used for test and balance purpose. All equipment shall remain in calibration, or be re-calibrated if certification expires, during the TAB procedures.

D. TAB Criteria:
   1. One or more of the applicable AABC, NEBB, TABB or SMACNA publications, supplemented by Chapter 39, "Testing, Adjusting and Balancing" of ASHRAE Handbook "HVAC Applications" and requirements stated herein shall be the basis for planning, procedures, and reports.
   2. Flow Rate Tolerance: Following tolerances are allowed. For tolerances not mentioned herein follow Chapter 39, "Testing, Adjusting and Balancing" of ASHRAE Handbook "HVAC Applications" as a guideline. Air Filter resistance during tests, artificially imposed, if necessary, shall be at least 100 percent of manufacturer recommended change over pressure drop values for pre-filters and after-filters.
      a. Air handling unit and all other fans, cubic meters/min (cubic feet per minute): Minus 5 percent to plus l0 percent.
      b. Air Terminal Units (maximum values): Minus 5 percent to plus 10 percent
      c. Exhaust Hoods/Cabinets: 0 percent to plus 10 percent.
      d. Minimum Outside Air: 0 percent to plus 10 percent.
      e. Individual room air outlets and inlets, and air flow rates not mentioned above: Minus 5 percent to plus l0 percent except if the air to air space is 100 CFM or less the tolerance will be minus 5 to plus 5 percent.
      f. Heating Hot Water Pumps and Hot Water Coils: Minus 5 percent to plus 5 percent.
      g. Chilled Water and Condenser Water Pumps: Minus 5 percent to plus 5 percent.
      h. Chilled Water Coils: Minus 5 percent to plus 5 percent.
   3. Systems shall be adjusted for energy efficient operation as described in PART 3.
   4. Typical TAB procedures and critical path results shall be demonstrated to the COR for one air distribution system (including all fans, 3 terminal units, 3 rooms randomly selected by the COR, one of which shall be a critical path) and 1 hydronic system (pumps and 3 coils) as follows:
      a. When field TAB work begins.
      b. During each partial final inspection and the final inspection for the project if requested by VA.

PART 2 - PRODUCTS

2.1 PLUGS

A. Provide plastic plugs to seal holes drilled in ductwork for test purposes.

2.2 INSULATION REPAIR MATERIAL

A. See Section 23 07 11, HVAC and BOILER PLANT INSULATION. Provide for repair of insulation removed or damaged for TAB work.

PART 3 - EXECUTION

3.1 GENERAL

A. Refer to TAB Criteria in Paragraph QUALITY ASSURANCE.

B. Obtain applicable contract documents and copies of approved submittals for HVAC equipment and automatic control systems.

3.2 DESIGN REVIEW REPORT

A. The TAB Specialist shall review the contract documents and advise the COR of any design deficiencies that would prevent the HVAC systems from effectively operating in accordance with the sequence of operation specified or prevent the effective and accurate TAB of the system. The TAB Specialist shall provide a report individually listing each deficiency and the corresponding proposed corrective action necessary for proper system operation.

3.3 SYSTEMS INSPECTION REPORT

A. Inspect equipment and installation for conformance with design.

B. The inspection and report shall be done after air distribution and hydronic equipment is onsite and duct and piping installation has begun, but well in advance of performance testing and balancing work. The purpose of the inspection is to identify and report deviations from design and ensure that systems will be ready for TAB at the appropriate time.

C. Reports: Follow checklist format developed by AABC, NEBB or SMACNA (TABB), supplemented by narrative comments, with emphasis on air-handling units and fans. Check for conformance with submittals. Verify that diffuser and register sizes are correct. Check air terminal unit installation including their duct sizes and routing.

3.4 DUCT AIR LEAKAGE TEST REPORT

A. TAB Agency shall perform the leakage test as outlined in "Duct Leakage Tests and Repairs" in Section 23 31 00, HVAC DUCTS and CASINGS for TAB agency's role and responsibilities in witnessing, recording and reporting of deficiencies.

3.5 SYSTEM READINESS REPORT

A. The TAB Contractor shall measure existing air and water flow rates associated with existing systems utilized to serve renovated areas as indicated in the contract documents. Submit report of findings to COR.

B. Inspect each system to ensure that it is complete including installation and operation of controls. Submit report to COR in standard format and forms prepared and/or approved by the CxA.

C. Verify that all items such as ductwork piping, dampers, valves, ports, terminals, connectors, etc., that are required for TAB are installed. Provide a report to the COR.

3.6 TAB REPORTS

A. Submit an intermediate report for 50 percent of systems and equipment tested and balanced to establish satisfactory test results.

B. The TAB Contractor shall provide raw data immediately in writing to the COR if there is a problem in achieving intended results before submitting a formal report.

C. If over 20 percent of readings in the intermediate report fall outside the acceptable range, the TAB report shall be considered invalid and all contract TAB work shall be repeated after engineering and construction have been evaluated and re-submitted for approval at no additional cost to the owner.

D. Do not proceed with the remaining systems until intermediate report is approved by the COR.

3.7 TAB PROCEDURES

A. TAB shall be performed in accordance with the requirement of the Standard under which TAB agency is certified by either AABC, TABB or NEBB. Balancing shall be done proportionally to all applicable systems.
   1. At least 1 trunk damper shall be 100 percent open.
   2. At least 1 branch damper shall be 100 percent open per trunk.
   3. At least 1 terminal device duct be 100 percent open per branch.
   4. At least one hydronic balancing valve shall be 100 percent open per hydronic system.

B. General: During TAB all related system components shall be in full operation. Fan and pump rotation, motor loads and equipment vibration shall be checked and corrected as necessary before proceeding with TAB. Set controls and/or block off parts of distribution systems to simulate design operation of variable volume air or water systems for test and balance work.

C. Coordinate TAB procedures with existing systems and any phased construction completion requirements for the project. Provide TAB reports for pre-construction air and water flow rate

and for each phase of the project prior to partial final inspections of each phase of the project. Return existing areas outside the work area to pre-constructed conditions.

D. Allow 21 days' time in construction schedule for TAB and submission of all reports for an organized and timely correction of deficiencies.

E. Air Balance and Equipment Test: Include air-handling units, fans, terminal units, fan coil units, room diffusers/outlets/inlets, computer room AC units, and laboratory fume hoods and biological safety cabinets.
   1. Artificially load air filters by partial blanking to produce static air pressure drop of manufacturer's recommended pressure drop.
   2. Adjust fan speeds to provide design air flow. V-belt drives, including fixed pitch pulley requirements, are specified in Section 23 05 11, COMMON WORK RESULTS FOR HVAC. Provide new drive sets as required to adjust fan speeds.
   3. Test and balance systems in all specified modes of operation, including variable volume, economizer, and fire emergency modes. Verify that dampers and other HVAC controls function properly.
   4. Variable Air Volume (VAV) Systems:
      a. Coordinate TAB, including system volumetric controls, with Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.
      b. Section 23 36 00, AIR TERMINAL UNITS, specifies that maximum and minimum flow rates for air terminal units (ATU) be factory set. Check and readjust ATU flow rates if necessary to meet design criteria. Balance air distribution from ATU on full cooling maximum scheduled cubic meters per minute (cubic feet per minute). Reset room thermostats and check ATU operation from maximum to minimum cooling, to the heating mode, and back to cooling. Record and report the heating coil leaving air temperature when the ATU is in the maximum heating mode. Record and report outdoor air flow rates under all operating conditions (The test shall demonstrate that the minimum outdoor air ventilation rate shall remain constant under all operating conditions).
      c. Adjust operating pressure control setpoint to maintain the design flow to each space with the lowest setpoint. Confirm static pressure reset is operational and functioning properly.
   5. Record final measurements for air handling equipment performance data sheets.
   6. Record final damper settings for all manual volume dampers.

F. Rooms with Specific Pressure Relationships:
   1. For rooms that require specific pressure relationships as noted in the contract documents report the following information:
      a. Room differential pressure at minimum and maximum flows.
      b. Room air changes per hour (ACH).
      c. Adjust airflows to achieve the required air pressure relationships. Increase/decrease the supply/exhaust airflow as needed. For positively pressurized rooms the supply airflow shall be set per the contract documents and return/exhaust airflow shall be adjusted to achieve the required pressure relationship. For negatively pressurized rooms the exhaust airflow per the contract documents and the supply airflow adjusted to achieve the required pressure relationship.

G. Water Balance and Equipment Test: Include circulating pumps, convertors, coils, coolers and condensers:
   1. Coordinate water chiller flow balancing with Section 23 64 00, PACKAGED WATER CHILLERS.
   2. Adjust flow rates for equipment. Set coils and evaporator to values on equipment submittals, if different from values in the contract documents.
   3. Primary-Secondary (variable volume) Systems: Coordinate TAB with Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC. Balance systems at design water flow and then verify that variable flow controls function as designed.

4. Record final measurements for hydronic equipment on performance data sheets. Include entering and leaving water temperatures for heating and cooling coils, and for convertors. Include entering and leaving air temperatures (DB/WB for cooling coils) for air-handling units and reheat coils. Make air and water temperature measurements at the same time.
5. On coils with automatic flow limiting valves (automatic balancing valves) measure and report Delta P across valve and measure Delta P across 100 percent open temperature control valve and using control valve CV calculate and report gpm.
6. Record final valve setting for all balancing valves.

3.8 VIBRATION TESTING

A. Furnish instruments and perform vibration measurements as specified in Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT. Field vibration balancing is specified in Section 23 05 11, COMMON WORK RESULTS FOR HVAC. Provide measurements for all rotating HVAC equipment of 373 watts (1/2 horsepower) and larger, including centrifugal/screw compressors, cooling towers, pumps, fans and motors.

B. Record initial measurements for each unit of equipment on test forms and submit a report to the COR. Where vibration readings exceed the allowable tolerance Contractor shall be directed to correct the problem. The TAB agency shall verify that the corrections are done and submit a final report to the COR.

3.9 SOUND TESTING

A. Perform and record required sound measurements in accordance with paragraph QUALITY ASSURANCE in Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.
   1. Take readings in rooms, approximately fifteen (15) percent of all rooms. The COR may designate the specific rooms to be tested.
   2. Provide chiller and cooling tower sound measurements. Refer to Section 23 64 00, PACKAGED WATER CHILLERS.

B. Take measurements with a calibrated sound level meter and octave band analyzer of the accuracy required by AABC, TABB or NEBB.

C. Sound reference levels, formulas and coefficients shall be according to ASHRAE Handbook "HVAC Applications", Chapter 49, “Noise and Vibration Control”.

D. Determine compliance with contract documents as follows:
   1. When sound pressure levels are specified, including the NC Criteria in Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT:
      a. Reduce the background noise as much as possible by shutting off unrelated audible equipment.
      b. Measure octave band sound pressure levels with specified equipment "off."
      c. Measure octave band sound pressure levels with specified equipment "on."
      d. Use the DIFFERENCE in corresponding readings to determine the sound pressure due to equipment.

DIFFERENCE:	0	1	2	3	4	5 to 9	10 or More
FACTOR:	10	7	4	3	2	1	0

      e. Sound pressure level due to equipment equals sound pressure level with equipment "on" minus FACTOR.
      f. Plot octave bands of sound pressure level due to equipment for typical rooms on a graph which also shows noise criteria (NC) curves.
   2. When sound power levels are specified:
      a. Perform steps 1.a. through 1.d., as specified above.

b. For Indoor Equipment: Determine room attenuating effect, i.e., difference between sound power level and sound pressure level. Determined sound power level will be the sum of sound pressure level due to equipment plus the room attenuating effect.

c. For Outdoor Equipment: Use directivity factor and distance from noise source to determine distance factor, i.e., difference between sound power level and sound pressure level. Measured sound power level will be the sum of sound pressure level due to equipment plus the distance factor. Use 9 meters (30 feet) for sound level location.

3. Where sound pressure levels are specified in terms of dB(A), measure sound levels using the "A" scale of meter. Single value readings will be used instead of octave band analysis.

E. Where measured sound levels exceed specified level, the installing contractor or equipment manufacturer shall take remedial action approved by the COR and the necessary sound tests shall be repeated.

F. Test readings for sound testing could go higher than 15 percent if determination is made by the COR based on the recorded sound data.

3.10 MARKING OF SETTINGS

A. Following approval of TAB Final Report, the setting of all HVAC adjustment devices including valves, splitters and dampers shall be permanently marked by the TAB Specialist so that adjustment can be restored if disturbed at any time. Style and colors used for markings shall be coordinated with the COR.

3.11 IDENTIFICATION OF TEST PORTS

A. The TAB Specialist shall permanently and legibly identify the location points of duct test ports. If the ductwork has exterior insulation, the identification shall be made on the exterior side of the insulation. All penetrations through ductwork and ductwork insulation shall be sealed to prevent air leaks and maintain integrity of vapor barrier.

3.12 PHASING

A. Phased Projects: Testing and Balancing Work to follow project with areas shall be completed per the project phasing. Upon completion of the project all areas shall have been tested and balanced per the contract documents.

B. Existing Areas: Systems that serve areas outside of the project scope shall not be adversely affected. Measure existing parameters where shown to document system capacity.

3.13 CRITICAL FLOW PATH

A. Provide a documented critical path for all fluid flows. There shall be at least one (1) terminal device that can be traced back to the fan or pump where there is no damper or valves that are less than 100 percent open.

3.14 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

B. Components provided under this section of the specification will be tested as part of a larger system.

- - E N D - -

SECTION 23 07 11

HVAC AND BOILER PLANT INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Field applied insulation for thermal efficiency and condensation control for
   1. HVAC piping, ductwork and equipment.
   2. Re-insulation of HVAC piping, ductwork and equipment, and boiler plant piping, breeching and stacks and equipment after asbestos abatement.

B. Definitions
   1. ASJ: All service jacket, white finish facing or jacket.
   2. Air conditioned space: Space having air temperature and/or humidity controlled by mechanical equipment.
   3. Cold: Equipment, ductwork or piping handling media at design temperature of 16 degrees C (60 degrees F) or below.
   4. Concealed: Ductwork and piping above ceilings and in chases and pipe spaces.
   5. Exposed: Piping, ductwork, and equipment exposed to view in finished areas including mechanical and electrical equipment rooms or exposed to outdoor weather. Attics and crawl spaces where air handling units are located are considered to be mechanical rooms. Shafts, chases, unfinished attics, crawl spaces and pipe basements are not considered finished areas.
   6. FSK: Foil-scrim-kraft facing.
   7. Hot: HVAC Ductwork handling air at design temperature above 16 degrees C (60 degrees F);HVAC equipment or piping handling media above 41 degrees C (105 degrees F).
   8. Density: kg/m^3 - kilograms per cubic meter (Pcf - pounds per cubic foot).
   9. Runouts: Branch pipe connections up to 25-mm (one-inch) nominal size to fan coil units or reheat coils for terminal units.
   10. Thermal conductance: Heat flow rate through materials.
      a. Flat surface: Watt per square meter (BTU per hour per square foot).
      b. Pipe or Cylinder: Watt per square meter (BTU per hour per linear foot).
   11. Thermal Conductivity (k): Watt per meter, per degree C (BTU per inch thickness, per hour, per square foot, per degree F temperature difference).
   12. Vapor Retarder (Vapor Barrier): A material which retards the transmission (migration) of water vapor. Performance of the vapor retarder is rated in terms of permeance (perms). For the purpose of this specification, vapor retarders shall have a maximum published permeance of 0.1 perms and vapor barriers shall have a maximum published permeance of 0.001 perms.
   13. HPS: High pressure steam (415 kPa [60 psig] and above).
   14. HPR: High pressure steam condensate return.
   15. MPS: Medium pressure steam (110 kPa [16 psig] thru 414 kPa [59 psig].
   16. MPR: Medium pressure steam condensate return.
   17. LPS: Low pressure steam (103 kPa [15 psig] and below).
   18. LPR: Low pressure steam condensate gravity return.
   19. PC: Pumped condensate.
   20. HWH: Hot water heating supply.
   21. HWHR: Hot water heating return.
   22. GH: Hot glycol-water heating supply.
   23. GHR: Hot glycol-water heating return.
   24. FWPD: Feedwater pump discharge.
   25. FWPS: Feedwater pump suction.
   26. CTPD: Condensate transfer pump discharge.

27. CTPS: Condensate transfer pump suction.
28. VR: Vacuum condensate return.
29. CPD: Condensate pump discharge.
30. R: Pump recirculation.
31. FOS: Fuel oil supply.
32. FOR: Fuel oil return.
33. CW: Cold water.
34. SW: Soft water.
35. HW: Hot water.
36. CH: Chilled water supply.
37. 3CHR: Chilled water return.
38. GC: Chilled glycol-water supply.
39. GCR: Chilled glycol-water return.
40. RS: Refrigerant suction.
41. PVDC: Polyvinylidene chloride vapor retarder jacketing, white.

1.2 RELATED WORK

A. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT.

C. Section 02 82 13. GLOVEBAG ASBESTOS ABATEMENT.

D. Section 07 84 00, FIRESTOPPING.

E. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

F. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

G. Section 23 21 13, HYDRONIC PIPING.

H. Section 23 22 13, STEAM and CONDENSATE HEATING PIPING

I. Section 23 22 23, STEAM CONDENSATE PUMPS

1.3 QUALITY ASSURANCE

A. Refer to article QUALITY ASSURANCE, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. Criteria:
1. Comply with NFPA 90A, particularly paragraphs 4.3.3.1 through 4.3.3.6, 4.3.10.2.6, and 5.4.6.4, parts of which are quoted as follows:
   a. **4.3.3.1** Pipe insulation and coverings, duct coverings, duct linings, vapor retarder facings, adhesives, fasteners, tapes, and supplementary materials added to air ducts, plenums, panels, and duct silencers used in duct systems, unless otherwise provided for in 4.3.3.1.1 or 4.3.3.1.2., shall have, in the form in which they are used, a maximum flame spread index of 25 without evidence of continued progressive combustion and a maximum smoke developed index of 50 when tested in accordance with NFPA 255, *Standard Method of Test of Surface Burning Characteristics of Building Materials*.
   b. **4.3.3.1.1** Where these products are to be applied with adhesives, they shall be tested with such adhesives applied, or the adhesives used shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when in the final dry state. *(See 4.2.4.2.)*
   c. **4.3.3.1.2** The flame spread and smoke developed index requirements of 4.3.3.1.1 shall not apply to air duct weatherproof coverings where they are located entirely outside of a building, do not penetrate a wall or roof, and do not create an exposure hazard.
   d. 4.3.3.2 Closure systems for use with rigid and flexible air ducts tested in accordance with UL 181, Standard for Safety Factory-Made Air Ducts and Air

Connectors, shall have been tested, listed, and used in accordance with the conditions of their listings, in accordance with one of the following:
1) UL 181A, Standard for Safety Closure Systems for Use with Rigid Air Ducts and Air Connectors
2) UL 181B, Standard for Safety Closure Systems for Use with Flexible Air Ducts and Air Connectors

e. 4.3.3.3 Air duct, panel, and plenum coverings and linings, and pipe insulation and coverings shall not flame, glow, smolder, or smoke when tested in accordance with a similar test for pipe covering, ASTM C 411, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation, at the temperature to which they are exposed in service.
f. 4.3.3.3.1 In no case shall the test temperature be below 121°C (250°F).
g. 4.3.3.4 Air duct coverings shall not extend through walls or floors that are required to be fire stopped or required to have a fire resistance rating, unless such coverings meet the requirements of 5.4.6.4.
h. 4.3.3.5* Air duct linings shall be interrupted at fire dampers to prevent interference with the operation of devices.
i. 4.3.3.6 Air duct coverings shall not be installed so as to conceal or prevent the use of any service opening.
j. 4.3.10.2.6 Materials exposed to the airflow shall be noncombustible or limited combustible and have a maximum smoke developed index of 50 or comply with the following.
k. 4.3.10.2.6.1 Electrical wires and cables and optical fiber cables shall be listed as noncombustible or limited combustible and have a maximum smoke developed index of 50 or shall be listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with NFPA 262, Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.
l. 4.3.10.2.6.4 Optical-fiber and communication raceways shall be listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with UL 2024, Standard for Safety Optical-Fiber Cable Raceway.
m. 4.3.10.2.6.6 Supplementary materials for air distribution systems shall be permitted when complying with the provisions of 4.3.3.
n. 5.4.6.4 Where air ducts pass through walls, floors, or partitions that are required to have a fire resistance rating and where fire dampers are not required, the opening in the construction around the air duct shall be as follows:
1) Not exceeding a 25.4 mm (1 in.) average clearance on all sides
2) Filled solid with an approved material capable of preventing the passage of flame and hot gases sufficient to ignite cotton waste when subjected to the time-temperature fire conditions required for fire barrier penetration as specified in NFPA 251, *Standard Methods of Tests of Fire Endurance of Building Construction and Materials*

2. Test methods: ASTM E84, UL 723, or NFPA 255.
3. Specified k factors are at 24 degrees C (75 degrees F) mean temperature unless stated otherwise. Where optional thermal insulation material is used, select thickness to provide thermal conductance no greater than that for the specified material. For pipe, use insulation manufacturer's published heat flow tables. For domestic hot water supply and return, run out insulation and condensation control insulation, no thickness adjustment need be made.
4. All materials shall be compatible and suitable for service temperature, and shall not contribute to corrosion or otherwise attack surface to which applied in either the wet or dry state.

C. Every package or standard container of insulation or accessories delivered to the job site for use must have a manufacturer's stamp or label giving the name of the manufacturer and description of the material.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Shop Drawings:
1. All information, clearly presented, shall be included to determine compliance with drawings and specifications and ASTM, federal and military specifications.
   a. Insulation materials: Specify each type used and state surface burning characteristics.
   b. Insulation facings and jackets: Each type used. Make it clear that white finish will be furnished for exposed ductwork, casings and equipment.
   c. Insulation accessory materials: Each type used.
   d. Manufacturer's installation and fitting fabrication instructions for flexible unicellular insulation.
   e. Make reference to applicable specification paragraph numbers for coordination.

C. Samples:
1. Each type of insulation: Minimum size 100 mm (4 inches) square for board/block/ blanket; 150 mm (6 inches) long, full diameter for round types.
2. Each type of facing and jacket: Minimum size 100 mm (4 inches square).
3. Each accessory material: Minimum 120 ML (4 ounce) liquid container or 120 gram (4 ounce) dry weight for adhesives / cement / mastic.

1.5 STORAGE AND HANDLING OF MATERIAL

A. Store materials in clean and dry environment, pipe covering jackets shall be clean and unmarred. Place adhesives in original containers. Maintain ambient temperatures and conditions as required by printed instructions of manufacturers of adhesives, mastics and finishing cements.

1.6 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only. The latest edition as of the specification issue date shall govern.

B. Federal Specifications (Fed. Spec.):
L-P-535E (2).....Plastic Sheet (Sheeting): Plastic Strip; Poly (Vinyl Chloride) and Poly (Vinyl Chloride - Vinyl Acetate), Rigid.

C. Military Specifications (Mil. Spec.):
MIL-A-3316C Adhesives, Fire-Resistant, Thermal Insulation

MIL-A-24179A (1) Adhesive, Flexible Unicellular-Plastic Thermal Insulation

MIL-C-19565C (1) Coating Compounds, Thermal Insulation, Fire-and Water-Resistant, Vapor-Barrier

MIL-C-20079H.....Cloth, Glass; Tape, Textile Glass; and Thread, Glass and Wire-Reinforced Glass

D. American Society for Testing and Materials (ASTM):
A167-99.....Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

B209.....Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

C411 ..... Standard test method for Hot-Surface Performance of High-Temperature Thermal Insulation

C449 ..... Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement

C533 ..... Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation

C534.. ..... Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form

C547 ..... Standard Specification for Mineral Fiber pipe Insulation

C552 ..... Standard Specification for Cellular Glass Thermal Insulation

C553 ..... Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications

C585 ..... Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System) R (1998)

C612 ..... Standard Specification for Mineral Fiber Block and Board Thermal Insulation

C1126 ..... Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation

C1136 ..... Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation

D1668 ..... Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing

E84 ..... Standard Test Method for Surface Burning Characteristics of Building

Materials

E119 ..... Standard Test Method for Fire Tests of Building Construction and Materials

E136 ..... Standard Test Methods for Behavior of Materials in a Vertical Tube Furnace at 750 degrees C (1380 F)

E. National Fire Protection Association (NFPA):

90A ..... Standard for the Installation of Air Conditioning and Ventilating Systems

96 ..... Standard~~s~~ for Ventilation Control and Fire Protection of Commercial Cooking Operations

101 ..... Life Safety Code

251 ..... Standard methods of Tests of Fire Endurance of Building Construction Materials

255 ..... Standard Method of tests of Surface Burning Characteristics of Building Materials

F. Underwriters Laboratories, Inc (UL):

723 ..... UL Standard for Safety Test for Surface Burning Characteristics of Building Materials with Revision of 09/08

G. Manufacturer's Standardization Society of the Valve and Fitting Industry (MSS):

SP58.....Pipe Hangers and Supports Materials, Design, and Manufacture

PART 2 - PRODUCTS

2.1 MINERAL FIBER OR FIBER GLASS

A. ASTM C612 (Board, Block), Class 1 or 2, density 48 kg/m^3 (3 pcf), k = 0.037 (0.26) at 24 degrees C (75 degrees F), external insulation for temperatures up to 204 degrees C (400 degrees F) with foil scrim (FSK) facing.

B. ASTM C553 (Blanket, Flexible) Type I, Class B-3, Density 16 kg/m^3 (1 pcf), k = 0.045 (0.31) at 24 degrees C (75 degrees F), for use at temperatures up to 204 degrees C (400 degrees F) with foil scrim (FSK) facing.

C. ASTM C547 (Pipe Fitting Insulation and Preformed Pipe Insulation), Class 1, k = 0.037 (0.26) at 24 degrees C (75 degrees F), for use at temperatures up to 230 degrees C (450 degrees F) with an all service vapor retarder jacket with polyvinyl chloride premolded fitting covering.

2.2 MINERAL WOOL OR REFRACTORY FIBER

A. Comply with Standard ASTM C612, Class 3, 450 degrees C (850 degrees F).

2.3 RIGID CELLULAR PHENOLIC FOAM

A. Preformed (molded) pipe insulation, ASTM C1126, type III, grade 1, k = 0.021(0.15) at 10 degrees C (50 degrees F), for use at temperatures up to 121 degrees C (250 degrees F) with all service vapor retarder jacket with polyvinyl chloride premolded fitting covering.

B. Equipment and Duct Insulation, ASTM C 1126, type II, grade 1, k = 0.021 (0.15) at 10 degrees C (50 degrees F), for use at temperatures up to 121 degrees C (250 degrees F) with rigid cellular phenolic insulation and covering, and all service vapor retarder jacket.

2.4 CELLULAR GLASS CLOSED-CELL

A. Comply with Standard ASTM C177, C518, density 120 kg/m^3 (7.5 pcf) nominal, k = 0.033 (0.29) at 24~~0~~ degrees C (75 degrees F).

B. Pipe insulation for use at temperatures up to 200 degrees C (400 degrees F) with all service vapor retarder jacket.

2.5 POLYISOCYANURATE CLOSED-CELL RIGID

A. Preformed (fabricated) pipe insulation, ASTM C591, type IV, K=0.027(0.19) at 24 degrees C (75 degrees F), flame spread not over 25, smoke developed not over 50, for use at temperatures up to 149 degree C (300 degree F) with factory applied PVDC or all service vapor retarder jacket with polyvinyl chloride premolded fitting covers.

B. Equipment and duct insulation, ASTM C 591,type IV, K=0.027(0.19) at 24 degrees C (75 degrees F), for use at temperatures up to 149 degrees C (300 degrees F) with PVDC or all service jacket vapor retarder jacket.

2.6 FLEXIBLE ELASTOMERIC CELLULAR THERMAL

A. ASTM C177, C518, k = 0.039 (0.27) at 24 degrees C (75 degrees F), flame spread not over 25, smoke developed not over 50, for temperatures from minus 4 degrees C (40 degrees F) to 93 degrees C (200 degrees F). No jacket required.

2.7 DUCT WRAP FOR KITCHEN HOOD GREASE DUCTS

A. Light weight, high temperature mineral fiber or ceramic fiber insulating material with low thermal conductivity K value of 0.060 W/m^2 degrees C (0.417 Btu in/hr ft^2 degrees F) at mean temperature of 260 degrees C (500 degrees F).

B. Material shall be fully encapsulated by UL classified aluminum foil and tested to ASTM E84 standard.

C. Material shall be UL tested for internal grease fire to 1093 degrees C (2,000 degrees F) with zero clearance and for through-penetration firestop.

D. Material shall be UL classified for 2 hour fire rating for grease duct enclosure, and meet NFPA 96 requirements for direct applied insulating material to grease ducts with zero clearance.

E. Material flame spread and smoke developed ratings shall not be higher than 5, as per ASTM E 84/UL 723 Flammability Test.

2.8 CALCIUM SILICATE

A. Preformed pipe Insulation: ASTM C533, Type I and Type II with indicator denoting asbestos-free material.

B. Premolded Pipe Fitting Insulation: ASTM C533, Type I and Type II with indicator denoting asbestos-free material.

C. Equipment Insulation: ASTM C533, Type I and Type II

D. Characteristics:

Insulation Characteristics		
ITEMS	**TYPE I**	**TYPE II**
Temperature, maximum degrees C (degrees F)	649 (1200)	927 (1700)
Density (dry), Kg/m^3 (lb/ ft3)	232 (14.5)	288 (18)
Thermal conductivity: Min W/ m K (Btu in/h ft^2 degrees F)@ mean temperature of 93 degrees C (200 degrees F)	0.059 (0.41)	0.078 (0.540)
Surface burning characteristics: Flame spread Index, Maximum	0	0
Smoke Density index, Maximum	0	0

2.9 INSULATION FACINGS AND JACKETS

A. Vapor Retarder, higher strength with low water permeance = 0.02 or less perm rating, Beach puncture 50 units for insulation facing on exposed ductwork, casings and equipment, and for pipe insulation jackets. Facings and jackets shall be all service type (ASJ) or PVDC Vapor Retarder jacketing.

B. ASJ jacket shall be white kraft bonded to 0.025 mm (1 mil) thick aluminum foil, fiberglass reinforced, with pressure sensitive adhesive closure. Comply with ASTM C1136. Beach puncture 50 units, Suitable for painting without sizing. Jackets shall have minimum 40 mm (1-1/2 inch) lap on longitudinal joints and minimum 75 mm (3 inch) butt strip on end joints. Butt strip material shall be same as the jacket. Lap and butt strips shall be self-sealing type with factory-applied pressure sensitive adhesive.

C. Vapor Retarder medium strength with low water vapor permeance of 0.02 or less perm rating), Beach puncture 25 units: Foil-Scrim-Kraft (FSK) or PVDC vapor retarder jacketing type for concealed ductwork and equipment.

D. Field applied vapor barrier jackets shall be provided, in addition to the specified facings and jackets, on all exterior piping and ductwork as well as on interior piping and conveying fluids below ambient temperature. The vapor barrier jacket shall consist of a multi-layer laminated cladding with a maximum water vapor permeance of 0.001 perms. The minimum puncture resistance shall be 35 cm-kg (30 inch-pounds) for interior locations and 92 cm-kg (80 inch-pounds) for exterior or exposed locations or where the insulation is subject to damage.

E. Glass Cloth Jackets: Presized, minimum 0.18 kg per square meter (7.8 ounces per square yard), 2000 kPa (300 psig) bursting strength with integral vapor retarder where required or specified. Weather proof if utilized for outside service.

F. Factory composite materials may be used provided that they have been tested and certified by the manufacturer.

G. Pipe fitting insulation covering (jackets): Fitting covering shall be premolded to match shape of fitting and shall be polyvinyl chloride (PVC) conforming to Fed Spec L-P-335, composition A, Type II Grade GU, and Type III, minimum thickness 0.7 mm (0.03 inches). Provide color matching vapor retarder pressure sensitive tape.

H. Aluminum Jacket-Piping systems: ASTM B209, 3003 alloy, H-14 temper, 0.6 mm (0.023 inch) minimum thickness with locking longitudinal joints. Jackets for elbows, tees and other fittings shall be factory-fabricated to match shape of fitting and of 0.6 mm (0.024) inch minimum thickness aluminum. Fittings shall be of same construction as straight run jackets but need not be of the same alloy. Factory-fabricated stainless steel bands shall be installed on all circumferential joints. Bands shall be 13 mm (0.5 inch) wide on 450 mm (18 inch) centers. System shall be weatherproof if utilized for outside service.

2.10 REMOVABLE INSULATION JACKETS

A. Insulation and Jacket:
1. Non-Asbestos Glass mat, type E needled fiber.
2. Temperature maximum of 450°F, Maximum water vapor transmission of 0.00 perm, and maximum moisture absorption of 0.2 percent by volume.
3. Jacket Material: Silicon/fiberglass and LFP 2109 pure PTFE.
4. Construction: One piece jacket body with three-ply braided pure Teflon or Kevlar thread and insulation sewn as part of jacket. Belt fastened.

2.11 PIPE COVERING PROTECTION SADDLES

A. Cold pipe support: Premolded pipe insulation 180 degrees (half-shells) on bottom half of pipe at supports. Material shall be cellular glass or high density Polyisocyanurate insulation of the same thickness as adjacent insulation. Density of Polyisocyanurate insulation shall be a minimum of 48 kg/m^3 (3.0 pcf).

Nominal Pipe Size and Accessories Material (Insert Blocks)	
Nominal Pipe Size mm (inches)	Insert Blocks mm (inches)
Up through 125 (5)	150 (6) long
150 (6)	150 (6) long
200 (8), 250 (10), 300 (12)	225 (9) long
350 (14), 400 (16)	300 (12) long
450 through 600 (18 through 24)	350 (14) long

B. Warm or hot pipe supports: Premolded pipe insulation (180 degree half-shells) on bottom half of pipe at supports. Material shall be high density Polyisocyanurate (for temperatures up to 149 degrees C [300 degrees F]), cellular glass or calcium silicate. Insulation at supports shall have same thickness as adjacent insulation. Density of Polyisocyanurate insulation shall be a minimum of 48 kg/m^3 (3.0 pcf).

2.12 ADHESIVE, MASTIC, CEMENT

A. Mil. Spec. MIL-A-3316, Class 1: Jacket and lap adhesive and protective finish coating for insulation.

B. Mil. Spec. MIL-A-3316, Class 2: Adhesive for laps and for adhering insulation to metal surfaces.

C. Mil. Spec. MIL-A-24179, Type II Class 1: Adhesive for installing flexible unicellular insulation and for laps and general use.

D. Mil. Spec. MIL-C-19565, Type I: Protective finish for outdoor use.

E. Mil. Spec. MIL-C-19565, Type I or Type II: Vapor barrier compound for indoor use.

F. ASTM C449: Mineral fiber hydraulic-setting thermal insulating and finishing cement.

G. Other: Insulation manufacturers' published recommendations.

2.13 MECHANICAL FASTENERS

A. Pins, anchors: Welded pins, or metal or nylon anchors with galvanized steel-coated or fiber washer, or clips. Pin diameter shall be as recommended by the insulation manufacturer.

B. Staples: Outward clinching galvanized steel.

C. Wire: 1.3 mm thick (18 gage) soft annealed galvanized or 1.9 mm (14 gage) copper clad steel or nickel copper alloy.

D. Bands: 13 mm (0.5 inch) nominal width, brass, galvanized steel, aluminum or stainless steel.

2.14 REINFORCEMENT AND FINISHES

A. Glass fabric, open weave: ASTM D1668, Type III (resin treated) and Type I (asphalt treated).

B. Glass fiber fitting tape: Mil. Spec MIL-C-20079, Type II, Class 1.

C. Tape for Flexible Elastomeric Cellular Insulation: As recommended by the insulation manufacturer.

D. Hexagonal wire netting: 25 mm (one inch) mesh, 0.85 mm thick (22 gage) galvanized steel.

E. Corner beads: 50 mm (2 inch) by 50 mm (2 inch), 0.55 mm thick (26 gage) galvanized steel; or, 25 mm (1 inch) by 25 mm (1 inch), 0.47 mm thick (28 gage) aluminum angle adhered to 50 mm (2 inch) by 50 mm (2 inch) Kraft paper.

F. PVC fitting cover: Fed. Spec L-P-535, Composition A, 11-86 Type II, Grade GU, with Form B Mineral Fiber insert, for media temperature 4 degrees C (40 degrees F) to 121 degrees C (250 degrees F). Below 4 degrees C (40 degrees F) and above 121 degrees C (250 degrees F). Provide double layer insert. Provide color matching vapor barrier pressure sensitive tape.

2.15 FIRESTOPPING MATERIAL

A. Other than pipe and duct insulation, refer to Section 07 84 00 FIRESTOPPING.

2.16 FLAME AND SMOKE

A. Unless shown otherwise all assembled systems shall meet flame spread 25 and smoke developed 50 rating as developed under ASTM, NFPA and UL standards and specifications. See paragraph 1.3 "Quality Assurance".

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Required pressure tests of duct and piping joints and connections shall be completed and the work approved by the Resident Engineer for application of insulation. Surface shall be clean and dry with all foreign materials, such as dirt, oil, loose scale and rust removed.

B. Except for specific exceptions, insulate entire specified equipment, piping (pipe, fittings, valves, accessories), and duct systems. Insulate each pipe and duct individually. Do not use scrap pieces of insulation where a full length section will fit.

C. Where removal of insulation of piping, ductwork and equipment is required to comply with Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT and Section 02 82 13.13, GLOVEBAG ASBESTOS ABATEMENT, such areas shall be reinsulated to comply with this specification.

D. Insulation materials shall be installed in a first class manner with smooth and even surfaces, with jackets and facings drawn tight and smoothly cemented down at all laps. Insulation shall be continuous through all sleeves and openings, except at fire dampers and duct heaters (NFPA 90A). Vapor retarders shall be continuous and uninterrupted throughout systems with operating temperature 16 degrees C (60 degrees F) and below. Lap and seal vapor retarder over ends and exposed edges of insulation. Anchors, supports and other metal projections through insulation on cold surfaces shall be insulated and vapor sealed for a minimum length of 150 mm (6 inches).

E. Install vapor stops at all insulation terminations on either side of valves, pumps and equipment and particularly in straight lengths of pipe insulation.

F. Construct insulation on parts of equipment such as chilled water pumps and heads of chillers, convertors and heat exchangers that must be opened periodically for maintenance or repair, so insulation can be removed and replaced without damage. Install insulation with bolted 1 mm thick (20 gage) galvanized steel or aluminum covers as complete units, or in sections, with all necessary supports, and split to coincide with flange/split of the equipment.

G. Insulation on hot piping and equipment shall be terminated square at items not to be insulated, access openings and nameplates. Cover all exposed raw insulation with white sealer or jacket material.

H. Protect all insulations outside of buildings with aluminum jacket using lock joint or other approved system for a continuous weather tight system. Access doors and other items requiring maintenance or access shall be removable and sealable.

I. Insulate PRVs, flow meters, and steam traps.

J. HVAC work not to be insulated:
   1. Internally insulated ductwork and air handling units.
   2. In hot piping: Unions, flexible connectors, control valves, safety valves and discharge vent piping, vacuum breakers, thermostatic vent valves, steam traps 20 mm (3/4 inch) and smaller, exposed piping through floor for convectors and radiators. Insulate piping to within approximately 75 mm (3 inches) of uninsulated items.

K. Apply insulation materials subject to the manufacturer's recommended temperature limits. Apply adhesives, mastic and coatings at the manufacturer's recommended minimum coverage.

L. Elbows, flanges and other fittings shall be insulated with the same material as is used on the pipe straights. The elbow/ fitting insulation shall be field-fabricated, mitered or factory prefabricated to the necessary size and shape to fit on the elbow/ fitting. Use of polyurethane spray-foam to fill a PVC elbow jacket is prohibited on cold applications.

M. Firestop Pipe and Duct insulation:
   1. Provide firestopping insulation at fire and smoke barriers through penetrations. Fire stopping insulation shall be UL listed as defines in Section 07 84 00, FIRESTOPPING.
   2. Pipe and duct penetrations requiring fire stop insulation including, but not limited to the following:
      a. Pipe risers through floors
      b. Pipe or duct chase walls and floors
      c. Smoke partitions
      d. Fire partitions

N. Freeze protection of above grade outdoor piping (over heat tracing tape): 26 mm (10 inch) thick insulation, for all pipe sizes 75 mm(3 inches) and smaller and 25 mm(1inch) thick insulation for larger pipes. Provide metal jackets for all pipes. Provide for cold water make-up to cooling towers and condenser water piping and chilled water piping as described in Section 23 21 13, HYDRONIC PIPING (electrical heat tracing systems).

O. Provide vapor barrier jackets over insulation as follows:
   1. All piping and ductwork exposed to outdoor weather.

2. All interior piping and ducts conveying fluids below ambient air temperature.

P. Provide metal jackets over insulation as follows:
1. All piping and ducts exposed to outdoor weather.
2. Piping exposed in building, within 1800 mm (6 feet) of the floor, that connects to sterilizers, kitchen and laundry equipment. Jackets may be applied with pop rivets. Provide aluminum angle ring escutcheons at wall, ceiling or floor penetrations.
3. A 50 mm (2 inch) overlap is required at longitudinal and circumferential joints.

3.2 INSULATION INSTALLATION

A. Mineral Fiber Board:
1. Faced board: Apply board on pins spaced not more than 300 mm (12 inches) on center each way, and not less than 75 mm (3 inches) from each edge of board. In addition to pins, apply insulation bonding adhesive to entire underside of horizontal metal surfaces. Butt insulation edges tightly and seal all joints with laps and butt strips. After applying speed clips cut pins off flush and apply vapor seal patches over clips.
2. Plain board:
   a. Insulation shall be scored, beveled or mitered to provide tight joints and be secured to equipment with bands spaced 225 mm (9 inches) on center for irregular surfaces or with pins and clips on flat surfaces. Use corner beads to protect edges of insulation.
   b. For hot equipment: Stretch 25 mm (1 inch) mesh wire, with edges wire laced together, over insulation and finish with insulating and finishing cement applied in one coat, 6 mm (1/4 inch) thick, trowel led to a smooth finish.
   c. For cold equipment: Apply meshed glass fabric in a tack coat 1.5 to 1.7 square meter per liter (60 to 70 square feet per gallon) of vapor mastic and finish with mastic at 0.3 to 0.4 square meter per liter (12 to 15 square feet per gallon) over the entire fabric surface.
   d. Chilled water pumps: Insulate with removable and replaceable 1 mm thick (20 gage) aluminum or galvanized steel covers lined with insulation. Seal closure joints/flanges of covers with gasket material. Fill void space in enclosure with flexible mineral fiber insulation.
3. Exposed, unlined ductwork and equipment in unfinished areas, mechanical and electrical equipment rooms and attics and duct work exposed to outdoor weather:
   a. 50 mm (2 inch) thick insulation faced with ASJ (white all service jacket): Supply air duct and after filter housing.
   b. 50 mm (2 inch) thick insulation faced with ASJ: Return air duct, mixed air plenums and prefilter housing.
   c. Outside air intake ducts: Two inch thick insulation faced with ASJ.
   d. Exposed, unlined supply and return ductwork exposed to outdoor weather: 50 mm (2 inch) thick insulation faced with a reinforcing membrane and two coats of vapor barrier mastic or multi-layer vapor barrier with a maximum water vapor permeability of 0.001 perms.
4. Supply air duct in the warehouse and in the laundry: two inch thick insulation faced with ASJ.
5. Cold equipment: 2 inch thick insulation faced with ASJ.
   a. Chilled water pumps, water filter, chemical feeder pot or tank.
   b. Pneumatic, cold storage water and surge tanks.
6. Hot equipment: 2 inch thick insulation faced with ASJ.
   a. Convertors, air separators, steam condensate pump receivers.
   b. Reheat coil casing and separation chambers on steam humidifiers located above ceilings.
   c. Domestic water heaters and hot water storage tanks (not factory insulated).
   d. Booster water heaters for dietetics dish and pot washers and for washdown grease-extracting hoods.

7. Laundry: Hot exhaust ducts from dryers and from ironers, where duct is exposed in the laundry.

B. Flexible Mineral Fiber Blanket:
1. Adhere insulation to metal with 75 mm (3 inch) wide strips of insulation bonding adhesive at 200 mm (8 inches) on center all around duct. Additionally secure insulation to bottom of ducts exceeding 600 mm (24 inches) in width with pins welded or adhered on 450 mm (18 inch) centers. Secure washers on pins. Butt insulation edges and seal joints with laps and butt strips. Staples may be used to assist in securing insulation. Seal all vapor retarder penetrations with mastic. Sagging duct insulation will not be acceptable. Install firestop duct insulation where required.
2. Supply air ductwork to be insulated includes main and branch ducts from AHU discharge to room supply outlets, and the bodies of ceiling outlets to prevent condensation. Insulate sound attenuator units, coil casings and damper frames. To prevent condensation insulate trapeze type supports and angle iron hangers for flat oval ducts that are in direct contact with metal duct.
3. Concealed supply air ductwork.
   a. Above ceilings at a roof level, in attics, and duct work exposed to outdoor weather: 50 mm (2 inch) thick insulation faced with FSK.
   b. Above ceilings for other than roof level: 40 mm (1 ½ inch) thick insulation faced with FSK.
4. Concealed return air duct:
   a. In attics (where not subject to damage): 50mmm (2 inch)thick insulation faced with FSK.
   b. Above ceilings at a roof level, unconditioned areas, and in chases with external wall or containing steam piping; 40 mm (1-1/2 inch) thick, insulation faced with FSK.
   c. Concealed return air ductwork in other locations need not be insulated.
5. Concealed outside air duct: 40 mm (1-1/2 inch) thick insulation faced with FSK.
6. Exhaust air branch duct from autopsy refrigerator to main duct: 40 mm (1-1/2 inch) thick insulation faced with FSK.

C. Molded Mineral Fiber Pipe and Tubing Covering:
1. Fit insulation to pipe or duct, aligning longitudinal joints. Seal longitudinal joint laps and circumferential butt strips by rubbing hard with a nylon sealing tool to assure a positive seal. Staples may be used to assist in securing insulation. Seal all vapor retarder penetrations on cold piping with a generous application of vapor barrier mastic. Provide inserts and install with metal insulation shields at outside pipe supports. Install freeze protection insulation over heating cable.
2. Contractor's options for fitting, flange and valve insulation:
   a. Insulating and finishing cement for sizes less than 100 mm (4 inches) operating at surface temperature of 16 degrees C (61 degrees F) or more.
   b. Factory premolded, one piece PVC covers with mineral fiber, (Form B), inserts. Provide two insert layers for pipe temperatures below 4 degrees C (40 degrees F), or above 121 degrees C (250 degrees F). Secure first layer of insulation with twine. Seal seam edges with vapor barrier mastic and secure with fitting tape.
   c. Factory molded, ASTM C547 or field mitered sections, joined with adhesive or wired in place. For hot piping finish with a smoothing coat of finishing cement. For cold fittings, 16 degrees C (60 degrees F) or less, vapor seal with a layer of glass fitting tape imbedded between two 2 mm (1/16 inch) coats of vapor barrier mastic.
   d. Fitting tape shall extend over the adjacent pipe insulation and overlap on itself at least 50 mm (2 inches).
3. Nominal thickness in millimeters and inches specified in the schedule at the end of this section.

D. Rigid Cellular Phenolic Foam:

1. Rigid closed cell phenolic insulation may be provided for piping, ductwork and equipment for temperatures up to 121 degrees C (250 degrees F).
2. Note the NFPA 90A burning characteristics requirements of 25/50 in paragraph 1.3.B
3. Provide secure attachment facilities such as welding pins.
4. Apply insulation with joints tightly drawn together
5. Apply adhesives, coverings, neatly finished at fittings, and valves.
6. Final installation shall be smooth, tight, neatly finished at all edges.
7. Exposed, unlined supply and return ductwork exposed to outdoor weather: 50 mm (2 inch) thick insulation faced with a multi-layer vapor barrier with a maximum water vapor permeance of 0.00 perms.
8. Condensation control insulation: Minimum 25 mm (1.0 inch) thick for all pipe sizes.
   a. HVAC: Cooling coil condensation piping to waste piping fixture or drain inlet. Omit insulation on plastic piping in mechanical rooms.

E. Cellular Glass Insulation:
1. Pipe and tubing, covering nominal thickness in millimeters and inches as specified in the schedule at the end of this section.
2. Underground Piping Other than or in lieu of that Specified in Section 23 21 13, HYDRONIC PIPING: Type II, factory jacketed with a 3 mm laminate jacketing consisting of 3000 mm x 3000 mm (10 ft x 10 ft) asphalt impregnated glass fabric, bituminous mastic and outside protective plastic film.
   a. 75 mm (3 inches) thick for hot water piping.
   b. As scheduled at the end of this section for chilled water piping.
   c. Underground piping: Apply insulation with joints tightly butted. Seal longitudinal self-sealing lap. Use field fabricated or factory made fittings. Seal butt joints and fitting with jacketing as recommended by the insulation manufacturer. Use 100 mm (4 inch) wide strips to seal butt joints.
   d. Provide expansion chambers for pipe loops, anchors and wall penetrations as recommended by the insulation manufacturer.
   e. Underground insulation shall be inspected and approved by the Resident Engineer as follows:
      1) Insulation in place before coating.
      2) After coating.
   f. Sand bed and backfill: Minimum 75 mm (3 inches) all around insulated pipe or tank, applied after coating has dried.
3. Cold equipment: 50 mm (2 inch) thick insulation faced with ASJ for chilled water pumps, water filters, chemical feeder pots or tanks, expansion tanks, air separators and air purgers.
4. Exposed, unlined supply and return ductwork exposed to outdoor weather: 50 mm (2 inch) thick insulation faced with a reinforcing membrane and two coats of vapor barrier mastic or multi-layer vapor barrier with a water vapor permeability of 0.00 perms.

F. Polyisocyanurate Closed-Cell Rigid Insulation:
1. Polyisocyanurate closed-cell rigid insulation (PIR) may be provided for exterior piping, equipment and ductwork for temperature up to 149 degree C (300 degree F).
2. Install insulation, vapor barrier and jacketing per manufacturer's recommendations. Particular attention should be paid to recommendations for joint staggering, adhesive application, external hanger design, expansion/contraction joint design and spacing and vapor barrier integrity.
3. Install insulation with all joints tightly butted (except expansion) joints in hot applications).
4. If insulation thickness exceeds 63 mm (2.5 inches), install as a double layer system with longitudinal (lap) and butt joint staggering as recommended by manufacturer.
5. For cold applications, vapor barrier shall be installed in a continuous manner. No staples, rivets, screws or any other attachment device capable of penetrating the vapor barrier shall be used to attach the vapor barrier or jacketing. No wire ties capable of penetrating the vapor barrier shall be used to hold the insulation in place. Banding shall be used to attach PVC or metal jacketing.

6. Elbows, flanges and other fittings shall be insulated with the same material as is used on the pipe straights. The elbow/ fitting insulation shall be field-fabricated, mitered or factory prefabricated to the necessary size and shape to fit on the elbow/ fitting. Use of polyurethane spray-foam to fill PVC elbow jacket is prohibited on cold applications.
7. For cold applications, the vapor barrier on elbows/fittings shall be either mastic-fabric-mastic or 2 mil thick PVDC vapor barrier adhesive tape.
8. All PVC and metal jacketing shall be installed so as to naturally shed water. Joints shall point down and shall be sealed with either adhesive or caulking (except for periodic slip joints).
9. Underground piping: Follow instructions for above ground piping but the vapor retarder jacketing shall be 6 mil thick PVDC or minimum 30 mil thick rubberized bituminous membrane. Sand bed and backfill shall be a minimum of 150 mm (6 inches) all around insulated pipe.
10. Exposed, unlined supply and return ductwork exposed to outdoor weather: 50 mm (2 inch) thick insulation faced with a multi-layer vapor barrier with a water vapor permeance of 0.00 perms.
11. Note the NFPA 90A burning characteristic requirements of 25/50 in paragraph 1.3B. Refer to paragraph 3.1 for items not to be insulated.
12. Minimum thickness in millimeter (inches) specified in the schedule at the end of this section.

G. Flexible Elastomeric Cellular Thermal Insulation:
1. Apply insulation and fabricate fittings in accordance with the manufacturer's installation instructions and finish with two coats of weather resistant finish as recommended by the insulation manufacturer.
2. Pipe and tubing insulation:
   a. To avoid undue compression of insulation, provide cork stoppers or wood inserts at supports as recommended by the insulation manufacturer. Insulation shields are specified under Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
   b. Where possible, slip insulation over the pipe or tubing prior to connection, and seal the butt joints with adhesive. Where the slip-on technique is not possible, slit the insulation and apply it to the pipe sealing the seam and joints with contact adhesive. Optional tape sealing, as recommended by the manufacturer, may be employed. Make changes from mineral fiber insulation in a straight run of pipe, not at a fitting. Seal joint with tape.
3. Apply sheet insulation to flat or large curved surfaces with 100 percent adhesive coverage. For fittings and large pipe, apply adhesive to seams only.
4. Pipe insulation: nominal thickness in millimeters (inches as specified in the schedule at the end of this section.
5. Minimum 20 mm (0.75 inch) thick insulation for pneumatic control lines for a minimum distance of 6 m (20 feet) from discharge side of the refrigerated dryer.
6. Use Class S (Sheet), 20 mm (3/4 inch) thick for the following:
   a. Chilled water pumps
   b. Bottom and sides of metal basins for winterized cooling towers (where basin water is heated).
   c. Chillers, insulate any cold chiller surfaces subject to condensation which has not been factory insulated.
   d. Piping inside refrigerators and freezers: Provide heat tape under insulation.
7. Exposed, unlined supply and return ductwork exposed to outdoor weather: 50 mm (2 inch) thick insulation faced with a multi-layer vapor barrier with a water vapor permeance of 0.00 perms.

H. Duct Wrap for Kitchen Hood Grease Ducts:
1. The insulation thickness, layers and installation method shall be as per recommendations of the manufacturer to maintain the fire integrity and performance rating.
2. Provide stainless steel jacket for all exterior and exposed interior ductwork.

I. Calcium Silicate:
   1. Minimum thickness in millimeter (inches) specified in the schedule at the end of this section for piping other than in boiler plant. See paragraphs 3.3 through 3.7 for Boiler Plant Applications.
   2. Engine Exhaust Insulation for Emergency Generator and Diesel Driven Fire Pump: Type II, Class D, 65 mm (2 1/2 inch) nominal thickness. Cover exhaust completely from engine through roof or wall construction, including muffler. Secure with 16 AWG galvanized annealed wire or 0.38 x 12 mm 0.015 x 1/2 IN wide galvanized bands on 300 mm 12 IN maximum centers. Anchor wire and bands to welded pins, clips or angles. Apply 25 mm 1 IN hex galvanized wire over insulation. Fill voids with 6 mm 1/4 IN insulating cement.
   3. ETO Exhaust (High Temperature): Type II, class D, 65 mm (2.5 inches) nominal thickness. Cover duct for entire length. Provide sheet aluminum jacket for all exterior ductwork.
   4. Kitchen Exhaust Duct work: Type II, class D, 65 mm (2.5 inches) nominal thickness. Wire insulation in place with 12 gauge galvanized wire.
   5. MRI Quench Vent Insulation: Type I, class D, 150 mm (6 inch) nominal thickness.

3.3 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of section 23 08 00 – COMMISSIONING OF HVAC SYSTEMS for all inspection, start up, and contractor testing required above and required by the System Readiness Checklist provided by the Commissioning Agent.

B. Components provided under this section of the specification will be tested as part of a larger system. Refer to section 23 08 00 – COMMISSIONING OF HVAC SYSTEMS and related sections for contractor responsibilities for system commissioning.

3.4 PIPE INSULATION SCHEDULE

A. Provide insulation for piping systems as scheduled below:

Insulation Wall Thickness Millimeters (Inches)					
		Nominal Pipe Size Millimeters (Inches)			
Operating Temperature Range/Service	Insulation Material	Less than 25 (1)	25 – 32 (1 – 1¼)	38 – 75 (1½ - 3)	100 (4) and Above
	Insulation Wall Thickness Millimeters (Inches)				
122-177 degrees C (251-350 degrees F) (HPS, MPS)	Mineral Fiber (Above ground piping only)	75 (3)	100 (4)	113 (4.5)	113 (4.5)
93-260 degrees C (200-500 degrees F) (HPS, HPR)	Calcium Silicate	100 (4)	125 (5)	150 (6)	150 (6)
100-121 degrees C (212-250 degrees F) (HPR, MPR, LPS, vent piping from PRV Safety Valves, Condensate receivers and flash tanks)	Mineral Fiber (Above ground piping only)	62 (2.5)	62 (2.5)	75 (3.0)	75 (3.0)
100-121 degrees C (212-250 degrees F) (HPR, MPR, LPS, vent piping from PRV Safety Valves, Condensate receivers and flash tanks)	Rigid Cellular Phenolic Foam	50 (2.0)	50 (2.0)	75 (3.0)	75 (3.0)
38-94 degrees C (100-200 degrees F)	Mineral Fiber (Above ground piping only)	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)

(LPR, PC, HWH, HWHR, GH and GHR)					
38-99 degrees C (100-211 degrees F) (LPR, PC, HWH, HWHR, GH and GHR)	Rigid Cellular Phenolic Foam	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
39-99 degrees C (100-211 degrees F) (LPR, PC, HWH, HWHR, GH and GHR)	Polyiso-cyanurate Closed-Cell Rigid (Exterior Locations only)	38 (1.5)	38 (1.5)	----	----
38-94 degrees C (100-200 degrees F) (LPR, PC, HWH, HWHR, GH and GHR)	Flexible Elastomeric Cellular Thermal (Above ground piping only)	38 (1.5)	38 (1.5)	----	----
4-16 degrees C (40-60 degrees F) (CH, CHR, GC, GCR and RS/RL for DX refrigeration)	Rigid Cellular Phenolic Foam	38 (1.5)	38 (1.5)	38 (1.5)	38 (1.5)
4-16 degrees C (40-60 degrees F) (CH and CHR within chiller room and pipe chase and underground)	Cellular Glass Closed-Cell	50 (2.0)	50 (2.0)	75 (3.0)	75 (3.0)
4-16 degrees C (40-60 degrees F) (CH, CHR, GC, GCR and RS/RL for DX refrigeration)	Cellular Glass Closed-Cell	38 (1.5)	38 (1.5)	38 (1.5)	38 (1.5)
4-16 degrees C (40-60 degrees F) (CH, CHR, GC and GCR (where underground)	Polyiso-cyanurate Closed-Cell Rigid	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
4-16 degrees C (40-60 degrees F) (CH, CHR, GC, GCR and RS/RL for DX refrigeration)	Polyiso-cyanurate Closed-Cell Rigid (Exterior Locations only)	38 (1.5)	38 (1.5)	38 (1.5)	38 (1.5)
(40-60 degrees F) (CH, CHR, GC, GCR and RS/RL for DX refrigeration)	Flexible Elastomeric Cellular Thermal (Above ground piping only)	38 (1.5)	38 (1.5)	38 (1.5)	38 (1.5)

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SECTION 23 08 00
COMMISSIONING OF HVAC SYSTEMS

1.GENERAL

1.1 DESCRIPTION

A. The requirements of this Section apply to all sections of Division 23.

B. This project will have selected building systems commissioned. The complete list of equipment and systems to be commissioned is specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS. The commissioning process, which the Contractor is responsible to execute, is defined in Section 01 91 00 GENERAL COMMISSIONING REQUIRMENTS. A Commissioning Agent (CxA) appointed by the VA will manage the commissioning process.

1.2 RELATED WORK

A. Section 01 00 00 GENERAL REQUIREMENTS.

B. Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

D. Section 23 05 41 NOISE AND VIBRATION CONTROL for HVAC PIPING AND EQUIPMENT.

E. Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC.

F. Section 23 09 23 DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

1.3 SUMMARY

A. This Section includes requirements for commissioning the HVAC systems of the related subsystems and equipment. This Section supplements the general requirements specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

B. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for more details regarding processes and procedures as well as roles and responsibilities for all Commissioning Team members.

1.4 DEFINITIONS

A. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for definitions.

1.5 COMMISSIONED SYSTEMS

A. Commissioning of a system or systems specified in Division 23 is part of the construction process. Documentation and testing of these systems, as well as training of the VA's Operation and Maintenance personnel in accordance with the requirements of Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS and of Division 23, is required in cooperation with the VA and the Commissioning Agent.

B. The Facility HVAC systems commissioning will include the systems listed in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

1.6 SUBMITTALS

A. The commissioning process requires review of selected Submittals that pertain to the systems to be commissioned. The Commissioning Agent will provide a list of submittals that will be reviewed by the Commissioning Agent. This list will be reviewed and approved by the VA prior to forwarding to the Contractor. Refer to Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, and SAMPLES for further details.

B. The commissioning process requires Submittal review simultaneously with engineering review. Specific submittal requirements related to the commissioning process are specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

1.7 APPLICABLE PUBLICATIONS

A. The following publications form a part of this specification to the extent indicated by the reference thereto. In text the publications are referenced to by the acronym of the organization.

B. Department of Veterans Affairs (VA):
PG 18-10 2020.....–Physical Security and Resiliency Design Manual

C. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE):
HANDBOOK 2023.....HVAC Applications ASHRAE Handbook, Chapter 39, Testing, Adjusting, and Balancing, Chapter 44, HVAC Commissioning and Chapter 49, Sound and Vibration Control

HANDBOOK 2025.....HVAC Fundamentals ASHRAE Handbook, Chapter 8, Sound and Vibration

D. Associated Air Balance Council (AABC):
7th Edition 2016 .....AABC National Standards for Total System Balance

E. National Environmental Balancing Bureau (NEBB):
9th Edition 2019 .....Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems

3rd Edition 2015 .....Procedural Standards for the Measurement of Sound and Vibration

2nd Edition 2019 ... Standard for Whole Building Technical Commissioning of New Construction

F. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
006 2020... .....HVAC Duct Construction Standard – Metal and Flexible Duct

4th Edition 2023 ... HVAC Systems Testing, Adjusting and Balancing

2.PRODUCTS (NOT USED)

3.EXECUTION

3.1 CONSTRUCTION INSPECTIONS

A. Commissioning of HVAC systems will require inspection of individual elements of the HVAC systems construction throughout the construction period. The Contractor shall coordinate with the Commissioning Agent in accordance with Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS and the Commissioning plan to schedule HVAC systems inspections as required to support the Commissioning Process.

3.2 PRE-FUNCTIONAL CHECKLISTS

A. The Contractor shall complete Pre-Functional Checklists to verify systems, subsystems, and equipment installation is complete and systems are ready for Systems Functional Performance Testing. The Commissioning Agent will prepare Pre-Functional Checklists to be used to document equipment installation. Refer to Sections 23 05 41 NOISE AND VIBRATION CONTROL for HVAC PIPING AND EQUIPMENT, Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC and Section 23 09 23 DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC requirements. The Contractor shall complete the checklists. Completed checklists shall be submitted to the VA and to the Commissioning Agent for review. The Commissioning

Agent may spot check a sample of completed checklists. If the Commissioning Agent determines that the information provided on the checklist is not accurate, the Commissioning Agent will return the marked-up checklist to the Contractor for correction and resubmission. If the Commissioning Agent determines that a significant number of completed checklists for similar equipment are not accurate, the Commissioning Agent will select a broader sample of checklists for review. If the Commissioning Agent determines that a significant number of the broader sample of checklists is also inaccurate, all the checklists for the type of equipment will be returned to the Contractor for correction and resubmission. Refer to SECTION 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for submittal requirements for Pre-Functional Checklists, Equipment Startup Reports, and other commissioning documents.

3.3 CONTRACTORS TESTS

A. Contractor tests as required by other sections of Division 23 shall be scheduled and documented in accordance with Section 01 00 00 GENERAL REQUIREMENTS. All testing shall be incorporated into the project schedule. Contractor shall provide no less than 7 calendar days' notice of testing. The Commissioning Agent will witness selected Contractor tests at the sole discretion of the Commissioning Agent. Contractor tests shall be completed prior to scheduling Systems Functional Performance Testing.

3.4 SYSTEMS FUNCTIONAL PERFORMANCE TESTING:

A. The Commissioning Process includes Systems Functional Performance Testing that is intended to test systems functional performance under steady state conditions, to test system reaction to changes in operating conditions, and system performance under emergency conditions. The Commissioning Agent will prepare detailed Systems Functional Performance Test procedures for review and approval by the Resident Engineer. The Contractor shall review and comment on the tests prior to approval. The Contractor shall provide the required labor, materials, and test equipment identified in the test procedure to perform the tests. The Commissioning Agent will witness and document the testing. The Contractor shall sign the test reports to verify tests were performed. See Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS, for additional requirements.

3.5 TRAINING OF VA PERSONNEL

A. Training of the VA operation and maintenance personnel is required in cooperation with the Resident Engineer and Commissioning Agent. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems. Contractor shall submit training agendas and trainer resumes in accordance with the requirements of Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS. The instruction shall be scheduled in coordination with the VA Resident Engineer after submission and approval of formal training plans. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS and Division 23 Sections for additional Contractor training requirements.

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SECTION 23 09 23
DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION

A. General Contractor shall provide direct-digital control system(s) as indicated on the project documents, point list, interoperability tables, drawings and as described in these specifications. Include a complete and working direct-digital control system. Include all engineering, programming, configuration/setup hardware and software, controls and installation materials, installation labor, commissioning and startup, training, final project documentation and warranty. A System Integrator and Direct Digital Controls Contractor shall be two separate direct subcontractors of General Contractor.

1. The building management and control system shall be open protocol, Java-based, based on Niagara Framework. System architecture shall provide an open automation infrastructure capable of integrating multi-vendor systems and devices regardless of manufacturer, communication standard or software, into a single interoperable system. The system shall be capable of integration and communication with BACnet, LonWorks, and other open and legacy protocol systems and devices. All software licenses shall follow Niagara Open Compatibility statements and specifications.
2. The system shall be comprised of a network of interoperable, stand-alone digital controllers, a computer system, graphical user interface software, printers, network devices and other devices as specified. The system shall connect to the facility's local or wide area network and shall provide secure password system access via the internet and/or local area network using a standard web browser.
3. The direct-digital control system(s) shall consist of high-speed, peer-to-peer network of DDC controllers, a control system server, all configuration and setup software and hardware devices, and an Engineering Control Center. Provide a remote user using a standard HTML 5 web browser to access the control system graphics and change adjustable setpoints with the proper password.
4. All new building controllers shall be native BACnet. All new BACnet workstations, controllers, devices and components shall be listed by BACnet Testing Laboratories. All new BACnet workstations, controllers, devices and components shall be accessible using a HTML5 Web browser interface. Browsers shall not require the use of an extension or add on software in order to access aforementioned workstations, controllers, devices, and components.
   a. If used, gateways shall be BTL listed.
   b. If used, gateways shall provide all object properties and read/write services shown on VA-approved interoperability schedules.
5. The work administered by this Section of the technical specifications shall include all labor, materials, special tools, equipment, enclosures, power supplies, software, software licenses, Project specific software configurations and database entries, interfaces, wiring, tubing, installation, labeling, engineering, calibration, documentation, submittals, testing, verification, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, Warranty, specified services and any other items required for a complete and fully functional Controls System.
6. The control systems shall be designed such that each mechanical system shall operate under stand-alone mode. The A/E shall designate what each “mechanical systems” is composed of. The contractor administered by this Section of the technical specifications shall provide controllers for each mechanical system. In the event of a network communication failure, or the loss of any other controller, the control system shall continue to operate independently. Failure of the ECC shall have no effect on the field controllers, including those involved with global strategies.

7. The control system shall accommodate 2 Engineering Control Center(s) and the control system shall accommodate 20 web-based Users simultaneously, and the access to the system should be limited only by operator password.

B. Some products are furnished but not installed by the contractor administered by this Section of the technical specifications. The contractor administered by this Section of the technical specifications shall formally coordinate in writing and receive from other contractors formal acknowledgements in writing prior to submission the installation of the products. These products include but are not limited to the following:
   1. Control valves.
   2. Flow switches.
   3. Flow meters.
   4. Sensor wells and sockets in piping.
   5. Terminal unit controllers.

C. Some products are installed but not furnished by the contractor administered by this Section of the technical specifications. The contractor administered by this Section of the technical specifications shall formally coordinate in writing and receive from other contractors formal acknowledgements in writing prior to submission the procurement of the products. These products include but are not limited to the following:
   1. Factory-furnished accessory thermostats and sensors furnished with unitary equipment.

D. Some products are not provided by, but are nevertheless integrated with the work executed by, the contractor administered by this Section of the technical specifications. These products include but are not limited to the following:
   1. Fire alarm systems. If zoned fire alarm is required by the project-specific requirements, this interface shall require multiple relays, which are provided and installed by the fire alarm system contractor, to be monitored.
   2. Advanced utility metering systems. These systems may take information from the control system or its component meters and sensors.
   3. Chiller controls. These controls, if not native BACnet, will require a BACnet Gateway.
   4. Terminal units' velocity sensors
   5. Unitary HVAC equipment split systems controls. These include:
      a. Discharge temperature control.
      b. Flowrate control.
      c. Setpoint reset.
      d. Time of day indexing.
      e. Status alarm.
   6. Steam trap monitoring system: Monitoring and alarms shall be connected to the ECC via BACnet.
   7. Variable frequency drives. These controls, if not native BACnet, will require a BACnet Gateway.
   8. The following systems have limited control (as individually noted below) from the ECC:
      a. Constant temperature rooms: temperature out of acceptable range and status alarms.
      b. Emergency generators: status alarms.
      c. Domestic water heating systems: low temperature, high temperature and status alarms.
      d. Building lighting systems: on/off and scene control.
      e. Isolation rooms: pressure outside of acceptable limit alarms.

E. Responsibility Table:

Work/Item/System	Furnish	Install	Low Voltage Wiring	Line Power
Control system low voltage and communication wiring	23 09 23	23 09 23	23 09 23	N/A
Terminal units	23	23	N/A	26
Controllers for terminal units	23 09 23	23	23 09 23	16
LAN conduits and raceway	23 09 23	23 09 23	N/A	N/A
Automatic dampers (not furnished with equipment)	23 09 23	23	N/A	N/A
Automatic damper actuators	23 09 23	23 09 23	23 09 23	23 09 23
Manual valves	23	23	N/A	N/A
Automatic valves	23 09 23	23	23 09 23	23 09 23
Pipe insertion devices and taps, flow and pressure stations.	23	23	N/A	N/A
Thermowells	23 09 23	23	N/A	N/A
Current Switches	23 09 23	23 09 23	23 09 23	N/A
Control Relays	23 09 23	23 09 23	23 09 23	N/A
Power distribution system monitoring interfaces	23 09 23	23 09 23	23 09 23	26
Interface with chiller/boiler controls	23 09 23	23 09 23	23 09 23	26
Chiller controls interface with control system	23	23	23 09 23	26
All control system nodes, equipment, housings, enclosures and panels.	23 09 23	23 09 23	23 09 23	26
Smoke detectors	28 31 00	28 31 00	28 31 00	28 31 00
Fire/Smoke Dampers	23	23	28 31 00	28 31 00
Smoke Dampers	23	23	28 31 00	28 31 00
Fire Dampers	23	23	N/A	N/A
Chiller/starter interlock wiring	N/A	N/A	26	26
Chiller Flow Switches	23	23	23	N/A
Water treatment system	23	23	23	26
VFDs	23	26	23 09 23	26
Fire Alarm shutdown relay interlock wiring	28	28	28	26
Control system monitoring of fire alarm smoke control relay	28	28	23 09 23	28
Fan Coil Unit controls (not furnished with equipment)	23 09 23	23 09 23	23 09 23	26

Work/Item/System	Furnish	Install	Low Voltage Wiring	Line Power
Unit Heater controls (not furnished with equipment)	23 09 23	23 09 23	23 09 23	26
Steam Trap Monitoring not in Boiler Plant	23 22 13	23 22 13	26	26

F. Integrate the existing facility's controls into the new DDC system. The contractor administered by this Section of the technical specifications shall observe the capabilities, communication network, services, spare capacity of the existing control system and its ECC prior to beginning work.
   1. Provide a new BACnet Niagara ECC, communications network, and controllers. Provide a programmable internetworking gateway allowing for real-time communication between the existing direct-digital control system and the new BACnet control system. Real-time communication shall provide all object properties and read/write services shown on VA-approved interoperability schedules. The contractor administered by this Section of the technical specifications shall provide all necessary investigation and site-specific programming to execute the interoperability schedules.
      a. The combined system shall operate and function as one complete system including one database of control point objects and global control logic capabilities. Facility operators shall have complete operations and control capability over all systems, new and existing including; monitoring, trending, graphing, scheduling, alarm management, global point sharing, global strategy deployment, graphical operations interface and custom reporting as specified.

G. Unitary standalone systems including Unit Heaters, Cabinet Unit Heaters, Fan Coil Units, Base Board Heaters, thermal comfort ventilation fans, and similar units for control of room environment conditions may be equipped with integral controls furnished and installed by the equipment manufacturer or field mounted. Refer to equipment specifications and as indicated in project documents. Application of standalone unitary controls is limited to at least those systems wherein remote monitoring, alarm and startup are not necessary. Examples of such systems include:
   1. Exterior stair heater
   2. Attic heating and ventilation
   3. Mechanical or electrical room heating and ventilation.

H. The direct-digital control system shall start and stop equipment, move (position) damper actuators and valve actuators, and vary speed of equipment to execute the mission of the control system. Use electricity as the motive force for all damper and valve actuators, unless use of pneumatics as motive force is specifically granted in writing by the VA.

1.2 RELATED WORK

A. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

B. Section 23 21 13, Hydronic Piping.

C. Section 23 22 13, Steam and Condensate Heating Piping.

D. Section 23 31 00, HVAC Ducts and Casings.

E. Section 23 36 00, Air Terminal Units.

F. Section 23 38 13, Commercial-Kitchen Hoods.

G. Section 23 64 00, Packaged Water Chillers.

H. Section 23 73 00, Indoor Central-Station Air-Handling Units.

I. Section 23 81 00, Decentralized Unitary HVAC Equipment.

J. Section 23 81 43, Air-Source Unitary Heat Pumps.

K. Section 26 05 11, Requirements for Electrical Installations.

L. Section 26 05 19, Low-Voltage Electrical Power Conductors and Cables (600 Volts and Below).

M. Section 26 05 26, Grounding and Bonding for Electrical Systems.

N. Section 26 05 33, Raceway and Boxes for Electrical Systems.

O. Section 26 09 23, Lighting Controls.

P. Section 26 27 26, Wiring Devices.

Q. Section 26 29 11, Motor Starters.

R. Section 27 15 00, Communications Horizontal Cabling

S. Section 28 31 00, Fire Detection and Alarm.

1.3 DEFINITION

A. Algorithm: A logical procedure for solving a recurrent mathematical problem; A prescribed set of well-defined rules or processes for the solution of a problem in a finite number of steps.

B. Analog: A continuously varying signal value (e.g., temperature, current, velocity etc.

C. BACnet: A Data Communication Protocol for Building Automation and Control Networks -as defined by ANSI/ASHRAE Standard 135. This communications protocol allows diverse building automation devices to communicate data and services over a network.

D. BACnet/IP: Annex J of Standard 135. It defines and allows for using a reserved UDP socket to transmit BACnet messages over IP networks. A BACnet/IP network is a collection of one or more IP sub-networks that share the same BACnet network number.

E. BACnet Internetwork: Two or more BACnet networks connected with routers. The two networks may use different LAN technologies.

F. BACnet Network: One or more BACnet segments that have the same network address and are interconnected by bridges at the physical and data link layers.

G. BACnet Segment: One or more physical segments of BACnet devices on a BACnet network, connected at the physical layer by repeaters.

H. BACnet Broadcast Management Device (BBMD): A communications device which broadcasts BACnet messages to all BACnet/IP devices and other BBMDs connected to the same BACnet/IP network.

I. BACnet Interoperability Building Blocks (BIBBs): BACnet Interoperability Building Blocks (BIBBs) are collections of one or more BACnet services. These are prescribed in terms of an "A" and a "B" device. Both of these devices are nodes on a BACnet internetwork.

J. BACnet Testing Laboratories (BTL). The organization responsible for testing products for compliance with the BACnet standard, operated under the direction of BACnet International.

K. Baud: It is a signal change in a communication link. One signal change can represent one or more bits of information depending on type of transmission scheme. Simple peripheral communication is normally one bit per Baud. (e.g., Baud rate = 78,000 Baud/sec is 78,000 bits/sec, if one signal change = 1 bit).

L. Binary: A two-state system where a high signal level represents an "ON" condition and an "OFF" condition is represented by a low signal level.

M. BMP or bmp: Suffix, computerized image file, used after the period in a DOS-based computer file to show that the file is an image stored as a series of pixels.

N. Bus Topology: A network topology that physically interconnects workstations and network devices in parallel on a network segment.

O. Control Unit (CU): Generic term for any controlling unit, stand-alone, microprocessor based, digital controller residing on secondary LAN or Primary LAN, used for local controls or global controls

P. Deadband: A temperature range over which no heating or cooling is supplied, i.e., 22-25 degrees C (72-78 degrees F), as opposed to a single point change over or overlap).

Q. Device: a control system component that contains a BACnet Device Object and uses BACnet to communicate with other devices.

R. Device Object: Every BACnet device requires one Device Object, whose properties represent the network visible properties of that device. Every Device Object requires a unique Object Identifier number on the BACnet internetwork. This number is often referred to as the device instance.

S. Device Profile: A specific group of services describing BACnet capabilities of a device, as defined in ASHRAE Standard 135, Annex L. Standard device profiles include BACnet Operator Workstations (B-OWS), BACnet Building Controllers (B-BC), BACnet Advanced Application Controllers (B-AAC), BACnet Application Specific Controllers (B-ASC), BACnet Smart Actuator (B-SA), and BACnet Smart Sensor (B-SS). Each device used in new construction is required to have a PICS statement listing which service and BIBBs are supported by the device.

T. Diagnostic Program: A software test program, which is used to detect and report system or peripheral malfunctions and failures. Generally, this system is performed at the initial startup of the system.

U. Direct Digital Control (DDC): Microprocessor based control including Analog/Digital conversion and program logic. A control loop or subsystem in which digital and analog information is received and processed by a microprocessor, and digital control signals are generated based on control algorithms and transmitted to field devices in order to achieve a set of predefined conditions.

V. Distributed Control System: A system in which the processing of system data is decentralized and control decisions can and are made at the subsystem level. System operational programs and information are provided to the remote subsystems and status is reported back to the Engineering Control Center. Upon the loss of communication with the Engineering Control center, the subsystems shall be capable of operating in a stand-alone mode using the last best available data.

W. Download: The electronic transfer of programs and data files from a central computer or operation workstation with secondary memory devices to remote computers in a network (distributed) system.

X. DXF: An AutoCAD 2-D graphics file format. Many CAD systems import and export the DXF format for graphics interchange.

Y. Electrical Control: A control circuit that operates on line or low voltage and uses a mechanical means, such as a temperature sensitive bimetal or bellows, to perform control functions, such as actuating a switch or positioning a potentiometer.

Z. Electronic Control: A control circuit that operates on low voltage and uses a solid-state components to amplify input signals and perform control functions, such as operating a relay or providing an output signal to position an actuator.

AA. Engineering Control Center (ECC): The centralized control point for the intelligent control network. The ECC comprises of personal computer and connected devices to form a single workstation.

BB. Ethernet: A trademark for a system for exchanging messages between computers on a local area network using coaxial, fiber optic, or twisted-pair cables.

CC. Firmware: Firmware is software programmed into read only memory (ROM) chips. Software may not be changed without physically altering the chip.

DD. Gateway: Communication hardware connecting two or more different protocols. It translates one protocol into equivalent concepts for the other protocol. In BACnet applications, a gateway has BACnet on one side and non-BACnet (usually proprietary) protocols on the other side.

EE. GIF: Abbreviation of Graphic interchange format.

FF. Graphic Program (GP): Program used to produce images of air handler systems, fans, chillers, pumps, and building spaces. These images can be animated and/or color-coded to indicate operation of the equipment.

GG. Graphic Sequence of Operation: It is a graphical representation of the sequence of operation, showing all inputs and output logical blocks.

HH. I/O Unit: The section of a digital control system through which information is received and transmitted. I/O refers to analog input (AI, digital input (DI), analog output (AO) and digital output (DO). Analog signals are continuous and represent temperature, pressure, flow rate etc., whereas digital signals convert electronic signals to digital pulses (values), represent motor status, filter status, on-off equipment etc.

II. I/P: a method for conveying and routing packets of information over LAN paths. User Datagram Protocol (UDP) conveys information to “sockets” without confirmation of receipt. Transmission Control Protocol (TCP) establishes "sessions", which have end-to-end confirmation and guaranteed sequence of delivery.

JJ. JPEG: A standardized image compression mechanism stands for Joint Photographic Experts Group, the original name of the committee that wrote the standard.

KK. Local Area Network (LAN): A communication bus that interconnects operator workstation and digital controllers for peer-to-peer communications, sharing resources and exchanging information.

LL. Network Repeater: A device that receives data packet from one network and rebroadcasts to another network. No routing information is added to the protocol.

MM. MS/TP: Master-slave/token-passing (ISO/IEC 8802, Part 3). It uses twisted-pair wiring for relatively low speed and low cost communication.

NN. Native BACnet Device: A device that uses BACnet as its primary method of communication with other BACnet devices without intermediary gateways. A system that uses native BACnet devices at all levels is a native BACnet system.

OO. Network Number: A site-specific number assigned to each network segment to identify for routing. This network number must be unique throughout the BACnet internetwork.

PP. Object: The concept of organizing BACnet information into standard components with various associated properties. Examples include analog input objects and binary output objects.

QQ. Object Identifier: An object property used to identify the object, including object type and instance. Object Identifiers must be unique within a device.

RR. Object Properties: Attributes of an object. Examples include present value and high limit properties of an analog input object. Properties are defined in ASHRAE 135; some are optional and some are required. Objects are controlled by reading from and writing to object properties.

SS. Operating system (OS): Software, which controls the execution of computer application programs.

TT. PCX: File type for an image file. When photographs are scanned onto a personal computer they can be saved as PCX files and viewed or changed by a special application program as Photo Shop.

UU. Peripheral: Different components that make the control system function as one unit. Peripherals include monitor, printer, and I/O unit.

VV. Peer-to-Peer: A networking architecture that treats all network stations as equal partners- any device can initiate and respond to communication with other devices.

WW. PICS: Protocol Implementation Conformance Statement, describing the BACnet capabilities of a device. All BACnet devices have published PICS.

XX. PID: Proportional, integral, and derivative control, used to control modulating equipment to maintain a setpoint.

YY. Repeater: A network component that connects two or more physical segments at the physical layer.

ZZ. Router: a component that joins together two or more networks using different LAN technologies. Examples include joining a BACnet Ethernet LAN to a BACnet MS/TP LAN.

AAA. Sensors: devices measuring state points or flows, which are then transmitted back to the DDC system.

BBB. Thermostats : devices measuring temperatures, which are used in control of standalone or unitary systems and equipment not attached to the DDC system.

1.4 QUALITY ASSURANCE

A. Criteria:

1. Single Source Responsibility of subcontractor: Either the DDC Contractor or the System Integrator shall obtain hardware and software supplied under this Section and delegate the responsibility to a single source controls installation subcontractor. The Integration subcontractor shall be responsible for the complete design, installation, integration, and commissioning of the system. The controls subcontractor shall be in the business of design, installation and service of such building automation control systems similar in size and complexity.
2. Equipment and Materials: Equipment and materials shall be cataloged products of manufacturers regularly engaged in production and installation of HVAC control systems. Products shall be manufacturer's latest standard design and have been tested and proven in actual use.
3. The controls subcontractor shall provide a list of no less than five similar projects which have building control systems as specified in this Section. These projects must be on-line and functional such that the Department of Veterans Affairs (VA) representative could observe the control systems in full operation.
4. The controls subcontractor shall have an in-place facility within 50 miles with technical staff, spare parts inventory for the next five (5) years, and necessary test and diagnostic equipment to support the control systems.
5. The controls subcontractor shall have minimum of three years of experience in design and installation of building automation systems similar in performance to those specified in this Section. Provide evidence of experience by submitting resumes of the project manager, the local branch manager, project engineer, the application engineering staff, and the electronic technicians who would be involved with the supervision, the engineering, and the installation of the control systems. Training and experience of these personnel shall not be less than three years. Failure to disclose this information will be a ground for disqualification of the supplier.
6. Provide a competent and experienced Project Manager employed by the Controls Contractor. The Project Manager shall be supported as necessary by other Contractor employees in order to provide professional engineering, technical and management service for the work. The Project Manager shall attend scheduled Project Meetings as required and shall be empowered to make technical, scheduling and related decisions on behalf of the Controls Contractor.

B. Codes and Standards:

1. All work shall conform to the applicable Codes and Standards.
2. Electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Governing Radio Frequency Electromagnetic Interference, and be so labeled.

1.5 PERFORMANCE

A. The system shall conform to the following:
1. Graphic Display: The system shall display up to four (4) graphics on a single screen with a minimum of twenty (20) dynamic points per graphic. All current data shall be displayed within ten (10) seconds of the request.
2. Graphic Refresh: The system shall update all dynamic points with current data within eight (8) seconds. Data refresh shall be automatic, without operator intervention.
3. Object Command: The maximum time between the command of a binary object by the operator and the reaction by the device shall be two(2) seconds. Analog objects shall start to adjust within two (2) seconds.
4. Object Scan: All changes of state and change of analog values shall be transmitted over the high-speed network such that any data used or displayed at a controller or work-station will be current, within the prior six (6) seconds.
5. Alarm Response Time: The maximum time from when an object goes into alarm to when it is annunciated at the workstation shall not exceed (10) seconds.
6. Program Execution Frequency: Custom and standard applications shall be capable of running as often as once every (5) seconds. The Contractor shall be responsible for selecting execution times consistent with the mechanical process under control.
7. Multiple Alarm Annunciations: All workstations on the network shall receive alarms within five (5) seconds of each other.
8. Performance: Programmable Controllers shall be able to execute DDC PID control loops at a selectable frequency from at least once every one (1) second. The controller shall scan and update the process value and output generated by this calculation at this same frequency.
9. Reporting Accuracy: Listed below are minimum acceptable reporting end-to-end accuracies for all values reported by the specified system:

Measured Variable	Reported Accuracy
Space temperature	±0.5 degrees C (±1 degrees F)
Ducted air temperature	±0.5 degrees C [±1 degrees F]
Outdoor air temperature	±1.0 degrees C [±2 degrees F]
Dew Point	±1.5 degrees C [±3 degrees F]
Water temperature	±0.5 degrees C [±1 degrees F]
Relative humidity	±2 percent RH
Water flow	±1 percent of reading
Air flow (terminal)	±10 percent of reading
Air flow (measuring stations)	±5 percent of reading
Carbon Monoxide (CO)	±5 percent of reading
Carbon Dioxide (CO_2)	±50 ppm
Air pressure (ducts)	±25 Pa [±0.1 inch wg]
Air pressure (space)	±0.3 Pa [±0.001 inch wg]
Water pressure	±2 percent of full scale *Note 1
Electrical Power	±0.5 percent of reading

Note 1: for both absolute and differential pressure

10. Control stability and accuracy: Control sequences shall maintain measured variable at setpoint within the following tolerances:

Controlled Variable	Control Accuracy	Range of Medium
Air Pressure	±50 Pa (±0.2 inch wg)	0–1.5 kPa (0–6 inch wg)
Air Pressure	±3 Pa (±0.01 inch wg)	-25 to 25 Pa (-0.1 to 0.1 inch wg)
Airflow	±10 percent of full scale	
Space Temperature	±1.0ºC (±2.0 degrees F)	
Duct Temperature	±1.5ºC (±3 degrees F)	
Humidity	±5 percent RH	MRI, SPS, PHARMACY
Fluid Pressure	±10 kPa (±1.5 psig)	0–1 MPa (1–150 psig)
Fluid Pressure	±250 Pa (±1.0 inch wg)	0–12.5 kPa (0–50 inch wg) differential

11. Extent of direct digital control: control design shall allow for at least the points indicated on the points lists on the drawings.

1.6 WARRANTY

A. Labor and materials for control systems shall be warranted for a period as specified under Warranty in FAR clause 52.246-21.

B. Control system failures during the warranty period shall be adjusted, repaired, or replaced at no cost or reduction in service to the owner. The system includes all computer equipment, transmission equipment, and all sensors and control devices.

C. The on-line support service shall allow the Controls supplier to dial out over telephone lines to or connect via (through password-limited access) VPN through the internet to monitor and control the facility's building automation system. This remote connection to the facility shall be within two (2) hours of the time that the problem is reported. This coverage shall include normal business hours, after business hours, weekend and holidays. If the problem cannot be resolved with on-line support services, the Controls supplier shall dispatch the qualified personnel to the job site to resolve the problem within 8 hours after the problem is reported.

D. Controls subcontractor shall be responsible for temporary operations and maintenance of the control systems during the construction period until final commissioning, training of facility operators and acceptance of the project by VA.

1.7 SUBMITTALS

A. Submit shop drawings in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC", with applicable paragraph identification.

C. Manufacturer's Literature and Data Including:

1. A wiring diagram for each type of input device and output device including DDC controllers, modems, repeaters, etc. Diagram shall show how the device is wired and powered, showing typical connections at the digital controllers and each power supply, as well as the device itself. Show for all field connected devices, including but not limited to,

control relays, motor starters, electric or electronic actuators, and temperature pressure, flow and humidity sensors and transmitters.

2. A diagram of each terminal strip, including digital controller terminal strips, terminal strip location, termination numbers and the associated point names.
3. Control dampers and control valves schedule, including the size and pressure drop.
4. Control air-supply components, and computations for sizing compressors, receivers and main air-piping, if pneumatic controls are furnished.
5. Catalog cut sheets of all equipment used. This includes, but is not limited to software (by manufacturer and by third parties), DDC controllers, panels, peripherals, airflow measuring stations and associated components, and auxiliary control devices such as sensors, actuators, and control dampers. When manufacturer's cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted. Each submitted piece of literature and drawings should clearly reference the specification and/or drawings that it supposed to represent.
6. Sequence of operations for each system and the associated control diagrams. Equipment and control labels shall correspond to those shown on the drawings.
7. Color prints of proposed graphics with a list of points for display.
8. Furnish a BACnet Protocol Implementation Conformance Statement (PICS) for each BACnet-compliant device.
9. Schematic wiring diagrams for all control, communication and power wiring. Provide a schematic drawing of the central system installation. Label all cables and ports with computer manufacturers' model numbers and functions. Show all interface wiring to the control system.
10. An instrumentation list for each controlled system. Each element of the controlled system shall be listed in table format. The table shall show element name, type of device, manufacturer, model number, and product data sheet number.
11. Riser diagrams of wiring between central control unit (CCU) and all control panels.
12. Plan drawings showing routing of LAN and locations of control panels, controllers, routers, gateways, ECC, and larger controlled devices.
13. Construction details for all installed conduit, cabling, raceway, cabinets, and similar. Construction details of all penetrations and their protection.
14. Quantities of submitted items may be reviewed but it is the responsibility of the contractor administered by this Section of the technical specifications to provide sufficient quantities for a complete and working system.

D. Product Certificates: Compliance with Article, QUALITY ASSURANCE.

E. Validation Test Plan: Along with manufacturer's literature, product certificates, wiring and functional diagrams, and sequence of operations, submit for review and approval a Validation Test Plan which is specific to the work of this project and which references the specific controls component nomenclatures found in the control contractor's wiring and functional diagrams and the specific sequences of controls for this project and which describes how the contractor will implement the controls system validation and demonstration as specified in paragraph 3.2 SYSTEM VALIDATION AND DEMONSTRATION found in this section.

F. Licenses: Provide licenses for all software residing on and used by the Controls Systems, ECC, and portable OWS and transfer these licenses to the Owner prior to completion.

G. As Built Control Drawings:
1. Furnish three (3) copies of as-built drawings for each control system. The documents shall be submitted for approval prior to final completion.
2. Furnish one (1) set of applicable control system prints for each mechanical system for wall mounting. The documents shall be submitted for approval prior to final completion.
3. Furnish one (1) CD-ROM in CAD DWG and/or .DXF format for the drawings noted in subparagraphs above.

H. Operation and Maintenance (O/M) Manuals):

1. Submit in accordance with Article, INSTRUCTIONS, in Specification Section 01 00 00, GENERAL REQUIREMENTS.
2. Include the following documentation:
   a. General description and specifications for all components, including logging on/off, alarm handling, producing trend reports, overriding computer control, and changing set points and other variables.
   b. Detailed illustrations of all the control systems specified for ease of maintenance and repair/replacement procedures, and complete calibration procedures.
   c. One copy of the final version of all software provided including operating systems, programming language, operator workstation software, and graphics software.
   d. Complete troubleshooting procedures and guidelines for all systems.
   e. Complete operating instructions for all systems.
   f. Recommended preventive maintenance procedures for all system components including a schedule of tasks for inspection, cleaning and calibration. Provide a list of recommended spare parts needed to minimize downtime.
   g. Training Manuals: Submit the course outline and training material to the Owner for approval three (3) weeks prior to the training to VA facility personnel. These persons will be responsible for maintaining and the operation of the control systems, including programming. The Owner reserves the right to modify any or all of the course outline and training material.
   h. Licenses, guaranty, and other pertaining documents for all equipment and systems.

I. Submit Performance Report to COR prior to final inspection.

1.8 INSTRUCTIONS

A. Instructions to VA operations personnel: Perform in accordance with Article, INSTRUCTIONS, in Specification Section 01 00 00, GENERAL REQUIREMENTS, and as noted below. Contractor shall also video tape instruction sessions noted below.
   1. First Phase: Formal instructions to the VA facilities personnel for a total of 48 hours, given in multiple training sessions (each no longer than four hours in length), conducted sometime between the completed installation and prior to the performance test period of the control system, at a time mutually agreeable to the Contractor and the VA.
   2. Second Phase: This phase of training shall comprise of on the job training during startup, checkout period, and performance test period. VA facilities personnel will work with the Contractor's installation and test personnel on a daily basis during startup and checkout period. During the performance test period, controls subcontractor will provide 48 hours of instructions, given in multiple training sessions (each no longer than four hours in length), to the VA facilities personnel.
   3. The O/M Manuals shall contain approved submittals as outlined in Article 1.7, SUBMITTALS. The Controls subcontractor will review the manual contents with VA facilities personnel during second phase of training.
   4. Training shall be given by direct employees of THE CONTROLS system subcontractor.

1.9 PROJECT CONDITIONS (ENVIRONMENTAL CONDITIONS OF OPERATION)

A. The ECC and peripheral devices and system support equipment shall be designed to operate in ambient condition of 20 to 35 degrees C (65 to 90 degrees F) at a relative humidity of 20 to 80 percent non-condensing.

B. The Controllers used outdoors shall be mounted in NEMA 4 waterproof enclosures, and shall be rated for operation at –40 to 65 degrees C (-40 to 150 degrees F).

C. All electronic equipment shall operate properly with power fluctuations of plus 10 percent to minus 15 percent of nominal supply voltage.

D. Sensors and controlling devices shall be designed to operate in the environment, which they are sensing or controlling.

1.10 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards will govern. The latest edition as of the specification issue date shall govern.

B. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE):
135 ..... BACnet A Data Communication Protocol for Building Automation and Control Networks

147 ..... Reducing the Release of Halogenated Refrigerants from Refrigerating and Air-Conditioning Equipment and Systems

C. Federal Communication Commission (FCC):
Rules and Regulations Title 47 Chapter 1-2014 Part 15: Radio Frequency Devices

D. Institute of Electrical and Electronic Engineers (IEEE):
802.3 ..... Standard for Ethernet

E. National Fire Protection Association (NFPA):
70 ..... National Electric Code

PART 2 - PRODUCTS

2.1 MATERIALS

A. Use new products that the manufacturer is currently manufacturing and that have been installed in a minimum of 25 installations. Spare parts shall be available for at least five years after completion of this contract.

2.2 CONTROLS SYSTEM ARCHITECTURE

A. General
1. The Controls Systems shall consist of multiple Nodes and associated equipment connected by industry standard digital and communication network arrangements.
2. The ECC, building controllers and principal communications network equipment shall be standard products of recognized major manufacturers available through normal PC and computer vendor channels – not "Clones" assembled by a third-party subcontractor.
3. The networks shall, at minimum, comprise, as necessary, the following:
   a. A fixed ECC and a portable operator’s terminal.
   b. Network computer processing, data storage and BACnet-compliant communication equipment including Servers and digital data processors.
   c. BACnet-compliant routers, bridges, switches, hubs, modems, gateways, interfaces and similar communication equipment.
   d. Active processing BACnet-compliant building controllers connected to other BACnet-compliant controllers together with their power supplies and associated equipment.
   e. Addressable elements, sensors, transducers and end devices.
   f. Third-party equipment interfaces and gateways as described and required by the Contract Documents.
   g. Other components required for a complete and working Control Systems as specified.

B. The Specifications for the individual elements and component subsystems shall be minimum requirements and shall be augmented as necessary by the Contractor to achieve both compliance with all applicable codes, standards, and to meet all requirements of the Contract Documents.

C. Network Architecture

1. The Controls communication network shall utilize BACnet communications protocol operating over a standard Ethernet LAN and operate at a minimum speed of 100 Mb/sec.
2. The networks shall utilize only copper and optical fiber communication media as appropriate and shall comply with applicable codes, ordinances and regulations.
3. All necessary telephone lines, ISDN lines and internet Service Provider services and connections will be provided by the VA.

D. Third Party Interfaces:
1. The contractor administered by this Section of the technical specifications shall include necessary hardware, equipment, software and programming to allow data communications between the controls systems and building systems supplied by other trades.
2. Other manufacturers and contractors supplying other associated systems and equipment shall provide their necessary hardware, software and startup at their cost and shall cooperate fully with the contractor administered by this Section of the technical specifications in a timely manner and at their cost to ensure complete functional integration.

E. Servers:
1. Provide data storage server(s) to archive historical data including trends, alarm and event histories and transaction logs.
2. Equip these server(s) with the same software tool set that is located in the BACnet building controllers for system configuration and custom logic definition and color graphic configuration.
3. Access to all information on the data storage server(s) shall be through the same browser functionality used to access individual nodes. When logged onto a server the operator will be able to also interact with any other controller on the control system as required for the functional operation of the controls systems. The contractor administered by this Section of the technical specifications shall provide all necessary digital processor programmable data storage server(s).
4. These server(s) shall be utilized for controls systems application configuration, for archiving, reporting and trending of data, for operator transaction archiving and reporting, for network information management, for alarm annunciation, for operator interface tasks, for controls application management and similar.

2.3 COMMUNICATION

A. Control products, communication media, connectors, repeaters, hubs, and routers shall comprise a BACnet internetwork. Controller and operator interface communication shall conform to ANSI/ASHRAE Standard 135, BACnet.
1. The Data link / physical layer protocol between the ECC and all B-BC's (for communication) acceptable to the VA throughout its facilities is Ethernet (ISO 8802-3) and BACnet/IP.
2. The MS/TP data link / physical layer protocol is prohibited to the VA in any new BACnet network or sub-network in its healthcare or lab facilities.

B. Each controller shall have a communication port for connection to an operator interface.

C. Internetwork operator interface and value passing shall be transparent to internetwork architecture.
1. An operator interface connected to a controller shall allow the operator to interface with each internetwork controller as if directly connected. Controller information such as data, status, reports, system software, and custom programs shall be viewable and editable from each internet controller.
2. Inputs, outputs, and control variables used to integrate control strategies across multiple controllers shall be readable by each controller on the internetwork. Program and test all cross-controller links required to execute specified control system operation. An authorized operator shall be able to edit cross-controller links by typing a standard object address.

D. System shall be expandable to at least twice the required input and output objects with additional controllers, associated devices, and wiring. Expansion shall not require operator interface hardware additions or software revisions.

E. ECCs and Controllers with real-time clocks shall use the BACnet Time Synchronization service. The system shall automatically synchronize system clocks daily from an operator-designated device via the internetwork. The system shall automatically adjust for daylight savings and standard time as applicable.

2.4 ENGINEERING CONTROL CENTER (ECC)

A. The ECC shall reside on a high-speed network with controllers as shown on system drawings. The ECC and each standard browser connected to server shall be able to access all system information.

B. ECC and controllers shall communicate using BACnet protocol. ECC and control network backbone shall communicate using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol and BACnet/IP addressing as specified in ASHRAE/ANSI 135, BACnet Annex J.

C. Hardware: ECC shall conform to the BACnet Advanced Workstation (B-AWS) Profile and shall be BTL-Listed as a B-AWS device.
   1. ECC shall be based on commercially available server grade hardware. Computers based on desktop architectures shall not be permitted. ECC shall have remote management capabilities.
   2. Processor(s):
      a. Processors shall be either Intel Xeon or AMD EPYC chips sets designed specifically for server use. Desktop processors will not be allowed.
      b. Minimum core count shall be 16 cores. Each Core shall be capable of executing 2 threads simultaneously.
      c. Minimum base clock speed shall be 3.0 GHz
   3. Memory:
      a. Engineering Control Center shall be equipped with a minimum of 32G of DDR4 Error Correcting Code (ECC) memory. After installation of required 32G of RAM, the motherboard must still have a minimum of 2 DIMM slots open for expansion. Motherboard shall be capable of minimum of 64GB of ECC memory.
      b. Minimum speed shall be 2133MHz for memory
   4. Storage:
      a. ECC shall be equipped with a RAID capable drive controller capable of handling at least 8 internal, hot swappable drives.
      b. All installed drives shall be “Enterprise Class” drives designed specifically for server use.
      c. Minimum configuration shall consist of 6 drives in 2 separate RAID arrays:
         1) The operating system shall be stored on a RAID 1 array compromising of 2 drives with each drive having a minimum capacity of 1TB each.
         2) The B-AWS software and all its related databases shall be stored in RAID 5 array consisting of 4 drives with each drive have a minimum of 4TB capacity for a minimum storage capacity of 12TB’s.
         3) An alternative configuration for the 2 RAID arrays described above is 8 drives arrayed in a RAID 10 configuration. In this case the OS RAID array would consist of 4 drives of 1TB minimum each, and the B-AWS RAID array consisting of 4 drives of 16TB minimum each. This configuration would provide faster write times and much quicker rebuild times in the event of a drive failure.
      d. ECC will include an 16X DVD R/W drive
   5. Case:
      a. Case shall have space for a minimum of 8 hot swap 3.5 inch hard drives and one internal optical drive
      b. Real-time clock:

1) Accuracy: Plus or minus 1 minute per month.
2) Time Keeping Format: 24-hour time format including seconds, minutes, hours, date, day, and month; automatic reset by software.
3) Clock shall function for one year without power.
4) Provide automatic time correction once every 24 hours by synchronizing clock with the Time Service Department of the U.S. Naval Observatory.

c. Serial ports: Four USB ports and two RS-232-F serial ports for general use, with additional ports as required. Data transmission rates shall be selectable under program control.
d. Parallel port: Enhanced.
e. Sound card: For playback and recording of digital WAV sound files associated with audible warning and alarm functions.
f. Color monitor: PC compatible, not less than 22 inches, LCD type, with a minimum resolution of 1280 by 1024 pixels, non-interlaced, and a maximum dot pitch of 0.28 mm.
g. Keyboard: Minimum of 64 characters, standard ASCII character set based on ANSI INCITS 154.
h. Mouse: Standard, compatible with installed software.
i. Removable disk storage: Include the following, each with appropriate controller:
1) Minimum 1 TB removable hard disk, maximum average access time of 10 ms.
j. Network interface card (NIC): integrated 10-100-1000 Base-TX Ethernet NIC with an RJ45 connector or a 100Base-FX Ethernet NIC with an SC/ST connector.

6. Cable modem: 42.88 MBit/s, DOCSIS 2.0 Certified, also backwards compatible with DOCSIS 1.1/1.0 standards. Provide Ethernet or USB connectivity.
7. Optical modem: full duplex link, for use on 10 GBase-R single-mode and multi-mode fiber with a XENPAK module.
8. Audible Alarm: Manufacturer's standard.
9. Printers:
a. Provide a dedicated, minimum resolution 600 dpi, color laser printer, connected to the ECC through a USB interface.
1) If a network printer is used instead of this dedicated printer, it shall have a 100Base-T interface with an RJ45 connection and shall have a firmware print spooler compatible with the Operating System print spooler.
2) RAM: 512 MB, minimum.
3) Printing Speed: Minimum twenty-six pages per minute (color); minimum 30 pages per minute (black/white).
4) Paper Handling: Automatic sheet feeder with 250-sheet x 8.5 inch x 11 inch paper cassette and with automatic feed.
b. Provide a dedicated black/white tractor-feed dot matrix printer for status/alarm message printing, minimum 10 characters per inch, minimum 160 characters per second, connected to the ECC through a USB interface.
1) Paper: One box of 2000 sheets of 8-1/2 x 11 inch multi-fold type printer paper
10. RS-232 ASCII Interface
a. ASCII interface shall allow RS-232 connections to be made between a meter or circuit monitor operating as the host PC and any equipment that will accept RS-232 ASCII command strings, such as local display panels, dial-up modems, and alarm transmitters.
1) Pager System Interface: Alarms shall be able to activate a pager system with customized message for each input alarm.
b. Alarm System Interface: RS-232 output shall be capable of transmitting alarms from other monitoring and alarm systems to workstation software.
c. RS-232 output shall be capable of connection to a pager interface that can be used to call a paging system or service and send a signal to a portable pager. System shall allow an individual alphanumeric message per alarm input to be sent

to paging system. This interface shall support both numeric and alphanumeric pagers.

d. Cables: provide Plenum-Type, RS-232 Cable: Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors, plastic insulation, and individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage; plastic jacket. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
   1) NFPA 70, Type CMP.
   2) Flame Resistance: NFPA 262, Flame Test.

11. Self-contained uninterruptible power supply (UPS):
   a. Size: Provide a minimum of six hours of operation of ECC equipment, including two hours of alarm printer operation.
   b. Batteries: Sealed, valve regulated, recombinant, lead calcium.
   c. Accessories:
      1) Transient voltage suppression.
      2) Input-harmonics reduction.
      3) Rectifier/charger.
      4) Battery disconnect device.
      5) Static bypass transfer switch.
      6) Internal maintenance bypass/isolation switch.
      7) External maintenance bypass/isolation switch.
      8) Output isolation transformer.
      9) Remote UPS monitoring.
      10) Battery monitoring.
      11) Remote battery monitoring.

D. ECC Software:
1. Provide for automatic system database save and restore on the ECC's hard disk a copy of the current database of each Controller. This database shall be updated whenever a change is made in any system panel. In the event of a database loss in a building management panel, the ECC shall automatically restore the database for that panel. This capability may be disabled by the operator.
2. Provide for manual database save and restore. An operator with proper clearance shall be able to save the database from any system panel. The operator also shall be able to clear a panel database and manually initiate a download of a specified database to any panel in the system.
3. Provide a method of configuring the system. This shall allow for future system changes or additions by users with proper clearance.
4. Operating System. Furnish a concurrent multi-tasking operating system. The operating system also shall support the use of other common software applications. Acceptable operating systems are Windows, Linux, and UNIX.
5. System Graphics. The operator workstation software shall be graphically oriented. The system shall allow display of up to 10 graphic screens at once for comparison and monitoring of system status. Provide a method for the operator to easily move between graphic displays and change the size and location of graphic displays on the screen. The system graphics shall be able to be modified while on-line. An operator with the proper password level shall be able to add, delete, or change dynamic objects on a graphic. Dynamic objects shall include analog and binary values, dynamic text, static text, and animation files. Graphics shall have the ability to show animation by shifting image files based on the status of the object.
6. Custom Graphics. Custom graphic files shall be created with the use of a graphics generation package furnished with the system. The graphics generation package shall be a graphically based system that uses the mouse to create and modify graphics that are saved in industry standard formats such as PCX, TIFF, and GEM. The graphics generation package also shall provide the capability of capturing or converting graphics from other programs such as Designer or AutoCAD.

7. Graphics Library. Furnish a complete library of standard HVAC equipment graphics such as chillers, boilers, air handlers, terminals, fan coils, and unit ventilators. This library also shall include standard symbols for other equipment including fans, pumps, coils, valves, piping, dampers, and ductwork. The library shall be furnished in a file format compatible with the graphics generation package program.
8. The Controls Systems Operator Interfaces shall be user friendly, readily understood and shall make maximum use of colors, graphics, icons, embedded images, animation, text based information and data visualization techniques to enhance and simplify the use and understanding of the displays by authorized users at the ECC. The operating system shall be Windows 10 latest version, or better, and shall support the third party software.
9. Provide graphical user software, which shall minimize the use of keyboard through the use of the mouse and "point and click" approach to menu selection.
10. The software shall provide a multi-tasking type environment that will allow the user to run several applications simultaneously. The mouse or Alt-Tab keys shall be used to quickly select and switch between multiple applications. The operator shall be able automatically export data to and work in Microsoft Word, Excel, and other Windows based software programs, while concurrently on-line system alarms and monitoring information.
11. On-Line Help. Provide a context-sensitive, on-line help system to assist the operator in operating and editing the system. On-line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the use of hypertext.
12. User access shall be protected by a flexible and Owner re-definable software-based password access protection. Password protection shall be multi-level and partition able to accommodate the varied access requirements of the different user groups to which individual users may be assigned. Provide the means to define unique access privileges for each individual authorized user. Provide the means to on-line manage password access control under the control of a project specific Master Password. Provide an audit trail of all user activity on the Controls Systems including all actions and changes.
13. The system shall be completely field-programmable from the common operator's keyboard thus allowing hard disk storage of all data automatically. All programs for the CUs shall be able to be downloaded from the hard disk. The software shall provide the following functionality as a minimum:
    a. Point database editing, storage and downloading of controller databases.
    b. Scheduling and override of building environmental control systems.
    c. Collection and analysis of historical data.
    d. Alarm reporting, routing, messaging, and acknowledgement.
    e. Definition and construction of dynamic color graphic displays.
    f. Real-time graphical viewing and control of environment.
    g. Scheduling trend reports.
    h. Program editing.
    i. Operating activity log and system security.
    j. Transfer data to third party software.
14. Provide functionality such that using the least number of steps to initiate the desired event may perform any of the following simultaneously:
    a. Dynamic color graphics and graphic control.
    b. Alarm management.
    c. Event scheduling.
    d. Dynamic trend definition and presentation.
    e. Program and database editing.
    f. Each operator shall be required to log on to the system with a username and password to view, edit or delete the data. System security shall be selectable for each operator, and the password shall be able to restrict the operator's access for viewing and changing the system programs. Each operator shall automatically be logged off the system if no keyboard or mouse activity is detected for a selected time.
15. Graphic Displays:

a. The workstation shall allow the operator to access various system schematics and floor plans via a graphical penetration scheme, menu selection, or text-based commands. Graphic software shall permit the importing of AutoCAD or scanned pictures in the industry standard format (such as PCX, BMP, GIF, and JPEG) for use in the system.
b. System Graphics shall be project specific and schematically correct for each system. (i.e.: coils, fans, dampers located per equipment supplied with project.) Standard system graphics that do not match equipment or system configurations are prohibited. Operator shall have capability to manually operate the entire system from each graphic screen at the ECC. Each system graphic shall include a button/tab to a display of the applicable sequence of operation.
c. Dynamic temperature values, humidity values, flow rates, and status indication shall be shown in their locations and shall automatically update to represent current conditions without operator intervention and without pre-defined screen refresh values.
d. Color shall be used to indicate status and change in status of the equipment. The state colors shall be user definable.
e. A clipart library of HVAC equipment, such as chillers, boilers, air handling units, fans, terminal units, pumps, coils, standard ductwork, piping, valves and laboratory symbols shall be provided in the system. The operator shall have the ability to add custom symbols to the clipart library.
f. A dynamic display of the site-specific architecture showing status of the controllers, the ECC and network shall be provided.
g. The windowing environment of the workstation shall allow the user to simultaneously view several applications at a time to analyze total building operation or to allow the display of graphic associated with an alarm to be viewed without interrupting work in progress. The graphic system software shall also have the capability to split screen, half portion of the screen with graphical representation and the other half with sequence of operation of the same HVAC system.

16. Trend reports shall be generated on demand or pre-defined schedule and directed to monitor display, printers or disk. As a minimum, the system shall allow the operator to easily obtain the following types of reports:
    a. A general list of all selected points in the network.
    b. List of all points in the alarm.
    c. List of all points in the override status.
    d. List of all disabled points.
    e. List of all points currently locked out.
    f. List of user accounts and password access levels.
    g. List of weekly schedules.
    h. List of holiday programming.
    i. List of limits and dead bands.
    j. Custom reports.
    k. System diagnostic reports, including, list of digital controllers on the network.
    l. List of programs.
17. ASHRAE Standard 147 Report: Provide a daily report that shows the operating condition of each chiller as recommended by ASHRAE Standard 147. At a minimum, this report shall include:
    a. Chilled water (or other secondary coolant) inlet and outlet temperature
    b. Chilled water (or other secondary coolant) flow
    c. Chilled water (or other secondary coolant) inlet and outlet pressures
    d. Evaporator refrigerant pressure and temperature
    e. Condenser refrigerant pressure and liquid temperature
    f. Condenser water inlet and outlet temperatures
    g. Condenser water flow
    h. Refrigerant levels

i. Oil pressure and temperature
j. Oil level
k. Compressor refrigerant discharge temperature
l. Compressor refrigerant suction temperature
m. Addition of refrigerant
n. Addition of oil
o. Vibration levels or observation that vibration is not excessive
p. Motor amperes per phase
q. Motor volts per phase
r. PPM refrigerant monitor level
s. Purge exhaust time or discharge count
t. Ambient temperature (dry-bulb and wet-bulb)
u. Date and time logged

18. Electrical, Gas, and Weather Reports
    a. Electrical Meter Report: Provide a monthly report showing the daily electrical consumption and peak electrical demand with time and date stamp for each building meter.
    b. Provide an annual (12-month) summary report showing the monthly electrical consumption and peak demand with time and date stamp for each meter.
    c. Gas Meter Report: Provide a monthly report showing the daily natural gas consumption for each meter. Provide an annual (12-month) report that shows the monthly consumption for each meter.
    d. Weather Data Report: Provide a monthly report showing the daily minimum, maximum, and average outdoor air temperature, as well as the number of heating and cooling degree-days for each day. Provide an annual (12-month) report showing the minimum, maximum, and average outdoor air temperature for the month, as well as the number of heating and cooling degree-days for the month.
19. Scheduling and Override:
    a. Provide override access through menu selection from the graphical interface and through a function key.
    b. Provide a calendar type format for time-of-day scheduling and overrides of building control systems. Schedules reside in the ECC. The digital controllers shall ensure equipment time scheduling when the ECC is off-line. The ECC shall not be required to execute time scheduling. Provide the following spreadsheet graphics as a minimum:
        1) Weekly schedules.
        2) Zone schedules, minimum of 100 zones.
        3) Scheduling up to 365 days in advance.
        4) Scheduled reports to print at workstation.
20. Collection and Analysis of Historical Data:
    a. Provide trending capabilities that will allow the operator to monitor and store records of system activity over an extended period. Points may be trended automatically on time-based intervals or change of value, both of which shall be user definable. The trend interval could be five (5) minutes to 120 hours. Trend data may be stored on hard disk for future diagnostic and reporting. Additionally trend data may be archived to network drives or removable disk media for off-site retrieval.
    b. Reports may be customized to include individual points or predefined groups of at least six points. Provide additional functionality to allow pre-defined groups of up to 250 trended points to be easily accessible by other industry standard word processing and spreadsheet packages. The reports shall be time and date stamped and shall contain a report title and the name of the facility.
    c. System shall have the set up to generate spreadsheet reports to track energy usage and cost based on weekly or monthly interval, equipment run times, equipment efficiency, and/or building environmental conditions.

d. Provide additional functionality that will allow the operator to view real time trend data on trend graph displays. A minimum of 20 points may be graphed regardless of whether they have been predefined for trending. In addition, the user may pause the graph and take snapshots of the screens to be stored on the workstation disk for future reference and trend analysis. Exact point values may be viewed, and the graph may be printed. Operator shall be able to command points directly on the trend plot by double clicking on the point.

21. Alarm Management:
    a. Alarm routing shall allow the operator to send alarm notification to selected printers or operator workstation based on time of day, alarm severity, or point type.
    b. Alarm notification shall be provided via two alarm icons, to distinguish between routine, maintenance type alarms and critical alarms. The critical alarms shall display on the screen at the time of its occurrence, while others shall display by clicking on their icon.
    c. Alarm display shall list the alarms with highest priority at the top of the display. The alarm display shall provide selector buttons for display of the associated point graphic and message in English language. The operator shall be able to sort out the alarms.
    d. Alarm messages shall be customized for each point to display detailed instructions to the operator regarding actions to take in the event of an alarm.
    e. An operator with proper security level access may acknowledge and clear the alarm. All that have not been cleared shall be archived at workstation disk.
22. Remote Communications: The system shall have the ability to dial out in the event of an alarm. Receivers shall include operator workstations, e-mail addresses, and alpha-numeric pagers. The alarm message shall include the name of the calling location, the device that generated the alarm, and the alarm message itself.
23. System Configuration:
    a. Network control strategies shall not be restricted to a single digital controller but shall be able to include data from all other network devices to allow the development of global control strategies.
    b. Provide automatic backup and restore of all digital controller databases on the workstation hard disk. In addition to all backup data, all databases shall be performed while the workstation is on-line without disturbing other system operations.

2.5 NETWORK AND DEVICE NAMING CONVENTION

A. Network Numbers
1. BACnet network numbers shall be based on a "facility code, network" concept. The "facility code" is the VAMC's or VA campus' assigned numeric value assigned to a specific facility or building. The "network" typically corresponds to a "floor" or other logical configuration within the building. BACnet allows 65535 network numbers per BACnet internet work.
2. The network numbers are thus formed as follows: "Net #" = "FFFNN" where:
    a. FFF = Facility code (see below)
    b. NN = 00-99 This allows up to 100 networks per facility or building

B. Device Instances
1. BACnet allows 4194305 unique device instances per BACnet internet work. Using Agency's unique device instances are formed as follows: "Dev #" = "FFFNNDD" where
    a. FFF and N are as above and
    b. DD = 00-99, this allows up to 100 devices per network.
2. Note Special cases, where the network architecture of limiting device numbering to DD causes excessive subnet works. The device number can be expanded to DDD and the network number N can become a single digit. In NO case shall the network number N and the device number D exceed 4 digits.
3. Facility code assignments:

4. 000-400 Building/facility number
5. Note that some facilities have a facility code with an alphabetic suffix to denote wings, related structures, etc. The suffix will be ignored. Network numbers for facility codes greater than 400 will be assigned in the range 000-399.

C. Device Names
1. Name the control devices based on facility name, location within a facility, the system or systems that the device monitors and/or controls, or the area served. The intent of the device naming is to be easily recognized. Names can be up to 254 characters in length, without embedded spaces. Provide the shortest descriptive, but unambiguous, name. For example, in building #123 prefix the number with a “B” followed by the building number, if there is only one chilled water pump "CHWP-1", a valid name would be "B123.CHWP. 1.STARTSTOP". If there are two pumps designated "CHWP-1", one in a basement mechanical room (Room 0001) and one in a penthouse mechanical room (Room PH01), the names could be "B123.R0001.CHWP.1. STARTSTOP" or "B123.RPH01.CHWP.1.STARTSTOP". In the case of unitary controllers, for example a VAV box controller, a name might be "B123.R101.VAV". These names should be used for the value of the "Object_Name" property of the BACnet Device objects of the controllers involved so that the BACnet name and the EMCS name are the same.

2.6 BACnet DEVICES

A. All BACnet Devices – controllers, gateways, routers, actuators, Operator Displays, and sensors shall conform to BACnet Device Profiles and shall be BACnet Testing Laboratories (BTL) - Listed as conforming to those Device Profiles. Protocol Implementation Conformance Statements (PICSs), describing the BACnet capabilities of the Devices shall be published and available for the Devices through links in the BTL website.
1. BACnet Building Controllers, shall conform to the BACnet B-BC Device Profile, and shall be BTL-Listed as conforming to the B-BC Device Profile. The Device’s PICS shall be submitted.
2. BACnet Advanced Application Controllers shall conform to the BACnet B-AAC Device Profile and shall be BTL-Listed as conforming to the B-AAC Device Profile. The Device’s PICS shall be submitted.
3. BACnet Application Specific Controllers shall conform to the BACnet B-ASC Device Profile and shall be BTL-Listed as conforming to the B-ASC Device Profile. The Device’s PICS shall be submitted.
4. BACnet Smart Actuators shall conform to the BACnet B-SA Device Profile and shall be BTL-Listed as conforming to the B-SA Device Profile. The Device’s PICS shall be submitted.
5. BACnet Smart Sensors shall conform to the BACnet B-SS Device Profile and shall be BTL-Listed as conforming to the B-SS Device Profile. The Device’s PICS shall be submitted.
6. BACnet routers and gateways shall conform to the BACnet B-OTH Device Profile, and shall be BTL-Listed as conforming to the B-OTH Device Profile. The Device’s PICS shall be submitted.

2.7 CONTROLLERS

A. General. Provide an adequate number of BTL listed B-BC building controllers, BTL listed B-AAC, BTL listed B-ASC, BTL listed B-SA, and BTL listed B-SS’s to achieve the performance specified in the Part 1 Article on “System Performance.” Each of these controllers shall meet the following requirements.
1. Communication.
   a. Each B-BC controller shall reside on a BACnet network using the ISO 8802-3 (Ethernet) Data Link/Physical layer protocol for its communications.
   b. Each B-BC controller shall provide a service communication port using BACnet Data Link/Physical layer protocol for connection to a portable operator’s terminal. If

this port is not available built into the controller, contractor is to install a 4 port unmanaged switch inside the B-BC control cabinet.

2. Keypad. A local keypad and display shall be provided for each controller. The keypad shall be provided for interrogating and editing data. Provide a system security password to prevent unauthorized use of the keypad and display.
3. Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.
4. Memory. The controller shall maintain all BIOS and programming information in the event of a power loss for at least 72 hours.
5. The controller shall be able to operate at 90 percent to 110 percent of nominal voltage rating and shall perform an orderly shutdown less than 80 percent nominal voltage. Controller operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 watt at 1 meter (3 feet).
6. Transformer. Power supply for the ASC must be rated at a minimum of 125 percent of B-ASC power consumption and shall be of the fused or current limiting type.

B. Provide BTL-Listed B-ASC application specific controllers for each piece of equipment for which they are constructed. Application specific controllers shall communicate with other BACnet devices on the internetwork using the BACnet Read (Execute) Property service.
1. Each B-ASC shall be capable of stand-alone operation and shall continue to provide control functions without being connected to the network.
2. Each B-ASC will contain sufficient I/O capacity to control the target system.
3. Communication.
   a. Each controller shall have a BACnet Data Link/Physical layer compatible connection for a laptop computer or a portable operator's tool. This connection shall be extended to a space temperature sensor port where shown.
4. Serviceability. Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips or to a termination card connected by a ribbon cable.
5. Memory. The application specific controller shall use nonvolatile memory and maintain all BIOS and programming information in the event of a power loss.
6. Immunity to power and noise. Controllers shall be able to operate at 90 percent to 110 percent of nominal voltage rating and shall perform an orderly shutdown below 80 percent. Operation shall be protected against electrical noise of 5-120 Hz and from keyed radios up to 5 watts at 1 meter (3 feet).

C. Direct Digital Controller Software
1. The software programs specified in this section shall be commercially available, concurrent, multi-tasking operating system and support the use of software application that operates under DOS, Linux or Microsoft Windows.
2. All points shall be identified by up to 30-character point name and 16-character point descriptor. The same names shall be used at the ECC.
3. All control functions shall execute within the stand-alone control units. All new controllers installed will also include all software and/or hardware required to program, commission, or alter the sequence of operation of said controller(s). Controllers requiring software or hardware that is not commercially available will not be allowed. Installation of software and/or hardware for controller configuration will be the responsibility of the DDC contractor. COR will direct to install said hardware and/or software on either the B-AWS or portable operator terminal. The VA shall be able to customize control strategies and sequences of operations defining the appropriate control loop algorithms and choosing the optimum loop parameters without requiring the services of a DDC contractor.
4. All controllers shall be capable of being programmed to utilize stored default values for assured fail-safe operation of critical processes. Default values shall be invoked upon sensor failure or, if the primary value is normally provided by the central or another CU, or by loss of bus communication. Individual application software packages shall be structured to assume a fail-safe condition upon loss of input sensors. Loss of an input

sensor shall result in output of a sensor-failed message at the ECC. Each ACU and RCU shall have capability for local readouts of all functions. The UCUs shall be read remotely.

5. All DDC control loops shall be able to utilize any of the following control modes:
   a. Two position (on-off, slow-fast) control.
   b. Proportional control.
   c. Proportional plus integral (PI) control.
   d. Proportional plus integral plus derivative (PID) control. All PID programs shall automatically invoke integral wind up prevention routines whenever the controlled unit is off, under manual control of an automation system or time-initiated program.
   e. Automatic tuning of control loops.
6. System Security: Operator access shall be secured using individual password and operator's name. Passwords shall restrict the operator to the level of object, applications, and system functions assigned to him. A minimum of three (3)or a maximum of six (6) levels of security for operator access shall be provided.
7. Application Software: The controllers shall provide the following programs as a minimum for the purpose of optimizing energy consumption while maintaining comfortable environment for occupants. All application software shall reside and run in the system digital controllers. Editing of the application shall occur at the ECC or via a portable operator's terminal, when it is necessary, to access directly the programmable unit.
   a. Economizer: An economizer program shall be provided for VAV systems. This program shall control the position of air handler relief, return, and outdoor dampers. If the outdoor air dry bulb temperature and humidity fall below changeover set point the energy control center will modulate the dampers to provide 100 percent outdoor air. The operator shall be able to override the economizer cycle and return to minimum outdoor air operation at any time.
   b. Night Setback/Morning Warm up Control: The system shall provide the ability to automatically adjust set points for this mode of operation.
   c. Optimum Start/Stop (OSS): Optimum start/stop program shall automatically be coordinated with event scheduling. The OSS program shall start HVAC equipment at the latest possible time that will allow the equipment to achieve the desired zone condition by the time of occupancy, and it shall also shut down HVAC equipment at the earliest possible time before the end of the occupancy period and still maintain desired comfort conditions. The OSS program shall consider both outside weather conditions and inside zone conditions. The program shall automatically assign longer lead times for weekend and holiday shutdowns. The program shall poll all zones served by the associated AHU and shall select the warmest and coolest zones. These shall be used in the start time calculation. It shall be possible to assign occupancy start times on a per air handler unit basis. The program shall meet the local code requirements for minimum outdoor air while the building is occupied. Modification of assigned occupancy start/stop times shall be possible via the ECC.
   d. Event Scheduling: Provide a comprehensive menu driven program to automatically start and stop designated points or a group of points according to a stored time. This program shall provide the capability to individually command a point or group of points. When points are assigned to one common load group it shall be possible to assign variable time advances/delays between each successive start or stop within that group. Scheduling shall be calendar based and advance schedules may be defined up to one year in advance. Advance schedule shall override the day-to-day schedule. The operator shall be able to define the following information:
      1) Time, day.
      2) Commands such as on, off, auto.
      3) Time delays between successive commands.
      4) Manual overriding of each schedule.
      5) Allow operator intervention.
   e. Alarm Reporting: The operator shall be able to determine the action to be taken in the event of an alarm. Alarms shall be routed to the ECC based on time and

events. An alarm shall be able to start programs, login the event, print and display the messages. The system shall allow the operator to prioritize the alarms to minimize nuisance reporting and to speed operator's response to critical alarms. A minimum of six (6) priority levels of alarms shall be provided for each point.

f. Remote Communications: The system shall have the ability to dial out in the event of an alarm to the ECC and alpha-numeric pagers. The alarm message shall include the name of the calling location, the device that generated the alarm, and the alarm message itself. The operator shall be able to remotely access and operate the system using dial up communications. Remote access shall allow the operator to function the same as local access.

g. Maintenance Management (PM): The program shall monitor equipment status and generate maintenance messages based upon the operators defined equipment run time, starts, and/or calendar date limits. A preventative maintenance alarm shall be printed indicating maintenance requirements based on pre-defined run time. Each preventive message shall include point description, limit criteria and preventative maintenance instruction assigned to that limit. A minimum of 480-character PM shall be provided for each component of units such as air handling units.

h. Chilled water Plant Operation: This program shall have the ability to sequence the multiple chillers to minimize energy consumption. The program shall provide sequence of operation as described on the drawings and include the following as a minimum:

1) Automatic start/stop of chillers and auxiliaries in accordance with the sequence of operation shown on the drawings, while incorporating requirements and restraints, such as starting frequency of the equipment imposed by equipment manufacturers.
2) Secondary chilled water pumps and controls.
3) Generate chilled water plant load profiles for different seasons for use in forecasting efficient operating schedule.
4) Cooling Tower Operation Program: The objective of cooling tower control is to optimize chiller/tower energy use within the equipment restraints and minimum condenser water temperature limit recommended by the equipment manufacturer. Maintain chilled water plant performance records and print reports at intervals selected by the operator. It shall be possible for the operator to change the set points and the operating schedule.
5) The chilled water plant program shall display the following as a minimum:
   a) Secondary chilled flow rate.
   b) Secondary chilled water supply and return temperature.
   c) Condenser water supply and return temperature.
   d) Outdoor air dry bulb temperature.
   e) Outdoor air wet bulb temperature.
   f) Ton-hours of chilled water per day/month/year.
   g) On-off status for each chiller.
   h) Chilled water flow rate.
   i) Chilled water supply and return temperature.
   j) Operating set points-temperature and pressure.
   k) Kilowatts and power factor.
   l) Current limit set point.
   m) Date and time.
   n) Operating or alarm status.
   o) Operating hours.

2.8 SPECIAL CONTROLLERS

A. Laboratory rooms and the fume hoods in those rooms shall be controlled to allow for a variable flow of conditioned air into the room, general exhaust from the room, and exhaust through the fume hood while maintaining a safe face velocity at the hood sash opening and proper space pressurization.

B. Fume Hood Exhaust Air Controller: The air flow through the open face of the hood, regardless of sash position, shall be controlled at a face velocity between 30 to 36 meter per minute (100 fpm and 120 fpm). A velocity sensor controller located in a sampling tube in the side wall of the hood shall control a damper in the hood discharge to maintain the face velocity.

C. Room Differential Pressure Controller: The differential pressure in laboratory rooms, operating rooms, in the SPS area, Chemo compounding rooms, and isolation rooms shall be maintained by controlling the quantity of air exhausted from or supplied to the room. A sensor-controller shall measure and control the velocity of air flowing into or out of the room through a sampling tube installed in the wall separating the room from the adjacent space and display the value on its monitor. The sensor-controller shall meet the following as a minimum:
1. Operating range: -0.25 to +0.25 inches of water column
2. Resolution: 5 percent of reading
3. Accuracy: +/- 10 percent of reading +/- 0.005 inches of water column
4. Analog output: 4-20 ma or 0-10 VDC
5. Operating temperature range: 32 degrees F - 120 degrees F

2.9 SENSORS (AIR, WATER AND STEAM)

A. Sensors' measurements shall be read back to the DDC system, and shall be visible by the ECC.

B. Temperature and Humidity Sensors shall be electronic, vibration and corrosion resistant for wall, immersion, and/or duct mounting. Provide all remote sensors as required for the systems.
1. Temperature Sensors: thermistor type for terminal units and Resistance Temperature Device (RTD) with an integral 4-20 mA or 0-10 VDC transmitter type for all other sensors.
   a. Duct sensors shall be rigid or averaging type as shown on drawings. Averaging sensor shall be a minimum of 1 linear foot of sensing element for each square feet of cooling/heating coil face area.
   b. Immersion sensors shall be provided with a separable well made of stainless steel, bronze or monel material. Pressure rating of well is to be consistent with the system pressure in which it is to be installed. Temperature well shall be filled with a thermal compound compatible with installed sensor.
   c. All space sensors shall be equipped with in-space User set-point adjustment, override switch, numerical temperature display on sensor cover, and BACnet communication port. Match room thermostats. Provide a tooled-access cover.
      1) Public space sensor: setpoint adjustment shall be only through the ECC or through the DDC system's diagnostic device/laptop. Do not provide in-space User set-point adjustment. Provide an opaque keyed-entry cover if needed to restrict in-space User set-point adjustment.
   d. Outdoor air temperature sensors shall have watertight inlet fittings and be shielded from direct sunlight.
   e. Room security sensors shall have stainless steel cover plate with insulated back and security screws.
   f. Wire: Twisted, shielded-pair cable.
   g. Output Signal: 4-20 mA or 0-10 VDC.
2. Humidity Sensors: Bulk polymer sensing element type.
   a. Duct and room sensors shall have a sensing range of 20 to 80 percent with accuracy of ± 2 to ± 5 percent RH, including hysteresis, linearity, and repeatability.
   b. Outdoor humidity sensors shall be furnished with element guard and mounting plate and have a sensing range of 0 to 100 percent RH.
   c. Continuous Output Signal: 4-20 mA or 0-10 VDC.

C. Static Pressure Sensors: Non-directional, temperature compensated.
1. 4-20 mA or 0-10 VDC output signal.
2. 0 to 5 inches wg for duct static pressure range.
3. 0 to 0.25 inch wg for Building static pressure range.

D. Vortex Water flow sensors:

1. Type: Insertion vortex type with retractable probe assembly and 2 inch full port gate valve.
   a. Pipe size: up to 24 inches.
   b. Retractor: ASME threaded, non-rising stem type with hand wheel.
   c. Mounting connection: 2 inch 150 PSI flange.
   d. Sensor assembly: Design for expected water flow and pipe size.
   e. Seal: Teflon (PTFE).
2. Controller:
   a. Integral to unit.
   b. Locally display flow rate and total.
   c. Output flow signal to BAS/EMS/BES/BMCS: Digital pulse or BACnet type.
3. Performance:
   a. Turndown: 20:1
   b. Response time: Adjustable from 1 to 100 seconds.
   c. Power: 24 volt DC
4. Install flow meters according to manufacturer's recommendations. Where recommended by manufacturer because of mounting conditions, provide flow rectifier.

E. Steam Flow Sensor/Transmitter:
1. Sensor: Vortex shedder incorporating wing type sensor and amplification technology for high signal-to-noise ratio, carbon steel body with 316 stainless steel working parts, 24 VDC power, NEMA 4 enclosure.
   a. Ambient conditions, -40 degrees C to 80 degrees C (-40 degrees F to 175 degrees F).
   b. Process conditions, 900 kPa (125 psig) saturated steam.
   c. Turn down ratio, 20 to 1.
   d. Output signal, 4-20 ma or 0-10 VDC DC.
   e. Processor/Transmitter, NEMA 4 enclosure with keypad program selector and six digit LCD output display of instantaneous flow rate or totalized flow, solid state switch closure signal shall be provided to the nearest DDC panel for totalization.
      1) Ambient conditions, -20 degrees C to 50 degrees C (0 degrees F to 120 degrees F), 0 to 95 percent non-condensing RH.
      2) Power supply, 120 VAC, 60 hertz or 24 VDC.
      3) Internal battery, provided for 24-month retention of RAM contents when all other power sources are removed.
   f. Sensor on all steam lines shall be protected by pigtail siphons installed between the sensor and the line, and shall have an isolation valve installed between the sensor and pressure source.

F. Flow switches:
1. Shall be either paddle or differential pressure type.
   a. Paddle-type switches (liquid service only) shall be UL Listed, SPDT snap-acting, adjustable sensitivity with NEMA 4 enclosure.
   b. Differential pressure type switches (air or water service) shall be UL listed, SPDT snap acting, NEMA 4 enclosure, with scale range and differential suitable for specified application.

G. Current Switches: Current operated switches shall be self powered, solid state with adjustable trip current as well as status, power, and relay command status LED indication. The switches shall be selected to match the current of the application and output requirements of the DDC systems.

H. Water Overflow Indicators:
1. Float Switches: Float switch manufactured to close a normally open electrical contact when water level rises at the bottom of a drain pan or sump. All parts that come in contact with water shall be plastic, brass, or stainless steel. Select switch configuration for reliable operation in the specific location it is to be used (primary drain pan, primary humidifier drain pan, secondary pan, pump sump etc.) Contact rating 4A at 24 VAC

maximum and 100 mA at 5 VDC minimum. For installation the switch shall be clamped to the side of the fan or sump. Switches that required drilling through the side of the pan or sump shall be prohibited.

2. Water Sensors: 24 VAC powered solid state single pole – double throw contacts that closes upon the sensor's detection of water at the bottom of pan, sump, floor etc. Sensor designed to be placed at the bottom of the pan, floor etc. where it will detect moisture. Sensor design shall incorporate water sensor array inside a hydrophilic pad designed to absorb and alarm with only a small amount of water. Contact rating 4A at 24 VAC maximum and 100 mA at 5 VDC minimum.

2.10 CONTROL CABLES

A. General:
1. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments. Comply with Sections 27 05 26 and 26 05 26.
2. Cable conductors to provide protection against induction in circuits. Crosstalk attenuation within the System shall be in excess of -80 dB throughout the frequency ranges specified.
3. Minimize the radiation of RF noise generated by the System equipment so as not to interfere with any audio, video, data, computer main distribution frame (MDF), telephone customer service unit (CSU), and electronic private branch exchange (EPBX) equipment the System may service.
4. The as-installed drawings shall identify each cable as labeled, used cable, and bad cable pairs.
5. Label system's cables on each end. Test and certify cables in writing to the VA before conducting proof-of-performance testing. Minimum cable test requirements are for impedance compliance, inductance, capacitance, signal level compliance, opens, shorts, cross talk, noise, and distortion, and split pairs on all cables in the frequency ranges used. Make available all cable installation and test records at demonstration to the VA. All changes (used pair, failed pair, etc.) shall be posted in these records as the change occurs.
6. Power wiring shall not be run in conduit with communications trunk wiring or signal or control wiring operating at 100 volts or less.

B. Analogue control cabling shall be not less than No. 18 AWG solid or stranded, with thermoplastic insulated conductors as specified in Section 26 05 19.

C. Copper digital communication cable between the ECC and the B-BC and B-AAC controllers shall be 100BASE-TX Ethernet, Category 6a, not less than minimum 24 American Wire Gauge (AWG) solid, Shielded Twisted Pair (STP) or Unshielded Twisted Pair (UTP), with thermoplastic insulated conductors, enclosed in a thermoplastic outer jacket, as specified in Section 27 15 00.
1. Other types of media commonly used within IEEE Std 802.3 LANs (e.g., 10Base-T and 10Base-2) shall be used only in cases to interconnect with existing media.

D. All MS/TP communications cables for devices utilizing the EIA-485 standard must be listed for use on EIA-485 networks by the manufacturer of the cable. This requirement overrides any cable recommendation by the controller manufacturer. The use of EIA-485 communication cables shall not affect the warranty from the installing DDC contractor. Cables shall have the following characteristic:
1. Nominal Impedance: 100-130 Ohms
2. Twisted/shielded construction of 1, 1.5, or 2 pairs depending on controller requirements.
3. Be plenum rated when required
4. Cables designated for use by the cable manufacturer for use in PA or Speaker systems shall not be allowed, regardless of recommendations by the controller manufacturer.

E. Optical digital communication fiber, if used, shall be Multimode or Single mode fiber, 62.5/125 micron for multimode or 10/125 micron for single mode micron with SC or ST connectors as specified in TIA-568-C.1. Terminations, patch panels, and other hardware shall be compatible with the specified fiber and shall be as specified in Section 27 15 00. Fiber-optic cable shall be

suitable for use with the 100Base-FX or the 100Base-SX standard (as applicable) as defined in IEEE Std 802.3.

2.11 THERMOSTATS AND HUMIDISTATS

A. Room thermostats controlling unitary standalone heating and cooling devices not connected to the DDC system shall have three modes of operation (heating - null or dead band - cooling). Thermostats for patient bedrooms shall have capability of being adjusted to eliminate null or dead band. Wall mounted thermostats shall have manufacturer's recommendation finish, setpoint range and temperature display and external adjustment:
   1. Electronic Thermostats: Solid-state, microprocessor based, BACnet enabled programmable to daily, weekend, and holiday schedules.
      a. Public Space Thermostat: Public space thermostat shall have a thermistor sensor and shall not have a visible means of set point adjustment. Adjustment shall be via the digital controller to which it is connected.
      b. Patient Room Thermostats: thermistor with in-space User set point adjustment and an on-casing room temperature numerical temperature display.
      c. Battery replacement without program loss.

B. Strap-on aquastat shall be enclosed in a dirt-and-moisture proof housing with adjustable temperature switching point and minimum single pole, double throw switch. Variable setpoint and variable differential ranges selected for the application. Automatic reset.

C. Freezestats shall have a minimum of 300 mm (one linear foot) of sensing element for each 0.093 square meter (one square foot) of coil area. A freezing condition at any increment of 300 mm (one foot) anywhere along the sensing element shall be sufficient to operate the thermostatic element. Freezestats shall be manually-reset.

D. Room Humidistats: Provide fully proportioning humidistat with adjustable throttling range for accuracy of settings and conservation. The humidistat shall have set point scales shown in percent of relative humidity located on the instrument. Systems showing moist/dry or high/low are prohibited.

E. Low Signal Selector High Limit Duct Humidistat: Duct mounted high limit humidistat mounted downstream of the humidifier steam injection grid to protect the ductwork and other components from moisture in the event of humidifier loop problems. Typically set at 70 percent to 80 percent RH the device provides proportional signal back to steam control equipment as duct humidity approaches high limit setpoint thus providing more accurate control. Duct mounted device with polymer sensor:
   1. Output 4 to 20 milliamp or 0-10 VDC.
   2. Setpoint range 60 percent RH to 95 percent RH.
   3. Proportional Band range 5 percent to 30 percent.
   4. Auxiliary contacts for alarms.
   5. Accuracy 2 percent RH and drift less than 0.5 percent per year.

2.12 FINAL CONTROL ELEMENTS AND OPERATORS

A. Fail Safe Operation: Control valves and dampers shall provide "fail safe" operation in either the normally open or normally closed position as required for freeze, moisture, and smoke or fire protection.

B. Spring Ranges: Range as required for system sequencing and to provide tight shut-off.

C. Power Operated Control Dampers (other than VAV Boxes): Factory fabricated, balanced type dampers. All modulating dampers shall be opposed blade type and gasketed. Blades for two-position, duct-mounted dampers shall be parallel, airfoil (streamlined) type for minimum noise generation and pressure drop.
   1. Leakage: maximum leakage in closed position shall not exceed 7 L/S (15 CFMs) differential pressure for outside air and exhaust dampers and 200 L/S/ square meter (40 CFM/square feet) at 50 mm (2 inches) differential pressure for other dampers.
   2. Frame shall be galvanized steel channel with seals as required to meet leakage criteria.

3. Blades shall be galvanized steel or aluminum, 200 mm (8 inch) maximum width, with edges sealed as required.
4. Bearing shall be nylon, bronze sleeve or ball type.
5. Hardware shall be zinc-plated steel. Connected rods and linkage shall be non-slip. Working parts of joints shall be brass, bronze, nylon or stainless steel.
6. Maximum air velocity and pressure drop through free area of the dampers:
   a. Smoke damper in air handling unit: 305 meter per minute (1000 fpm).
   b. Duct mounted damper: 600 meter per minute (2000 fpm).
   c. Maximum static pressure loss: 50 Pascal (0.20 inches water gauge).

D. Smoke Dampers and Combination Fire/Smoke Dampers: Dampers and operators are specified in Section 23 31 00, HVAC DUCTS AND CASINGS. Control of these dampers is specified under this Section.

E. Control Valves:
1. Valves shall be rated for a minimum of 150 percent of system operating pressure at the valve location but not less than 900 kPa (125 psig).
2. Valves 50 mm (2 inches) and smaller shall be bronze body with threaded or flare connections.
3. Valves 60 mm (2 1/2 inches) and greater shall be bronze or iron body with flanged connections.
4. Brass or bronze seats except for valves controlling media greater than 100 degrees C (210 degrees F), which shall have stainless steel seats.
5. Flow characteristics:
   a. Three way modulating valves shall be globe pattern. Position versus flow relation shall be linear relation for steam or equal percentage for water flow control.
   b. Two-way modulating valves shall be globe pattern. Position versus flow relation shall be linear for steam and equal percentage for water flow control.
   c. Two-way 2-position valves shall be ball, gate or butterfly type.
6. Maximum pressure drop:
   a. Two position steam control: 20 percent of inlet gauge pressure.
   b. Modulating Steam Control: 80 percent of inlet gauge pressure (acoustic velocity limitation).
   c. Modulating water flow control, greater of 3 meters (10 feet) of water or the pressure drop through the apparatus.
7. Two position water valves shall be line size.

F. Damper and Valve Operators and Relays:
1. Electric operator shall provide full modulating control of dampers and valves. For dampers a linkage and pushrod shall be furnished for mounting the actuator on the damper frame internally in the duct, externally in the duct, externally on the duct wall, or shall be furnished with a direct-coupled design. Metal parts shall be aluminum, mill finish galvanized steel, or zinc plated steel or stainless steel. Provide actuator heads which allow for electrical conduit attachment. The motor(s) shall have sufficient closure torque to allow for complete closure of valve or damper under pressure. Provide multiple motors as required to achieve sufficient close-off torque.
   a. Minimum valve close-off pressure shall be equal to the system pump's dead-head pressure, minimum 50 psig for valves smaller than 4 inches.
2. Electronic damper operators: Metal parts shall be aluminum, mill finish galvanized steel, or zinc plated steel or stainless steel. Provide actuator heads which allow for electrical conduit attachment. The motors shall have sufficient closure torque to allow for complete closure of valve or damper under pressure. Provide multiple motors as required to achieve sufficient close-off torque.
   a. VAV Box actuator shall be mounted on the damper axle or shall be of the air valve design, and shall provide complete modulating control of the damper. The motor shall have a closure torque of 35-inch pounds minimum with full torque applied at close off to attain minimum leakage.

3. See and coordinate drawings for required control operation.

2.13 AIR FLOW CONTROL

A. Airflow and static pressure shall be controlled via digital controllers with inputs from airflow control measuring stations and static pressure inputs as specified. Controller outputs shall be analog or pulse width modulating output signals. The controllers shall include the capability to control via simple proportional (P) control, proportional plus integral (PI), proportional plus integral plus derivative (PID), and on-off. The airflow control programs shall be factory-tested programs that are documented in the literature of the control manufacturer.

B. Air Flow Measuring Station -- Electronic Thermal Type:
   1. Air Flow Sensor Probe:
      a. Each air flow sensor shall contain two individual thermal sensing elements. One element shall determine the velocity of the air stream while the other element shall compensate for changes in temperature. Each thermal flow sensor and its associated control circuit and signal conditioning circuit shall be factory calibrated and be interchangeable to allow replacement of a sensor without recalibration of the entire flow station. The sensor in the array shall be located at the center of equal area segment of the duct and the number of sensors shall be adequate to accommodate the expected velocity profile and variation in flow and temperature. The airflow station shall be of the insertion type in which sensor support structures are inserted from the outside of the ducts to make up the complete electronic velocity array.
      b. Thermal flow sensor shall be constructed of hermetically sealed thermistors or nickel chromium or reference grade platinum wire, wound over an epoxy, stainless steel or ceramic mandrel and coated with a material suitable for the conditions to be encountered. Each dual sensor shall be mounted in an extruded aluminum alloy strut.
   2. Air Flow Sensor Grid Array:
      a. Each sensor grid shall consist of a lattice network of temperature sensors and linear integral controllers (ICs) situated inside an aluminum casing suitable for mounting in a duct. Each sensor shall be mounted within a strut facing downstream of the airflow and located so that it is protected on the upstream side. All wiring shall be encased (out of the air stream) to protect against mechanical damage.
      b. The casing shall be made of welded aluminum of sufficient strength to prevent structural bending and bowing. Steel or iron composite shall not be acceptable in the casing material.
      c. Pressure drop through the flow station shall not exceed 4 Pascal (0.015 inch WG) at 1,000 meter per minute (3,000 FPM).
   3. Electronics Panel:
      a. Electronics Panel shall consist of a surface mounted enclosure complete with solid-state microprocessor and software.
      b. Electronics Panel shall be A/C powered 120 VAC and shall have the capability to transmit signals of 4-20 ma or 0-10 VDC type or PWM type for use in control of the HVAC Systems. The electronic panel shall have the capability to accept user defined scaling parameters for all output signals.
      c. Electronics Panel shall have the capability to digitally display airflow in CFM and temperature in degrees F. The displays shall be provided as an integral part of the electronics panel. The electronic panel shall have the capability to totalize the output flow in CFM for two or more systems, as required. A single output signal shall be provided which will equal the sum of the systems totalized. Output signals shall be provided for temperature and airflow. Provide remote mounted air flow or temperature displays where indicated on the plans.
      d. Electronics Panel shall have the following:
         1) Minimum of 12-bit A/D conversion.

2) Field adjustable digital primary output offset and gain.
3) Airflow analog output scaling of 100 to 10,000 FPM.
4) Temperature analog output scaling from -45 degrees C to 70 degrees C (-50 degrees F to 160 degrees F).
5) Analog output resolution (full scale output) of 0.025 percent.

e. All readings shall be in I.P. or S.I. units.

4. Thermal flow sensors and its electronics shall be installed as per manufacturer's instructions. The required probe sensor density shall be as follows:

Probe Sensor Density

Area (square feet)	Qty. Sensors
<=1	2
>1 to <4	4
4 to <8	6
8 to <12	8
12 to <16	12
>=16	16

a. Complete installation shall not exhibit more than ± 2.0 percent error in airflow measurement output for variations in the angle of flow of up to 10 percent in any direction from its calibrated orientation. Repeatability of readings shall be within ± 0.25 percent.

C. Static Pressure Measuring Station: shall consist of one or more static pressure sensors and transmitters along with relays or auxiliary devices as required for a complete functional system. The span of the transmitter shall not exceed two times the design static pressure at the point of measurement. The output of the transmitter shall be true representation of the input pressure with plus or minus 25 Pascal (0.1 inch) W.G. of the design input pressure:

1. Static pressure sensors shall have the same requirements as Airflow Measuring Devices except that total pressure sensors are optional, and only multiple static pressure sensors positioned on an equal area basis connected to a network of headers are required.
2. For systems with multiple major or main trunk supply ducts, furnish a static pressure transmitter for each trunk duct. The transmitter signal representing the lowest static pressure shall be selected and this shall be the input signal to the controller.
3. The controller shall receive the static pressure transmitter signal and Control Unit (CU) shall provide a control output signal to the supply fan capacity control device. The control mode shall be proportional plus integral (PI) (automatic reset) and where required shall also include derivative mode.
4. In systems with multiple static pressure transmitters, provide a switch located near the fan discharge to prevent excessive pressure during abnormal operating conditions. High-limit switches shall be manually reset.

D. Constant Volume Control Systems shall consist of an air flow measuring station along with such relays and auxiliary devices as required to produce a complete functional system. The transmitter shall receive its air flow signal or from the flow measuring station and shall have a span not exceeding three times the design flow rate. The CU shall receive the transmitter signal and shall provide an output to the fan volume control device to maintain a constant flow rate. The CU shall provide proportional plus integral (PI) (automatic reset) control mode and where required also inverse derivative mode. Overall system accuracy shall be plus or minus the equivalent of 2 Pascal (0.008 inch) velocity pressure as measured by the flow station.

E. Airflow Synchronization:

1. Systems shall consist of an air flow measuring station for each main supply and return duct, the CU and such relays, as required to provide a complete functional system that

will maintain a constant flow rate difference between supply and return air to an accuracy of ±10 percent. In systems where there is no suitable location for a flow measuring station that will sense total supply or return flow, provide multiple flow stations with a differential pressure transmitter for each station. Signals from the multiple transmitters shall be added through the CU such that the resultant signal is a true representation of total flow.

2. The total flow signals from supply and return air shall be the input signals to the CU. This CU shall track the return air fan capacity in proportion to the supply air flow under all conditions.

2.14 SAFETY

A. Provide hard-wired interlocked connections for such all safety devices, such as freeze stats, smoke detectors, smoke dampers, and refrigerant leak detection devices. All safety devises shall be provided with additional dry contacts and shall be connected to the DDC system for monitoring and sequencing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
1. Examine project plans for control devices and equipment locations; and report any discrepancies, conflicts, or omissions to COR for resolution before proceeding for installation.
2. Install equipment, piping, wiring /conduit parallel to or at right angles to building lines.
3. Install all equipment and piping in readily accessible locations. Do not run tubing and conduit concealed under insulation or inside ducts.
4. Mount control devices, tubing and conduit located on ducts and apparatus with external insulation on standoff support to avoid interference with insulation.
5. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.
6. Run tubing and wire connecting devices on or in control cabinets parallel with the sides of the cabinet neatly racked to permit tracing.
7. Install equipment level and plumb.

B. Electrical Wiring Installation:
1. All wiring and cabling shall be installed in conduits. Install conduits and wiring in accordance with Specification Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS. Conduits carrying control wiring and cabling shall be dedicated to the control wiring and cabling: these conduits shall not carry power wiring. Provide plastic end sleeves at all conduit terminations to protect wiring from burrs.
2. Install analog signal and communication cables in conduit and in accordance with Specification Division 27 – COMMINICATIONS. Install digital communication cables in conduit and in accordance with Specification Section 27 15 00, COMMINICATIONS STRUCTURED CABLING.
3. Install conduit and wiring between operator workstation(s), digital controllers, electrical panels, indicating devices, instrumentation, miscellaneous alarm points, thermostats, and relays as shown on the drawings or as required under this section.
4. Install all electrical work required for a fully functional system and not shown on electrical plans or required by electrical specifications. Where low voltage (less than 50 volt) power is required, provide suitable Class B transformers.
5. Install all system components in accordance with local Building Code and National Electric Code.
   a. Splices: Splices in shielded and coaxial cables shall consist of terminations and the use of shielded cable couplers. Terminations shall be in accessible locations. Cables shall be harnessed with cable ties.

b. Equipment: Fit all equipment contained in cabinets or panels with service loops, each loop being at least 300 mm (12 inches) long. Equipment for fiber optics system shall be rack mounted, as applicable, in ventilated, self-supporting, code gauge steel enclosure. Cables shall be supported for minimum sag.
c. Cable Runs: Keep cable runs as short as possible. Allow extra length for connecting to the terminal board. Do not bend flexible coaxial cables in a radius less than ten times the cable outside diameter.
d. Use vinyl tape, sleeves, or grommets to protect cables from vibration at points where they pass around sharp corners, through walls, panel cabinets, etc.

6. Conceal cables, except in mechanical rooms and areas where other conduits and piping are exposed.
7. Permanently label or code each point of all field terminal strips to show the instrument or item served. Color-coded cable with cable diagrams may be used to accomplish cable identification.
8. Grounding: ground electrical systems per manufacturer's written requirements for proper and safe operation.

C. Install Sensors and Controls:
1. Temperature Sensors:
a. Install all sensors and instrumentation according to manufacturer's written instructions. Temperature sensor locations shall be readily accessible, permitting quick replacement and servicing of them without special skills and tools.
b. Calibrate sensors to accuracy specified, if not factory calibrated.
c. Use of sensors shall be limited to its duty, e.g., duct sensor shall not be used in lieu of room sensor.
d. Install room sensors permanently supported on wall frame. They shall be mounted at 1.5 meter (5.0 feet) above the finished floor unless otherwise noted on the plans or drawings.
e. Mount sensors rigidly and adequately for the environment within which the sensor operates. Separate extended-bulb sensors form contact with metal casings and coils using insulated standoffs.
f. Sensors used in mixing plenum, and hot and cold decks shall be of the averaging of type. Averaging sensors shall be installed in a serpentine manner horizontally across duct. Each bend shall be supported with a capillary clip.
g. All pipe mounted temperature sensors shall be installed in wells.
h. All wires attached to sensors shall be air sealed in their conduits or in the wall to stop air transmitted from other areas affecting sensor reading.
i. Permanently mark terminal blocks for identification. Protect all circuits to avoid interruption of service due to short-circuiting or other conditions. Line-protect all wiring that comes from external sources to the site from lightning and static electricity.
2. Pressure Sensors:
a. Install duct static pressure sensor tips facing directly downstream of airflow.
b. Install high-pressure side of the differential switch between the pump discharge and the check valve.
c. Install snubbers and isolation valves on steam pressure sensing devices.
3. Actuators:
a. Mount and link damper and valve actuators according to manufacturer's written instructions.
b. Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed position.
c. Check operation of valve/actuator combination to confirm that actuator modulates valve smoothly in both open and closed position.
4. Flow Switches:
a. Install flow switch according to manufacturer's written instructions.

b. Mount flow switch a minimum of 10 pipe diameters up stream and 10 pipe diameters downstream or 600 mm (2 feet) whichever is greater, from fittings and other obstructions.
c. Assure correct flow direction and alignment.
d. Mount in horizontal piping-flow switch on top of the pipe.

D. Installation of network:
1. Ethernet:
a. The network shall employ Ethernet LAN architecture, as defined by IEEE 802.3. The Network Interface shall be fully Internet Protocol (IP) compliant allowing connection to currently installed IEEE 802.3, Compliant Ethernet Networks.
b. The network shall directly support connectivity to a variety of cabling types. As a minimum provide the following connectivity: 100 Base TX (Category 6a cabling) for the communications between the ECC and the B-BC and the B-AAC controllers.
2. Third party interfaces: Contractor shall integrate real-time data from building systems by other trades and databases originating from other manufacturers as specified and required to make the system work as one system.

E. Installation of digital controllers and programming:
1. Provide a separate digital control panel for each major piece of equipment, such as air handling unit, chiller, pumping unit etc. Points used for control loop reset such as outdoor air, outdoor humidity, or space temperature could be located on any of the remote control units.
2. Provide sufficient internal memory for the specified control sequences and trend logging. There shall be a minimum of 25 percent of available memory free for future use.
3. System point names shall be human readable, permitting easy operator interface without the use of a written point index.
4. Provide software programming for the applications intended for the systems specified, and adhere to the strategy algorithms provided.
5. Provide graphics for each piece of equipment and floor plan in the building. This includes each chiller, cooling tower, air handling unit, fan, terminal unit, boiler, pumping unit etc. These graphics shall show all points dynamically as specified in the point list.

3.2 SYSTEM VALIDATION AND DEMONSTRATION

A. As part of final system acceptance, a system demonstration is required (see below). Prior to start of this demonstration, the contractor is to perform a complete validation of all aspects of the controls and instrumentation system. The system validation/test shall be part of the commissioning and shall be witnessed by the CxA.

B. Validation
1. Prepare and submit for approval a validation test plan including test procedures for the performance verification tests. Test Plan shall be submitted for review with the control system submittal as indicated in paragraph 1.7 Submittals. Test Plan address all specified functions of the ECC and all specified sequences of operation. Explain in detail actions and expected results used to demonstrate compliance with the requirements of this specification. Explain the method for simulating the necessary conditions of operation used to demonstrate performance of the system. Test plan shall include a test check list to be used by the Installer's agent to check and initial that each test has been successfully completed. Deliver test plan documentation for the performance verification tests to the owner's representative 30 days prior to start of performance verification tests. Provide draft copy of operation and maintenance manual with performance verification test.
2. After approval of the validation test plan, installer shall carry out all tests and procedures therein. Installer shall completely check out, calibrate, and test all connected hardware and software to ensure that system performs in accordance with approved specifications and sequences of operation submitted. Installer shall complete and submit Test Check List.

C. Demonstration
1. System operation and calibration to be demonstrated by the installer in the presence of the Architect, CxA or COR on random samples of equipment as dictated by the COR. Should random sampling indicate improper work, the owner reserves the right to subsequently witness complete calibration of the system at no addition cost to the VA.
2. Make accessible, personnel to provide necessary adjustments and corrections to systems as directed by balancing agency.
3. The following witnessed demonstrations of field control equipment shall be included:
   a. Observe HVAC systems in shut down condition. Check dampers and valves for normal position.
   b. Test application software for its ability to communicate with digital controllers, operator workstation, and uploading and downloading of control programs.
   c. Demonstrate the software ability to edit the control program off-line.
   d. Demonstrate reporting of alarm conditions for each alarm and ensure that these alarms are received at the assigned location, including operator workstations.
   e. Demonstrate ability of software program to function for the intended applications-trend reports, change in status etc.
   f. Demonstrate via graphed trends to show the sequence of operation is executed in correct manner, and that the HVAC systems operate properly through the complete sequence of operation, e.g., seasonal change, occupied/unoccupied mode, and warm-up condition.
   g. Demonstrate hardware interlocks and safeties functions, and that the control systems perform the correct sequence of operation after power loss and resumption of power loss.
   h. Prepare and deliver to the VA graphed trends of all control loops to demonstrate that each control loop is stable and the set points are maintained.
   i. Demonstrate that each control loop responds to set point adjustment and stabilizes within one (1) minute. Control loop trend data shall be instantaneous and the time between data points shall not be greater than one (1) minute.
4. Witnessed demonstration of ECC functions shall consist of:
   a. Running each specified report.
   b. Display and demonstrate each data entry to show site specific customizing capability. Demonstrate parameter changes.
   c. Step through penetration tree, display all graphics, demonstrate dynamic update, and direct access to graphics.
   d. Execute digital and analog commands in graphic mode.
   e. Demonstrate DDC loop precision and stability via trend logs of inputs and outputs (6 loops minimum).
   f. Demonstrate Energy Management System (EMS) performance via trend logs and command trace.
   g. Demonstrate scan, update, and alarm responsiveness.
   h. Demonstrate spreadsheet/curve plot software, and its integration with database.
   i. Demonstrate on-line user guide, and help function and mail facility.
   j. Demonstrate digital system configuration graphics with interactive upline and downline load, and demonstrate specified diagnostics.
   k. Demonstrate multitasking by showing dynamic curve plot, and graphic construction operating simultaneously via split screen.
   l. Demonstrate class programming with point options of beep duration, beep rate, alarm archiving, and color banding.

3.3 STARTUP AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

C. The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the COR and CxA. Provide a minimum notice of 10 working days prior to startup and testing.

3.4 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

B. Components provided under this section of the specification will be tested as part of a larger system.

3.5 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer's technical representative for 48 hours to instruct each VA personnel responsible in the operation and maintenance of the system.

B. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

3.6 CONSTRUCTION WASTE MANAGEMENT

A. General: Comply with Contractor's Waste Management Plan and Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.

B. To the greatest extent possible, separate reusable and recyclable products from contaminated waste and debris in accordance with the Contractor's Waste Management Plan. Place recyclable and reusable products in designated containers and protect from moisture and contamination.

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SECTION 23 21 13
HYDRONIC PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Water piping to connect HVAC equipment, including the following:
   1. Chilled water,, heating hot water and drain piping.
   2. Extension of domestic water make-up piping for HVAC systems.
   3. Glycol-water piping.

B. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

E. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

F. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

G. Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.

H. Section 23 07 11, HVAC AND BOILER PLANT INSULATION.

I. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

J. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

K. Section 23 21 23, HYDRONIC PUMPS.

L. Section 23 22 13, STEAM AND CONDENSATE HEATING PIPING.

M. Section 23 25 00, HVAC WATER TREATMENT.

N. Section 23 82 00, CONVECTION HEATING AND COOLING UNITS.

O. Section 31 20 11, EARTHWORK (SHORT FORM): Excavation and backfill.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standard will govern. The latest edition as of the specification issue date shall govern.

B. American Society of Mechanical Engineers (ASME):
   B1.20.1 ..... Pipe Threads, General Purpose, Inch

   B16.3 ..... Malleable Iron Threaded Fittings: Classes 150 and 300

   B16.4 ..... Gray Iron Threaded Fittings: (Classes 125 and 250)

   B16.5 ..... Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard

   B16.9 ..... Factory Made Wrought Buttwelding Fittings

B16.11 ..... Forged Fittings, Socket-Welding and Threaded

B16.18 ..... Cast Copper Alloy Solder Joint Pressure Fittings

B16.22 ..... Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings

B16.24 ..... Cast Copper Alloy Pipe Flanges, Flanged Fittings, and Valves: Classes 150, 300, 600, 900, 1500, and 2500

B16.39 ..... Malleable Iron Threaded Pipe Unions: Classes 150, 250, and 300

B16.42 ..... Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300

B31.9 ..... Building Services Piping

B40.100 ..... Pressure Gauges and Gauge Attachments

ASME Boiler and Pressure Vessel Code (BPVC):

BPVC Section VIII ..... Rules for Construction of Pressure Vessels, Division 1

C. American Society for Testing and Materials (ASTM):

A47/A47M..... Standard Specification for Ferritic Malleable Iron Castings

A53/A53M..... Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

A106/A106M..... Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service

A126 ..... Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings

A183 ..... Standard Specification for Carbon Steel Track Bolts and Nuts

A193 ..... Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications

A216/A216M..... Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service

A536 ..... Standard Specification for Ductile Iron Castings

B62 ..... Standard Specification for Composition Bronze or Ounce Metal Castings

B88 ..... Standard Specification for Seamless Copper Water Tube

F439 ..... Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80

F441/F441M ..... Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80

D. American Welding Society (AWS):

B2.1/B2.1M..... Specification for Welding Procedure and Performance Qualification

E. Expansion Joint Manufacturer's Association, Inc. (EJMA):

EJMA..... Standards of the Expansion Joint Manufacturers Association, Tenth Edition

F. Manufacturers Standardization Society (MSS) of the Valve and Fitting Industry, Inc.:

SP-67 .....Butterfly Valves

SP-70 .....Gray Iron Gate Valves, Flanged and Threaded Ends

SP-71 .....Gray Iron Swing Check Valves, Flanged and Threaded Ends

SP-80 .....Bronze Gate, Globe, Angle, and Check Valves

SP-85 .....Gray Iron Globe and Angle Valves, Flanged and Threaded Ends

SP-110 .....Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

SP-125 .....Check Valves: Gray Iron and Ductile Iron, In-line, Spring-Loaded, Center-Guided

G. National Fire Protection Association (NFPA):
70 .....National Electrical Code (NEC)

H. Tubular Exchanger Manufacturers Association (TEMA):
TEMA Standards.....10th Edition

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 23 21 13, HYDRONIC PIPING”, with applicable paragraph identification.

C. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
1. Pipe and equipment supports. Submit calculations for variable spring and constant support hangers.
2. Pipe and tubing, with specification, class or type, and schedule.
3. Pipe fittings, including miscellaneous adapters and special fittings.
4. Flanges, gaskets and bolting.
5. Couplings and fittings.
6. Valves of all types.
7. Strainers.
8. Flexible connectors for water service.
9. Pipe alignment guides.
10. Expansion joints.
11. Expansion compensators.
12. All specified hydronic system components.
13. Water flow measuring devices.
14. Gauges.
15. Thermometers and test wells.
16. Electric heat tracing systems.
17. Seismic bracing details for piping.

D. Manufacturer's certified data report, Form No. U-1, for ASME pressure vessels:
1. Heat exchangers (Water to Water).
2. Air separators.
3. Expansion tanks.
4. Buffer tanks.

E. Submit the welder’s qualifications in the form of a current (less than 1-year old) and formal certificate.

F. Coordination Drawings: Refer to paragraph, SUBMITTALS of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

G. As-Built Piping Diagrams: Provide drawings as follows for chilled water, condenser water, and heating hot water system and other piping systems and equipment.
   1. 1wall-mounted stick file with complete set of prints. Mount stick file in the chiller plant or control room along with control diagram stick file.
   2. 1 complete set of reproducible drawings.
   3. 1 complete set of drawings in electronic AutoCAD and pdf format.

H. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replacement parts, and troubleshooting guide:
   1. Include complete list indicating all components of the systems.
   2. Include complete diagrams of the internal wiring for each item of equipment.
   3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

I. Completed System Readiness Checklist provided by the CxA and completed by the contractor, signed by a qualified technician, and dated on the date of completion, in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

J. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

1.5 QUALITY ASSURANCE

A. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC, which includes welding qualifications.

B. Submit prior to welding of steel piping a certificate of Welder's certification. The certificate shall be current and not more than 1-year old.

C. All couplings, fittings, valves, and specialties shall be the products of a single manufacturer.
   1. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

D. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

E. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

1.6 AS-BUILT DOCUMENTATION

A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

1.7 SPARE PARTS

A. For mechanical pressed sealed fittings provide tools required for each pipe size used at the facility.

PART 2 - PRODUCTS

2.1 PIPE AND EQUIPMENT SUPPORTS, PIPE SLEEVES, AND WALL AND CEILING PLATES

A. Provide in accordance with Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

2.2 PIPE AND TUBING

A. Chilled Water, Condenser Water, Heating Hot Water, and Glycol-Water, and Vent Piping:
   1. Steel: ASTM A53/A53M Grade B, seamless or ERW, Schedule 40.
   2. Copper Water Tube Option: ASTM B88, Type K or L, hard drawn.

B. Extension of Domestic Water Make-up Piping: ASTM B88, Type K or L, hard drawn copper tubing.

C. Cooling Coil Condensate Drain Piping:
   1. From Air Handling Units: Copper water tube, ASTM B88, Type M, or Schedule 40 PVC plastic piping. Use of PVC piping is prohibited in exterior applications.
   2. From Fan Coil or Other Terminal Units: Copper water tube, ASTM B88, Type M for runouts and Type L for mains.

D. Chemical Feed Piping for Condenser Water Treatment: CPVC, Schedule 80, ASTM F441/F441M.

E. Pipe supports, including insulation shields, for aboveground piping: Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

2.3 FITTINGS FOR STEEL PIPE

A. 50 mm (2 inches) and Smaller: Screwed or welded joints.
   1. Butt Welding: ASME B16.9 with same wall thickness as connecting piping.
   2. Forged Steel, Socket Welding or Threaded: ASME B16.11.
   3. Screwed: 150-pound malleable iron, ASME B16.3. 125-pound cast-iron, ASME B16.4, may be used in lieu of malleable iron. Bushing reduction of a single pipe size, or use of close nipples, is prohibited.
   4. Unions: ASME B16.39.
   5. Water Hose Connection Adapter: Brass, pipe thread to 19 mm (3/4 inch) garden hose thread, with hose cap nut.

B. 63 mm (2-1/2 inches) and Larger: Welded or flanged joints.
   1. Butt Welding Fittings: ASME B16.9 with same wall thickness as connecting piping. Elbows shall be long radius type, unless otherwise noted.
   2. Welding Flanges and Bolting: ASME B16.5:
      a. Water Service: Weld neck or slip-on, plain face, with 3.2 mm (1/8 inch) thick full-face neoprene gasket suitable for 104 degrees C (220 degrees F).
         1) Contractor's Option: Convoluted, cold formed 150-pound steel flanges, with Teflon gaskets, may be used for water service.
      b. Flange Bolting: Carbon steel machine bolts or studs and nuts, ASTM A193.

C. Welded Branch and Tap Connections: Forged steel weldolets, or branchlets and threadolets shall be used for branch connections up to 1 pipe size smaller than the main. Forged steel half-couplings, ASME B16.11 shall be used for drain, vent, and gauge connections.

D. Pro-Press fittings are not allowable.

2.4 FITTINGS FOR COPPER TUBING

A. Joints:
   1. Solder Joints: Joints shall be made up in accordance with recommended practices of the materials applied. Apply 95/5 tin and antimony on all copper piping.

B. Bronze Flanges and Flanged Fittings: ASME B16.24.

C. Fittings: ASME B16.18 cast copper or ASME B16.22 solder wrought copper.

2.5 FITTINGS FOR PLASTIC PIPING

A. Schedule 40, socket type for solvent welding.

B. Schedule 40 PVC Drain Piping: Drainage pattern.

2.6 DIELECTRIC FITTINGS

A. Provide where copper tubing and ferrous metal pipe are joined.

B. 50 mm (2 inches) and Smaller: Threaded dielectric union, ASME B16.39.

C. 63 mm (2-1/2 inches) and Larger: Flange union with dielectric gasket and bolt sleeves, ASME B16.42. Dielectric gasket material shall be compatible with hydronic medium.

D. Temperature Rating: 99 degrees C (210 degrees F).

E. Contractor's Option: On pipe sizes 50 mm (2 inch) and smaller, screwed end brass ball valves may be used in lieu of dielectric unions.

2.7 SCREWED JOINTS

A. Pipe Thread: ASME B1.20.1.

B. Lubricant or Sealant: Oil and graphite or other compound approved for the intended service.

2.8 VALVES

A. Asbestos packing is prohibited.

B. All valves of the same type shall be products of a single manufacturer.

C. Provide chain operators for valves 152 mm (6 inches) and larger when the centerline is located 2.4 m (8 feet) or more above the floor or operating platform.

D. Shut-Off Valves:
1. Ball Valves (Pipe Sizes 50 mm (2 inch) and Smaller): MSS SP-110, screwed or solder connections, brass or bronze body with chrome-plated ball with full port and Teflon seat at 4138 kPa (600 psig) working pressure rating. Provide stem extension to allow operation without interfering with pipe insulation.
2. Butterfly Valves (Pipe Sizes 63 mm (2-1/2 inch) and Larger): Provide stem extension to allow 50 mm (2 inches) of pipe insulation without interfering with valve operation. MSS SP-67, flange lug type rated 1200 kPa (175 psig) working pressure at 93 degrees C (200 degrees F). Valves shall be ANSI Leakage Class VI and rated for bubble tight shut-off to full valve pressure rating. Valve shall be rated for dead end service and bi-directional flow capability to full rated pressure. Butterfly valves are prohibited for direct buried pipe applications.
   a. Body: Cast-iron, ASTM A126, Class B. Malleable iron, ASTM A47/A47M electro-plated, or ductile iron, ASTM A536, Grade 65-45-12 electro-plated.
   b. Trim: Bronze, aluminum bronze, or 300 series stainless-steel disc, bronze bearings, 316 stainless-steel shaft and manufacturer's recommended resilient seat. Resilient seat shall be field replaceable, and fully line the body to completely isolate the body from the product. A phosphate coated steel shaft or stem is acceptable if the stem is completely isolated from the product.
3. Gate Valves:
   a. 50 mm (2 inches) and Smaller: MSS SP-80, Bronze, 1034 kPa (150 psig), wedge disc, rising stem, union bonnet.
   b. 63 mm (2-1/2 inches) and Larger: Flanged, outside screw and yoke. MSS SP-70, iron body, bronze mounted, 860 kPa (125 psig) wedge disc.
4. Field Interchangeable Actuators: Valves for balancing service shall have adjustable memory stop to limit open position.
   a. Valves 152 mm (6 inches) and Smaller: Lever actuator with minimum of seven locking positions, except where chain wheel is required.
   b. Valves 203 mm (8 inches) and Larger: Enclosed worm gear with handwheel, and where required, chain-wheel operator.

E. Globe and Angle Valves:
1. Globe Valves:
   a. 50 mm (2 inches) and Smaller: MSS SP-80, bronze, 1034 kPa (150 psig) Globe valves shall be union bonnet with metal plug type disc.
   b. 63 mm (2-1/2 inches) and Larger: 860 kPa (125 psig), flanged, iron body, bronze trim, MSS SP-85 for globe valves.
2. Angle Valves:

a. 50 mm (2 inches) and Smaller: MSS SP-80, bronze, 1034 kPa (150 psig) Angle valves shall be union bonnet with metal plug type disc.
b. 63 mm (2-1/2 inches) and Larger: 860 kPa (125 psig), flanged, iron body, bronze trim, MSS SP-85 for angle.

F. Check Valves:
1. Swing Check Valves:
a. 50 mm (2 inches) and Smaller: MSS SP-80, bronze, 1034 kPa (150 psig), 45-degree swing disc.
b. 63 mm (2-1/2 inches) and Larger: 860 kPa (125 psig), flanged, iron body, bronze trim, MSS SP-71 for check valves.
2. Non-Slam or Silent Check Valve: Spring loaded double disc swing check or internally guided flat disc lift type check for bubble tight shut-off. Provide where check valves are shown in chilled water and hot water piping. Check valves incorporating a balancing feature may be used.
a. Body: MSS SP-125 cast-iron, ASTM A126, Class B, or steel, ASTM A216/A216M, Class WCB, or ductile iron, ASTM 536, flanged or wafer type.
b. Seat, Disc and Spring: 18-8 stainless-steel, or bronze, ASTM B62. Seats may be elastomer material.

G. Water Flow Balancing Valves: For flow regulation. Provide separate isolation valve. Valves shall be sized to provide the needed pressure drop in the middle of their throttling range.
1. Ball or Globe style valve.
2. A dual-purpose flow balancing valve and adjustable flow meter, with bronze or cast-iron body, calibrated position pointer, valved pressure taps or quick disconnects with integral check valves and preformed polyurethane insulating enclosure.
3. Provide a readout kit including flow meter, readout probes, hoses, flow charts or calculator, and carrying case.

H. Automatic Balancing Control Valves: Factory calibrated to maintain constant flow (plus or minus five percent) over system pressure fluctuations of 28 to 393 kPa (4 to 57 psig). Provide standard pressure taps and 4 sets of capacity charts. Valves shall be line size and be one of the following designs:
1. Gray iron ASTM A126 or brass body rated 1200 kPa (175 psig) at 93 degrees C (200 degrees F), with stainless-steel piston and spring.
2. Brass or ferrous body designed for 2070 kPa (300 psig) service at 121 degrees C (250 degrees F), with corrosion resistant, tamper proof, self-cleaning piston/spring assembly that is easily removable for inspection or replacement.
3. Combination assemblies containing ball type shut-off valves, unions, flow regulators, strainers with blowdown valves and pressure temperature ports shall be acceptable.
4. Provide a readout kit including flow meter, probes, hoses, flow charts and carrying case.

I. Manual Radiator/Convector Valves: Brass, packless, with position indicator.

2.9 WATER FLOW MEASURING DEVICES

A. Minimum overall accuracy plus or minus 3 percent over a range of 70 to 110 percent of design flow. Select devices for not less than 110 percent of design flow rate.

B. Venturi Type: Bronze, steel, or cast-iron with bronze throat, with valved pressure sensing taps upstream and at the throat.

C. Wafer Type Circuit Sensor: Cast-iron wafer-type flow meter equipped with readout valves to facilitate the connecting of a differential pressure meter. Each readout valve shall be fitted with an integral check valve designed to minimize system fluid loss during the monitoring process.

D. Self-Averaging Annular Sensor Type: Brass or stainless-steel metering tube, shutoff valves and quick-coupling pressure connections. Metering tube shall be rotatable so all sensing ports may be pointed down-stream when unit is not in use.

E. Insertion Turbine Type Sensor: Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

F. Flow Measuring Device Identification:
   1. Metal tag attached by chain to the device.
   2. Include meter or equipment number, manufacturer's name, meter model, flow rate factor and design flow rate in gpm.

G. Portable Water Flow Indicating Meters:
   1. Minimum 152 mm (6 inch) diameter dial, forged brass body, beryllium-copper bellows designed for 1200 kPa (175 psig) working pressure at 121 degrees C (250 degrees F).
   2. Bleed and equalizing valves.
   3. Vent and drain hose and two 3 m (10 feet) lengths of hose with quick disconnect connections.
   4. Factory-fabricated carrying case with hose compartment and a bound set of capacity curves showing flow rate versus pressure differential.
   5. Provide 1 portable meter for each range of differential pressure required for the installed flow devices.

H. Permanently Mounted Water Flow Indicating Meters: Minimum 152 mm (6 inch) diameter, or 457 mm (18 inch) long scale, for 120 percent of design flow rate, direct reading in gpm, with 3 valve manifold and 2 shut-off valves.

2.10 STRAINERS

A. Y Type.
   1. Screens: Bronze, Monel metal or 18-8 stainless-steel, free area not less than 2-1/2 times pipe area, with perforations as follows: 1.1 mm (0.045 inch) diameter perforations for 100 mm (4 inches) and larger: 3.2 mm (1/8 inch) diameter perforations.

B. Suction Diffusers: Specified in Section 23 21 23, HYDRONIC PUMPS.

2.11 FLEXIBLE CONNECTORS FOR WATER SERVICE

A. Flanged Spool Connector:
   1. Single arch or multiple arch type. Tube and cover shall be constructed of chlorobutyl elastomer with full faced integral flanges to provide a tight seal without gaskets. Connectors shall be internally reinforced with high strength synthetic fibers impregnated with rubber or synthetic compounds as recommended by connector manufacturer, and steel reinforcing rings.
   2. Working pressures and temperatures shall be as follows:
      a. Connector sizes 50 mm to 100 mm (2 inches to 4 inches), 1137 kPa (165 psig) at 121 degrees C (250 degrees F).
      b. Connector sizes 127 mm to 305 mm (5 inches to 12 inches), 965 kPa (140 psig) at 121 degrees C (250 degrees F).
   3. Provide ductile iron retaining rings and control units.

B. Braided Hose: Corrugated-metal inner hose and braided outer shell.
   1. Piping Up To 50 mm (2 inches): Bronze hoses and single-braid bronze sheaths with 3102 kPa at 21 degrees C (450 psig at 70 degrees F) and 2344 kPa at 232 degrees C (340 psig at 450 degrees F) ratings.
   2. Piping From 65 mm (2-1/2 inches) To 100 mm (4 inches): Stainless-steel hoses and single-braid, stainless-steel sheaths with 2070 kPa at 21 degrees C (300 psig at 70 degrees F) and 1550 kPa at 232 degrees C (225 psig at 450 degrees F) ratings.
   3. Piping From 150 mm (6 inches) and Above: Stainless-steel hoses and single-braid, stainless-steel sheaths with 1380 kPa at 21 degrees C (200 psig at 70 degrees F) and 1000 kPa at 315 degrees C (145 psig at 600 degrees F) ratings.

2.12 EXPANSION JOINTS

A. Factory built devices, inserted in the pipe lines, designed to absorb axial cyclical pipe movement which results from thermal expansion and contraction. This includes factory-built or field-fabricated guides located along the pipe lines to restrain lateral pipe motion and direct the axial pipe movement into the expansion joints.

B. Manufacturing Quality Assurance: Conform to Expansion Joints Manufacturers Association (EJMA) Standards.

C. Bellows - Internally Pressurized Type:
   1. Multiple corrugations of Type 304 or Type A240-321 stainless-steel.
   2. Internal stainless-steel sleeve entire length of bellows.
   3. External cast-iron equalizing rings for services exceeding 345 kPa (50 psig).
   4. Welded ends.
   5. Design shall conform to standards of EJMA and ASME B31.9.
   6. External tie rods designed to withstand pressure thrust force upon anchor failure if one or both anchors for the joint are at change in direction of pipeline.
   7. Integral external cover.

D. Bellows - Externally Pressurized Type:
   1. Multiple corrugations of Type 304 stainless-steel.
   2. Internal and external guide integral with joint.
   3. Design for external pressurization of bellows to eliminate squirm.
   4. Welded ends.
   5. Conform to the standards of EJMA and ASME B31.9.
   6. Threaded connection at bottom, 25 mm (1 inch) minimum, for drain or drip point.
   7. Integral external cover and internal sleeve.

E. Expansion Compensators:
   1. Corrugated bellows, externally pressurized, stainless-steel or bronze.
   2. Internal guides and anti-torque devices.
   3. Threaded ends.
   4. External shroud.
   5. Conform to standards of EJMA.

F. Expansion Joint (Contractor’s Option): 2413 kPa (350 psig) maximum working pressure, steel pipe fitting consisting of telescoping body and slip-pipe sections, PTFE modified polyphenylene sulfide coated slide section, with welded or flanged ends, suitable for axial end movement to 75 mm (3 inch).

G. Expansion Joint Identification: Provide stamped brass or stainless-steel nameplate on each expansion joint listing the manufacturer, the allowable movement, flow direction, design pressure and temperature, date of manufacture, and identifying the expansion joint by the identification number in the contract documents.

H. Guides: Provide factory-built guides along the pipe line to permit axial movement only and to restrain lateral and angular movement. Guides shall be designed to withstand a minimum of 15 percent of the axial force which will be imposed on the expansion joints and anchors. Field-built guides shall be used if detailed in the contract documents.

I. Supports: Provide saddle supports and frame or hangers for heat exchanger. Mounting height shall be adjusted to facilitate gravity return of steam condensate. Construct supports from steel, weld joints.

2.13 HYDRONIC SYSTEM COMPONENTS

A. Heat Exchanger (Water to Water): Shell and tube type, U-bend removable tube bundle, heating fluid in shell, heated fluid in tubes, equipped with support cradles.
   1. Maximum Tube Velocity: 2.3 m/s (7.5 f/s).
   2. Tube Fouling Factor: TEMA Standards, but not less than 0.001.

3. Materials:
   a. Shell: Steel.
   b. Tube Sheet and Tube Supports: Steel or brass.
   c. Tubes: 19 mm (3/4 inch) OD copper.
   d. Head or Bonnet: Cast-iron or steel.
4. Construction: In accordance with ASME BPVC Section VIII for 861 kPa (125 psig) working pressure for shell and tubes. Provide manufacturer's certified data report, Form No. U-1.

B. Plate and Frame Heat Exchanger:
1. Fixed frame with bolted removable corrugated channel plate assembly, ASME code stamped for 1034 kPa (150 psig) working pressure.
2. Corrugated channel plates shall be type 316 or 304 stainless-steel.
3. Channel plate ports to be double gasketed to prevent mixing or cross-contamination of hot side and cold side fluids. Gaskets to be EPPM.
4. Channel plate carrying bars to be carbon steel with zinc yellow chromate finish.
5. Fixed frame plates and moveable pressure plates to be corrosion resistant epoxy painted carbon steel.
6. Piping connections 50 mm (2 inch) and smaller to be carbon steel NPT tappings. Piping connections 100 mm (4 inch) and larger to be studded port design to accept ANSI flange connections. Connection ports to be integral to the frame or pressure plate.
7. Finished units to be provided with OSHA required, formed aluminum splash guards to enclose exterior channel plate and gasket surfaces.
8. Provide 2 sets of replacement gaskets and provide 1 set of wrenches for disassembly of plate type heat exchangers.
9. Performance: As scheduled in the contract documents.

C. Optional Heat Transfer Package: In lieu of field erected individual components, the Contractor may provide a factory or shop assembled package of converters, pumps, and other components, pre-piped and pre-wired supported on a welded steel frame or skid. Refer to Section 23 22 13, STEAM AND CONDENSATE HEATING PIPING, for additional requirements.

D. Air Purger: Cast-iron or fabricated steel, 861 kPa (125 psig) water working pressure, for in-line installation.

E. Tangential Air Separator: ASME BPVC Section VIII construction for 861 kPa (125 psig) working pressure, flanged tangential inlet and outlet connection, internal perforated stainless-steel air collector tube designed to direct released air into expansion tank, bottom blowdown connection. Provide Form No. U-1. If scheduled in the contract documents, provide a removable stainless-steel strainer element having 5 mm (3/16 inch) perforations and free area of not less than five times the cross-sectional area of connecting piping.

F. Diaphragm Type Pre-Pressurized Expansion Tank: ASME BPVC Section VIII construction for 861 kPa (125 psig) working pressure, welded steel shell, rustproof coated, with a flexible elastomeric diaphragm suitable for a maximum operating temperature of 115 degrees C (240 degrees F). Provide Form No. U-1. Tank shall be equipped with system connection, drain connection, standard air fill valve and be factory pre-charged to a minimum of 83 kPa (12 psig).

G. Closed Expansion (Compression) Tank: ASME BPVC Section VIII construction for 861 kPa (125 psig) working pressure, steel, rustproof coated. Provide gauge glass, with protection guard, and angle valves with tapped openings for drain (bottom) and plugged vent (top). Provide Form No. U-1.
1. Horizontal Tank: Provide cradle supports and following accessories:
   a. Air control tank fittings: Provide in each expansion tank to facilitate air transfer from air separator, or purger, into tank while restricting gravity circulation. Fitting shall include an integral or separate air vent tube, cut to length of about 2/3 of tank diameter, to allow venting air from the tank when establishing the initial water level in the tank.

b. Tank Drainer-Air Charger: Shall incorporate a vent tube, cut to above 2/3 of tank diameter, and drain valve with hose connection draining and recharging with air.

2. Vertical Floor-Mounted Expansion Tank: Provide gauge glass, system or drain connection (bottom) and air charging (top) tappings. Provide gate valve and necessary adapters for charging system. Tank support shall consist of floor mounted base ring with drain access opening or four angle iron legs with base plates.

H. Pressure Reducing Valve (Water): Diaphragm or bellows operated, spring loaded type, with minimum adjustable range of 28 kPa (4 psig) above and below set point. Bronze, brass or iron body and bronze, brass or stainless-steel trim, rated 861 kPa (125 psig) working pressure at 107 degrees C (225 degrees F).

I. Pressure Relief Valve: Bronze or iron body and bronze or stainless-steel trim, with testing lever. Comply with ASME BPVC Section VIII and bear ASME stamp.

J. Automatic Air Vent Valves: Where shown in the contract documents, cast-iron or semi-steel body, 1034 kPa (150 psig) working pressure, stainless-steel float, valve, valve seat and mechanism, minimum 13 mm (1/2 inch) water connection and 6 mm (1/4 inch) air outlet. Air outlet shall be piped to the nearest floor drain.

K. Buffer Tank: Buffer tank shall be constructed with a built-in baffle to allow mixing of the fluid inside the tank. Tank shall be constructed in accordance with ASME BPVC Section VIII requirements and stamped and registered with the National Board of Boiler and Pressure Vessel Inspectors. Tank shall have a working pressure of 861 kPa (125 psig) and shall come equipped with a base ring for installing the buffer tank directly on a level surface. The tank shall be furnished with two flanged connections, tappings for air vent, relief valve and drain. Buffer tank shall have a capacity as indicated in the contract documents.

2.14 WATER FILTERS AND POT CHEMICAL FEEDERS

A. See Section 23 25 00, HVAC WATER TREATMENT, paragraph, CHEMICAL TREATMENT FOR CLOSED LOOP SYSTEMS.

2.15 GAUGES, PRESSURE AND COMPOUND

A. ASME B40.100, Accuracy Grade 1A, (pressure, vacuum, or compound for air, oil or water), initial mid-scale accuracy 1 percent of scale (Qualify grade), metal or phenolic case, 114 mm (4-1/2 inches) in diameter, 6 mm (1/4 inch) NPT bottom connection, white dial with black graduations and pointer, clear glass or acrylic plastic window, suitable for board mounting. Provide red "set hand" to indicate normal working pressure.

B. Provide brass lever handle union cock. Provide brass/bronze pressure snubber for gauges in water service.

C. Range of Gauges: Provide range equal to at least 130 percent of normal operating range.

1. For Condenser Water Suction (Compound): 101 kPa (29.5 inches Hg) to 689 kPa (100 psig).

2.16 PRESSURE/TEMPERATURE TEST PROVISIONS

A. Pete's Plug: 6 mm (1/4 inch) MPT by 75 mm (3 inches) long, brass body and cap, with retained safety cap, Nordel self-closing valve cores, permanently installed in piping where shown, or in lieu of pressure gauge test connections shown in the contract documents.

B. Provide one each of the following test items to the COR:

1. 6 mm (1/4 inch) FPT by 3.2 mm (1/8 inch) diameter stainless-steel pressure gauge adapter probe for extra-long test plug.
2. 89 mm (3-1/2 inch) diameter, one percent accuracy, compound gauge, 101 kPa (29.5 inches Hg) to 689 kPa (100 psig) range.
3. 0 to 104 degrees C (32 to 220 degrees F) pocket thermometer 1/2-degree accuracy, 25 mm (1 inch) dial, 127 mm (5 inch) long stainless-steel stem, plastic case.

2.17 THERMOMETERS

A. Mercury or organic liquid filled type, red or blue column, clear plastic window, with 152 mm (6 inch) brass stem, straight, fixed or adjustable angle as required for each in reading.

B. Case: Chrome plated brass or aluminum with enamel finish.

C. Scale: Not less than 228 mm (9 inches), range as described below, 2-degree graduations.

D. Separable Socket (Well): Brass, extension neck type to clear pipe insulation.

E. Scale Ranges:
1. Chilled Water and Glycol-Water: 0 to 38 degrees C (32 to 100 degrees F).
2. Hot Water and Glycol-Water: 38 to 93 degrees C (100 to 200 degrees F).

2.18 FIRESTOPPING MATERIAL

A. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

2.19 ELECTRICAL HEAT TRACING SYSTEMS

A. Systems shall meet requirements of NFPA 70.

B. Provide tracing for outdoor piping subject to freezing temperatures below 3.3 degrees C (38 degrees F) as follows:
1. Chilled water piping and all other areas exposed to the weather.
2. Domestic water lines exposed to weather.

C. Heat tracing shall be provided to the extent shown in the contract documents (Floor plans and Elevations). Heat tracing shall extend below grade to below the defined frost line.

D. Heating Cable: Flexible, parallel circuit construction consisting of a continuous self-limiting resistance, conductive inner core material between two parallel copper bus wires, designed for cut-to-length at the job site and for wrapping around valves and complex fittings. Self-regulation shall prevent overheating and burnouts even where the cable overlaps itself.
1. Provide end seals at ends of circuits. Wire at the ends of the circuits is not to be tied together.
2. Provide sufficient cable, as recommended by the manufacturer, to keep the pipe surface at 2.2 degrees C (36 degrees F) minimum during winter outdoor design temperature, but not less than the following:
   a. 75 mm (3 inch) pipe and smaller with 25 mm (1 inch) thick insulation: 4 watts per foot of pipe.
   b. 100 mm (4 inch) pipe and larger 38 mm (1-1/2 inch) thick insulation: 8 watts per feet of pipe.

E. Electrical Heating Tracing Accessories:
1. Power supply connection fitting and stainless-steel mounting brackets. Provide stainless-steel worm gear clamp to fasten bracket to pipe.
2. 13 mm (1/2 inch) wide fiberglass reinforced pressure sensitive cloth tape to fasten cable to pipe at 305 mm (12 inch) intervals.
3. Pipe surface temperature control thermostat: Cast aluminum, NEMA 4 (watertight) enclosure, 13 mm (1/2 inch) NPT conduit hub, SPST switch rated 20 amps at 480 volts ac, with capillary and copper bulb sensor. Set thermostat to maintain pipe surface temperature at not less than 1 degree C (34 degrees F).
4. Signs: Manufacturer's standard (NFPA 70), stamped "ELECTRIC TRACED" located on the insulation jacket at 3 m (10 feet) intervals along the pipe on alternating sides.

PART 3 - EXECUTION

3.1 INSTALLATION

A. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no additional cost or time to the Government.

B. The contract documents show the general arrangement of pipe and equipment but do not show all required fittings and offsets that may be necessary to connect pipes to equipment, fan-coils, coils, radiators, etc., and to coordinate with other trades. Provide all necessary fittings, offsets and pipe runs based on field measurements and at no additional cost or time to the Government. Coordinate with other trades for space available and relative location of HVAC equipment and accessories to be connected on ceiling grid. Pipe location in the contract documents shall be altered by contractor where necessary to avoid interferences and clearance difficulties.

C. Store materials to avoid excessive exposure to weather or foreign materials. Keep inside of piping relatively clean during installation and protect open ends when work is not in progress.

D. Support piping securely. Refer to PART 3, Section 23 05 11, COMMON WORK RESULTS FOR HVAC. Install heat exchangers at height sufficient to provide gravity flow of condensate to the flash tank and condensate pump.

E. Install piping generally parallel to walls and column center lines, unless shown otherwise in the contract documents. Space piping, including insulation, to provide 25 mm (1 inch) minimum clearance between adjacent piping or other surface. Unless shown otherwise, slope drain piping down in the direction of flow not less than 25 mm (1 inch) in 12 m (40 feet). Provide eccentric reducers to keep bottom of sloped piping flat.

F. Locate and orient valves to permit proper operation and access for maintenance of packing, seat and disc. Generally, locate valve stems in overhead piping in horizontal position. Provide a union adjacent to one end of all threaded end valves. Control valves usually require reducers to connect to pipe sizes shown in the contract documents. Install butterfly valves with the valve open as recommended by the manufacturer to prevent binding of the disc in the seat.

G. Offset equipment connections to allow valving off for maintenance and repair with minimal removal of piping. Provide flexibility in equipment connections and branch line take-offs with 3-elbow swing joints where noted in the contract documents.

H. Tee water piping runouts or branches into the side of mains or other branches. Avoid bull-head tees, which are two return lines entering opposite ends of a tee and exiting out the common side.

I. Provide manual or automatic air vent at all piping system high points and drain valves at all low points. Install piping to floor drains from all automatic air vents.

J. Connect piping to equipment as shown in the contract documents. Install components furnished by others such as:
   1. Water treatment pot feeders and condenser water treatment systems.
   2. Flow elements (orifice unions), control valve bodies, flow switches, pressure taps with valve, and wells for sensors.

K. Thermometer Wells: In pipes 63 mm (2-1/2 inches) and smaller increase the pipe size to provide free area equal to the upstream pipe area.

L. Firestopping: Fill openings around uninsulated piping penetrating floors or fire walls, with firestop material. For firestopping insulated piping refer to Section 23 07 11, HVAC AND BOILER PLANT INSULATION.

M. Where copper piping is connected to steel piping, provide dielectric connections.

3.2 PIPE JOINTS

A. Welded: Beveling, spacing and other details shall conform to ASME B31.9 and AWS B2.1/B2.1M. See Welder's qualification requirements in paragraph QUALITY ASSURANCE of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. Screwed: Threads shall conform to ASME B1.20.1; joint compound shall be applied to male threads only and joints made up so no more than 3 threads show. Coat exposed threads on steel pipe with joint compound, or red lead paint for corrosion protection.

C. 125 Pound Cast-Iron Flange (Plain Face): Mating flange shall have raised face, if any, removed to avoid overstressing the cast-iron flange.

D. Solvent Welded Joints: As recommended by the manufacturer.

3.3 EXPANSION JOINTS (BELLOWS AND SLIP TYPE)

A. Anchors and Guides: Provide type, quantity and spacing as recommended by manufacturer of expansion joint and as shown. A professional engineer shall verify in writing that anchors and guides are properly designed for forces and moments which will be imposed.

B. Cold Set: Provide setting of joint travel at installation as recommended by the manufacturer for the ambient temperature during the installation.

C. Preparation for Service: Remove all apparatus provided to restrain joint during shipping or installation. Representative of manufacturer shall visit the site and verify that installation is proper.

D. Access: Expansion joints shall be located in readily accessible space. Locate joints to permit access without removing piping or other devices. Allow clear space to permit replacement of joints and to permit access to devices for inspection of all surfaces and for adding.

3.4 SEISMIC BRACING ABOVEGROUND PIPING

A. Provide in accordance with Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

3.5 LEAK TESTING ABOVEGROUND PIPING

A. Inspect all joints and connections for leaks and workmanship and make corrections as necessary to the satisfaction of the COR. Tests shall be either of those below, or a combination, as approved by the COR.

B. An operating test at design pressure, and for hot systems, design maximum temperature.

C. A hydrostatic test at 1.5 times design pressure. For water systems, the design maximum pressure would usually be the static head, or expansion tank maximum pressure, plus pump head. Factory tested equipment (convertors, exchangers, coils, etc.) need not be field tested. Isolate equipment where necessary to avoid excessive pressure on mechanical seals and safety devices.

3.6 FLUSHING AND CLEANING PIPING SYSTEMS

A. Water Piping: Clean systems as recommended by the suppliers of chemicals specified in Section 23 25 00, HVAC WATER TREATMENT.

B. Initial Flushing: Remove loose dirt, mill scale, metal chips, weld beads, rust, and like deleterious substances without damage to any system component. Provide temporary piping or hose to bypass coils, control valves, exchangers and other factory cleaned equipment unless acceptable means of protection are provided and subsequent inspection of hide-out areas takes place. Isolate or protect clean system components, including pumps and pressure vessels, and remove any component which may be damaged. Open all valves, drains, vents and strainers at all system levels. Remove plugs, caps, spool pieces, and components to facilitate early debris discharge from system. Sectionalize system to obtain debris carrying velocity of 1.8 m/s (5.9

f/s), if possible. Connect dead-end supply and return headers as necessary. Flush bottoms of risers. Install temporary strainers where necessary to protect down-stream equipment. Supply and remove flushing water and drainage by various type hose, temporary and permanent piping and Contractor's booster pumps. Flush until clean as approved by the COR.

C. Cleaning: Using products supplied in Section 23 25 00, HVAC WATER TREATMENT, circulate systems at normal temperature to remove adherent organic soil, hydrocarbons, flux, pipe mill varnish, pipe joint compounds, iron oxide, and like deleterious substances not removed by flushing, without chemical or mechanical damage to any system component. Removal of tightly adherent mill scale is not required. Keep isolated equipment which is "clean" and where dead-end debris accumulation cannot occur. Sectionalize system, if possible, to circulate at velocities not less than 1.8 m/s (5.9 f/s). Circulate each section for not less than 4 hours. Blow-down all strainers or remove and clean as frequently as necessary. Drain and prepare for final flushing.

D. Final Flushing: Return systems to conditions required by initial flushing after all cleaning solution has been displaced by clean make-up. Flush all dead ends and isolated clean equipment. Gently operate all valves to dislodge any debris in valve body by throttling velocity. Flush for not less than one hour.

3.7 WATER TREATMENT

A. Install water treatment equipment and provide water treatment system piping.

B. Close and fill system as soon as possible after final flushing to minimize corrosion.

C. Charge systems with chemicals specified in Section 23 25 00, HVAC WATER TREATMENT.

D. Utilize this activity, by arrangement with the COR, for instructing VA operating personnel.

3.8 ELECTRIC HEAT TRACING

A. Install tracing as recommended by the manufacturer.

B. Coordinate electrical connections.

3.9 STARTUP AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

C. The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with COR and CxA. Provide a minimum notice of 10 working days prior to startup and testing.

D. Adjust red set hand on pressure gauges to normal working pressure.

3.10 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

B. Components provided under this section of the specification will be tested as part of a larger system.

3.11 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative for 32 hours to instruct each VA personnel responsible in operation and maintenance of the system.

B. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

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SECTION 23 21 23
HYDRONIC PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Hydronic pumps for heating, ventilating and air conditioning.

B. Definitions:
1. Capacity: Liters per second (L/s) (Gallons per minute (gpm)) of the fluid pumped.
2. Head: Total dynamic head in kPa (feet) of the fluid pumped.
3. Flat head-capacity curve: Where the shutoff head is less than 1.16 times the head at the best efficiency point.

C. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

E. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

F. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

G. Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT.

H. Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.

I. Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

J. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

K. Section 23 21 13, HYDRONIC PIPING.

L. Section 26 29 11, MOTOR CONTROLLERS.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur, these specifications and the VHA standard will govern. The latest edition as of the specification issue date shall govern.

B. American Society of Mechanical Engineers (ASME):
B16.1 ..... Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250

C. American Society for Testing and Materials (ASTM):
A48/48M ..... Standard Specification for Gray Iron Castings

B62 ..... Standard Specification for Composition Bronze or Ounce Metal Castings

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION XX XX XX, SECTION TITLE”, with applicable paragraph identification.

C. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
   1. Pumps and accessories.
   2. Motors and drives.
   3. Variable speed motor controllers.

D. Characteristic Curves: Head-capacity, efficiency-capacity, brake horsepower-capacity, and NPSHR-capacity for each pump and for combined pumps in parallel or series service. Identify pump and show fluid pumped, specific gravity, pump speed and curves plotted from zero flow to maximum for the impeller being furnished and at least the maximum diameter impeller that can be used with the casing.

E. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replacement parts, and troubleshooting guide:
   1. Include complete list indicating all components of the systems.
   2. Include complete diagrams of the internal wiring for each item of equipment.
   3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

F. Completed System Readiness Checklist provided by the CxA and completed by the contractor, signed by a qualified technician, and dated on the date of completion, in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

G. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

1.5 QUALITY ASSURANCE

A. Design Criteria:
   1. Pumps design and manufacturer shall conform to Hydraulic Institute Standards.
   2. Pump sizes, capacities, pressures, operating characteristics and efficiency shall be as scheduled.
   3. Head-capacity curves shall slope up to maximum head at shut-off.. Select pumps near the midrange of the curve, so the design capacity falls to the left of the best efficiency point, to allow a cushion for the usual drift to the right in operation, without approaching the pump curve end point and possible cavitation and unstable operation. Select pumps for open systems so that required net positive suction head (NPSHR) does not exceed the net positive head available (NPSHA). Provide pumps with non-overloading motors.
   4. Pump Driver: Furnish with pump. Size shall be non-overloading at any point on the head-capacity curve, including in a parallel or series pumping installation with one pump in operation.
   5. Provide all pumps with motors, impellers, drive assemblies, bearings, coupling guard and other accessories specified. Statically and dynamically balance all rotating parts.
   6. Furnish each pump and motor with a nameplate giving the manufacturers name, serial number of pump, capacity in gpm and head in feet at design condition, horsepower, voltage, frequency, speed and full load current and motor efficiency. Name plates shall be visible when pumps are insulated.
   7. Test all pumps before shipment. The manufacturer shall certify all pump ratings.
   8. After completion of balancing, provide replacement of impellers or trim impellers to provide specified flow at actual pumping head, as installed.

B. Allowable Vibration Tolerance for Pump Units: Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.

C. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

D. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

1.6 AS-BUILT DOCUMENTATION

A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

1.7 SPARE MATERIALS

A. Furnish one spare seal and casing gasket for each pump to the COR.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL PUMPS, BRONZE FITTED

A. General:
1. Provide pumps that will operate continuously without overheating bearings or motors at every condition of operation on the pump curve, or produce noise audible outside the room or space in which installed.
2. Provide pumps of size, type and capacity as indicated, complete with electric motor and drive assembly, unless otherwise indicated. Design pump casings for the indicated working pressure and factory test at 1-1/2 times the designed pressure.
3. Provide pumps of the same type, the product of a single manufacturer, with pump parts of the same size and type interchangeable.
4. General Construction Requirements:
   a. Balance: Rotating parts, statically and dynamically.
   b. Construction: To permit servicing without breaking piping or motor connections.
   c. Pump Motors: Provide high efficiency motors, inverter duty for variable speed service. Refer to Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT. Motors shall operate at 1750 RPM unless noted otherwise.
   d. Heating pumps shall be suitable for handling water to 107 degrees C (225 degrees F).
   e. Provide coupling guards that meet OSHA requirements.
   f. Pump Connections: Flanged.
   g. Pump shall be factory tested.
   h. Performance: As scheduled in the contract documents.
5. Variable Speed Pumps:
   a. The pumps shall be the type shown in the contract documents and specified herein flex coupled to an open drip proof motor.
   b. Variable Speed Motor Controllers: Refer to Section 26 29 11, MOTOR CONTROLLERS /Section 23 05 11, COMMON WORK RESULTS FOR HVAC paragraph, VARIABLE SPEED MOTOR CONTROLLERS. Furnish controllers with pumps and motors.
   c. Pump operation and speed control shall be as shown in the contract documents.

B. Inline Type, Base Mounted End Suction or Double Suction Type:
1. Casing and Bearing Housing: Close-grained cast-iron, ASTM A48/A48M.
2. Casing Wear Rings: Bronze.
3. Suction and Discharge: Plain face flange, 861 kPa (125 psig), ASME B16.1.

4. Casing Vent: Manual brass cock at high point.
5. Casing Drain and Gauge Taps: 13 mm (1/2 inch) plugged connections minimum size.
6. Impeller: Bronze, ASTM B62, enclosed type, keyed to shaft.
7. Shaft: Steel, Type 1045 or stainless-steel.
8. Shaft Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and EPDM bellows and gasket.
9. Shaft Sleeve: Bronze or stainless-steel.
10. Motor: Furnish with pump. Refer to Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT.
11. Base Mounted Pumps:
    a. Designed for disassembling for service or repair without disturbing the piping or removing the motor.
    b. Impeller Wear Rings: Bronze.
    c. Shaft Coupling: Non-lubricated steel flexible type or spacer type with coupling guard, bolted to the baseplate.
    d. Bearings (Double-Suction pumps): Regreaseable ball or roller type.
    e. Provide lip seal and slinger outboard of each bearing.
    f. Base: Cast-iron or fabricated steel for common mounting to a concrete base.
12. Provide line sized shut-off valve and suction strainer, maintain manufacturer recommended straight pipe length on pump suction (with blowdown valve). Contractor option: Provide suction diffuser as follows:
    a. Body: Cast-iron with steel inlet vanes and combination diffuser-strainer-orifice cylinder with 5 mm (3/16 inch) diameter openings for pump protection. Provide taps for strainer blowdown and gauge connections.
    b. Provide adjustable foot support for suction piping.
    c. Strainer free area: Not less than 5 times the suction piping.
    d. Provide disposable startup strainer.

2.2 AUTOMATIC CONDENSATE PUMP UNITS

A. Packaged units with corrosion-resistant pump, aluminum tank with cover, and automatic controls. Collects and removes condensate from fan coil units, air handling units, condensing boilers, and similar components. Include factory- or field-installed check valve and 1829 mm (72 inch) minimum, electrical power cord with plug.

PART 3 - EXECUTION

3.1 INSTALLATION

A. If an installation is unsatisfactory to the COR, the contractor shall correct the installation at no additional cost or time to the Government.

B. Follow manufacturer's written instructions for pump mounting and startup. Access/Service space around pumps shall not be less than minimum space recommended by pumps manufacturer.

C. Provide drains for bases and seals for base mounted pumps, piped to and discharging into floor drains.

D. Coordinate location of thermometer and pressure gauges as per Section 23 21 13, HYDRONIC PIPING.

3.2 STARTUP AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

C. The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with COR and CxA. Provide a minimum notice of 10 working days prior to startup and testing.

D. Verify that the piping system has been flushed, cleaned and filled.

E. Lubricate pumps before startup.

F. Prime the pump, vent all air from the casing and verify that the rotation is correct. To avoid damage to mechanical seals, never start or run the pump in dry condition.

G. Verify that correct size heaters-motor over-load devices are installed for each pump controller unit.

H. Field modifications to the bearings and or impeller (including trimming) are prohibited. If the pump does not meet the specified vibration tolerance, send the pump back to the manufacturer for a replacement pump. All modifications to the pump shall be performed at the factory.

I. Ensure the disposable strainer is free of debris prior to testing and balancing of the hydronic system.

J. After several days of operation, replace the disposable startup strainer with a regular strainer in the suction diffuser.

3.3 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

B. Components provided under this section of the specification will be tested as part of a larger system.

3.4 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer's technical representative for 16 hours to instruct each VA personnel responsible in operation and maintenance of the system.

B. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

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SECTION 23 22 13
STEAM AND CONDENSATE HEATING PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Steam, condensate, and vent piping inside buildings.

B. Boiler plant and outside steam distribution piping is covered in specification Section 33 63 00, STEAM ENERGY DISTRIBUTION.

C. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

E. Section 09 91 00, PAINTING.

F. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

G. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

H. Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

I. Section 23 07 11, HVAC AND BOILER PLANT INSULATION.

J. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

K. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

L. Section 23 22 23, STEAM CONDENSATE PUMPS.

M. Section 23 25 00, HVAC WATER TREATMENT.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards shall govern. The latest edition as of the specification issue date shall govern.

B. American Society of Mechanical Engineers (ASME):

B1.20.1 ..... Pipe Threads, General Purpose (Inch)

B16.5 ..... Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard

B16.9 ..... Factory Made Wrought Buttwelding Fittings

B16.11 ..... Forged Fittings, Socket-Welding and Threaded

B16.42 ..... Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300

B31.1 ..... Power Piping

B31.9 ..... Building Services Piping

B40.100 ..... Pressure Gauges and Gauge Attachments

ASME Boiler and Pressure Vessel Code (BPVC) -

BPVC Section II Materials

BPVC Section VIII Rules for Construction of Pressure Vessels, Division 1

BPVC Section IX Welding, Brazing, and Fusing Qualifications

C. American Society for Testing and Materials (ASTM):

A53/A53M..... Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

A106/A106M..... Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service

A193/A193M..... Standard Specification for Alloy-Steel and Stainless-Steel Bolting for High Temperature or High-Pressure Service and Other Special Purpose Applications

A194/A194M..... Standard Specification for Carbon Steel, Alloy Steel, and Stainless-Steel Nuts for Bolts for High Pressure or High-Temperature Service, or Both

A216/A216M..... Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service

A285/A285M..... Standard Specification for Pressure Vessel Plates, Carbon Steel, Low-and Intermediate-Tensile Strength

A516/A516M..... Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service

A536 ..... Standard Specification for Ductile Iron Castings

B62 ..... Standard Specification for Composition Bronze or Ounce Metal Castings

D. American Welding Society (AWS):

B2.1/B2.1M..... Specification for Welding Procedure and Performance Qualifications

Z49.1 ..... Safety in Welding and Cutting and Allied Processes

E. Manufacturers Standardization Society (MSS) of the Valve and Fitting Industry, Inc.:

SP-80 ..... Bronze Gate, Globe, Angle, and Check Valves

F. Military Specifications (Mil. Spec.):

MIL-DTL-901E..... Shock Tests, H.I. (High Impact) Shipboard Machinery, Equipment, and Systems

G. National Board of Boiler and Pressure Vessel Inspectors (NB):

Relieving Capacities of Safety Valves and Relief Valves

H. Tubular Exchanger Manufacturers Association (TEMA):

TEMA Standards-2019..... 10th Edition

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 23 22 13, STEAM AND CONDENSATE HEATING PIPING”, with applicable paragraph identification.

C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
   1. Pipe and equipment supports. Submit calculations for variable spring and constant support hangers.
   2. Pipe and tubing, with specification, class or type, and schedule.
   3. Pipe fittings, including miscellaneous adapters and special fittings.
   4. Flanges, gaskets and bolting.
   5. Valves of all types.
   6. Steam traps.
   7. Steam trap monitoring system.
   8. Strainers.
   9. Pipe alignment guides.
   10. Expansion joints.
   11. Expansion compensators.
   12. Flexible ball joints: Catalog sheets, performance charts, schematic drawings, specifications and installation instructions.
   13. All specified steam system components.
   14. Gauges.
   15. Thermometers and test wells.
   16. Electric heat tracing systems.
   17. Seismic bracing details for piping.

D. Manufacturer's certified data report, Form No. U-1, for ASME pressure vessels:
   1. Heat Exchangers (Steam-to-Hot Water).
   2. Flash tanks.

E. Coordination Drawings: Refer to paragraph, SUBMITTALS of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

F. As-Built Piping Diagrams: Provide drawing as follows for steam and steam condensate piping and other central plant equipment.
   1. One wall-mounted stick file for prints. Mount stick file in the chiller plant or adjacent control room along with control diagram stick file.
   2. One set of reproducible drawings.

G. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replacement parts, and troubleshooting guide:
   1. Include complete list indicating all components of the systems.
   2. Include complete diagrams of the internal wiring for each item of equipment.
   3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

H. Completed System Readiness Checklist provided by the CxA and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

I. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

1.5 QUALITY ASSURANCE

A. Section 23 05 11, COMMON WORK RESULTS FOR HVAC, which includes welding qualifications.

B. The products and execution of work specified in this section shall conform to the referenced codes and standards as required by the specifications. Local codes and amendments shall be

enforced, along with requirements of local utility companies. The most stringent requirements of these specifications, local codes, or utility company requirements shall always apply. Any conflicts shall be brought to the attention of the COR.

C. Welding Qualifications: Before any welding is performed, contractor shall submit a certificate certifying that welders comply with the following requirements:
   1. Qualify welding processes and operators for piping according to ASME BPVC Section IX, AWS Z49.1 and AWS B2.1/B2.1M.
   2. Comply with provisions in ASME B31.9.
   3. Certify that each welder and welding operator has passed AWS qualification tests for welding processes involved and that certification is current and recent. Submit documentation to the COR.
   4. All welds shall be stamped according to the provisions of the American Welding Society.

D. ASME Compliance: Comply with ASME B31.9 for materials, products, and installation. Safety valves and pressure vessels shall bear appropriate ASME labels.

1.6 AS-BUILT DOCUMENTATION

A. Submit manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.

B. Submit operation and maintenance data updated to include submittal review comments, VA approved substitutions and construction revisions shall be in electronic version on CD or DVD and also inserted into a three-ring binder. All aspects of system operation and maintenance procedures, including applicable piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.

C. The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. Should the installing contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement. Provide record drawings as follows:
   1. Red-lined, hand-marked drawings are to be provided, with one paper copy and a scanned PDF version of the hand-marked drawings provided on CD or DVD.
   2. As-built drawings are to be provided, with a copy of them on AutoCAD version 2020 provided on CD or DVD. The CAD drawings shall use multiple line layers with a separate individual layer for each system.

D. The as-built drawings shall indicate the location and type of all lockout/tagout points for all energy sources for all equipment and pumps to include breaker location and numbers, valve tag numbers, etc. Coordinate lockout/tagout procedures and practices with local VA requirements.

E. Certification documentation shall be provided to COR 21 working days prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and provide documentation/certification that all results of tests were within limits specified. Test results shall contain written sequence of test procedure with written test results annotated at each step along with the expected outcome or setpoint. The results shall include all readings, including but not limited to data on device (make, model and performance characteristics), normal pressures, switch ranges, trip points, amp readings, and calibration data to include equipment serial numbers or individual identifications, etc.

PART 2 - PRODUCTS

2.1 PIPE AND EQUIPMENT SUPPORTS, PIPE SLEEVES, AND WALL AND CEILING PLATES

A. Provide in accordance with Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

2.2 PIPE AND TUBING

A. Steam Piping: Steel, ASTM A53/A53M, Grade B, seamless or ERW; ASTM A106/A106M Grade B, seamless; Schedule 40.

B. Steam Condensate and Pumped Condensate Piping: Steel, ASTM A53/A53M, Grade B, seamless or ERW; or ASTM A106/A106M Grade B, seamless, Schedule 80.

C. Vent Piping: Steel, ASTM A53/A53M, Grade B, seamless or ERW; ASTM A106/A106M Grade B, seamless; Schedule 40, galvanized.

D. Clean steam and Condensate: Stainless Steel Min 316L Pipe and fittings.

2.3 FITTINGS FOR STEEL PIPE

A. 50 mm (2 inches) and Smaller: Screwed or welded.
   1. Cast iron fittings or piping is prohibited for steam and steam condensate piping. Bushing reduction or use of close nipples is prohibited.
   2. Forged steel, socket welding or threaded: ASME B16.11, 13,790 kPa (2000 psig) class with ASME B1.20.1 threads. Use Schedule 80 pipe and fittings for threaded joints. Lubricant or sealant shall be oil and graphite, or other compound approved for the intended service.
   3. Unions: Forged steel, 13,790 kPa (2000 psig) class or 20,685 kPa (3000 psig) class on piping 50 mm (2 inches) and less.
   4. Steam line drip station and strainer quick-couple blowdown hose connection: Straight through, plug and socket, screw or cam locking type for 15 mm (1/2 inch) ID hose. No integral shut-off is required.

B. 65 mm (2-1/2 inches) and Larger: Welded or flanged joints.
   1. Cast iron fittings or piping is prohibited for steam and steam condensate piping.
   2. Butt welding fittings: ASME B16.9 with same wall thickness as connecting piping. Elbows shall be long radius type, unless otherwise noted.
   3. Welding flanges and bolting: ASME B16.5:
      a. Steam service: Weld neck or slip-on, raised face, with non-asbestos gasket. Non-asbestos gasket shall either be stainless steel spiral wound strip with flexible graphite filler or compressed inorganic fiber with nitrile binder rated for saturated and superheated steam service 400 degrees C (750 degrees F) and 10,342 kPa (1500 psig).
      b. Flange bolting: Bolts shall be high strength steel ASTM A193/A193M, Grade B7. Nuts shall be ASTM A194/A194M.

C. Welded Branch and Tap Connections: Forged steel weldolets, or branchlets and threadolets may be used for branch connections up to one pipe size smaller than the main. Forged steel half-couplings, ASME B16.11 may be used for drain, vent and gauge connections.

2.4 DIELECTRIC FITTINGS

A. Provide where dissimilar metal pipe are joined.

B. 50 mm (2 inches) and Smaller: Threaded dielectric union.

C. 65 mm (2-1/2 inches) and Larger: Flange union with dielectric gasket and bolt sleeves, ASME B16.42.

D. Temperature Rating, 121 degrees C (250 degrees F) for steam condensate and as required for steam service.

E. Contractor's option: On pipe sizes 50 mm (2 inches) and smaller, screwed end steel gate valves may be used in lieu of dielectric unions.

2.5 VALVES

A. Asbestos packing is prohibited.

B. All valves of the same type shall be products of a single manufacturer.

C. Provide chain operators for valves 150 mm (6 inches) and larger when the centerline is located 2.1 meter (7 feet) or greater above the floor or operating platform.

D. Shut-Off Valves:
1. Ball Valves:
a. 50 mm (2 inches) and smaller: Forged steel body, rated for 1380 kPa (200 psig) saturated steam, 2758 kPa (400 psig) WOG, bronze wedges and Monel or stainless-steel seats, threaded ends, rising stem, and union bonnet.
b. 65 mm (2-1/2 inches) and larger: Flanged, outside screw and yoke.
1) High pressure steam 110 kPa (16 psig) and above system: Cast steel body, ASTM A216/A216M grade WCB, 1035 kPa (150 psig) at 260 degrees C (500 degrees F), 11-1/2 to 13 percent chrome stainless steel solid disc and seats. Provide 25 mm (1 inch) factory installed bypass with globe valve on valves 100 mm (4 inches) and larger.
2) All other services: Forged steel body, Class B, rated for 850 kPa (123 psig) saturated steam, 1380 kPa (200 psig) WOG, bronze or bronze face wedge and seats, 850 kPa (123 psig) ASME flanged ends, OS&Y, rising stem, bolted bonnet, and renewable seat rings.

E. Ball Valves: Reduced port permitted for bypass (throttling) service; full port required for all other services, one-fourth turn to open.
1. Type 501: Type 316 stainless steel body, ball and stem, rated for 1034 kPa at 185 degrees C (150 psig at 365 degrees F), 4137 kPa at 93 degrees C (600 psig at 200 degrees F); reinforced TFE seat, stem seal and thrust washer; end entry, threaded ends.
2. Type 502: Steel body, rated for 1034 kPa at 185 degrees C (150 psig at 365 degrees F), 1724 kPa at 121 degrees C (250 psig at 250 degrees F), reinforced TFE seat, stem seal and thrust washer; end entry, threaded ends, UL-listed for natural or LP gas shut off service when used on those services.
3. Type 503: Carbon steel body, steam service, rated for 1380 kPa at 200 degrees C (200 psig at 392 degrees F), stainless steel ball and stem, Polyfil seat, live-loaded or adjustable stem seal, threaded ends.

F. Globe and Angle Valves:
1. Globe Valves:
a. 50 mm (2 inches) and smaller: Forged steel body, rated for 1380 kPa (200 psig) saturated steam, 2758 kPa (400 psig) WOG, hardened stainless steel disc and seat, threaded ends, rising stem, union bonnet, and renewable seat rings.
b. 65 mm (2-1/2 inches) and larger:
1) Globe valves for high pressure steam 110 kPa (16 psig): Cast steel body, ASTM A216/A216M grade WCB, flanged, OS&Y, 1035 kPa (150 psig) at 260 degrees C (500 degrees F), 11-1/2 to 13 percent chrome stainless steel disc and renewable seat rings.
2) All other services: Steel body, rated for 850 kPa (123 psig) saturated steam, 1380 kPa (200 psig) WOG, bronze or bronze-faced disc (Teflon or composition facing permitted) and seat, 850 kPa (123 psig) ASME flanged ends, OS&Y, rising stem, bolted bonnet, and renewable seat rings.
2. Angle Valves:
a. 50 mm (2 inches) and smaller: Cast steel 1035 kPa (150 psig), union bonnet with metal plug type disc.
b. 65 mm (2-1/2 inches) and larger:

1) Angle valves for high pressure steam 110 kPa (16 psig): Cast steel body, ASTM A216/A216M grade WCB, flanged, OS&Y, 1035 kPa (150 psig) at 260 degrees C (500 degrees F), 11-1/2 to 13 percent chrome stainless steel disc and renewable seat rings.
2) All other services: 861 kPa (125 psig), flanged, cast steel body, and bronze trim.

G. Swing Check Valves:
1. 50 mm (2 inches) and smaller: Cast steel, 1035 kPa (150 psig), 45-degree swing disc.
2. 65 mm (2-1/2 inches) and Larger:
a. Check valves for high pressure steam 110 kPa (16 psig) and above system: Cast steel body, ASTM A216/A216M grade WCB, flanged, OS&Y, 1035 kPa (150 psig) at 260 degrees C (500 degrees F), 11-1/2 to 13 percent chrome stainless steel disc and renewable seat rings.
b. All other services: 861 kPa (125 psig), flanged, cast steel body, and bronze trim.

H. Manual Radiator/Convector Valves: Brass, packless, with position indicator.

2.6 STRAINERS

A. Basket or Y Type. Tee type is acceptable for gravity flow and pumped steam condensate service.

B. High Pressure Steam: Rated 1035 kPa (150 psig) saturated steam.
1. 50 mm (2 inches) and smaller: Cast steel, rated for saturated steam at 1034 kPa (150 psig) threaded ends.
2. 65 mm (2-1/2 inches) and larger: Cast steel rated for 1034 kPa (150 psig) saturated steam with 1034 kPa (150 psig) ASME flanged ends or forged steel with 1724 kPa (250 psig) ASME flanged ends.

C. All Other Services: Rated 861 kPa (125 psig) saturated steam.
1. 50 mm (2 inches) and smaller: Cast steel body.
2. 65 mm (2-1/2 inches) and larger: Flanged, cast steel body.

D. Screens: Bronze, Monel metal or 18-8 stainless steel, free area not less than 2-1/2 times pipe area, with perforations as follows:
1. 75 mm (3 inches) and smaller: 20 mesh for steam and 1.1 mm (0.045 inch) diameter perforations for liquids.
2. 100 mm (4 inches) and larger: 1.1 mm (0.045) inch diameter perforations for steam and 3.2 mm (1/8 inch) diameter perforations for liquids.

2.7 PIPE ALIGNMENT

A. Guides: Provide factory-built guides along the pipe line to permit axial movement only and to restrain lateral and angular movement. Guides shall be designed to withstand a minimum of 15 percent of the axial force which will be imposed on the expansion joints and anchors. Field-built guides may be used if detailed in the contract documents.

2.8 EXPANSION JOINTS

A. Factory built devices, inserted in the pipe lines, designed to absorb axial cyclical pipe movement which results from thermal expansion and contraction. This includes factory-built or field-fabricated guides located along the pipe lines to restrain lateral pipe motion and direct the axial pipe movement into the expansion joints.

B. Minimum Service Requirements:
1. Pressure Containment:
a. Steam Service 35-200 kPa (5-29 psig): Rated 345 kPa (50 psig) at 148 degrees C (298 degrees F).
b. Steam Service 214-850 kPa (31-123 psig): Rated 1035 kPa (150 psig) at 186 degrees C (366 degrees F).

c. Steam Service 869-1035 kPa (126-150 psig): Rated 1380 kPa (200 psig) at 194 degrees C (381 degrees F).
d. Condensate Service: Rated 690 kPa (100 psig) at 154 degrees C (309 degrees F).

2. Number of Full Reverse Cycles without failure: Minimum 1000.
3. Movement: As shown on contract documents plus recommended safety factor of manufacturer.

C. Manufacturing Quality Assurance: Conform to Expansion Joints Manufacturers Association Standards.

D. Bellows - Internally Pressurized Type:
1. Multiple corrugations of Type 304 or Type A240-321 stainless steel.
2. Internal stainless-steel sleeve entire length of bellows.
3. External cast iron equalizing rings for services exceeding 345 kPa (50 psig).
4. Welded ends.
5. Design shall conform to standards of EJMA and ASME B31.1.
6. External tie rods designed to withstand pressure thrust force upon anchor failure if one or both anchors for the joint are at change in direction of pipeline.
7. Integral external cover.

E. Bellows - Externally Pressurized Type:
1. Multiple corrugations of Type 304 stainless steel.
2. Internal and external guide integral with joint.
3. Design for external pressurization of bellows to eliminate squirm.
4. Welded ends.
5. Conform to the standards of EJMA and ASME B31.1.
6. Threaded connection at bottom, 25 mm (1 inch) minimum, for drain or drip point.
7. Integral external cover and internal sleeve.

F. Expansion Joint Identification: Provide stamped brass or stainless-steel nameplate on each expansion joint listing the manufacturer, the allowable movement, flow direction, design pressure and temperature, date of manufacture, and identifying the expansion joint by the identification number in the contract documents.

2.9 FLEXIBLE BALL JOINTS

A. Design and Fabrication: One-piece component construction, fabricated from steel with welded ends, designed for a working steam pressure of 1725 kPa (250 psig) and a temperature of 232 degrees C (450 degrees F). Each joint shall provide for 360 degrees rotation in addition to a minimum angular flexible movement of 30 degrees for sizes 6 mm (1/4 inch) to 150 mm (6 inch) inclusive, and 15 degrees for sizes 65 mm (2-1/2 inches) to 762 mm (30 inches). Joints through 355 mm (14 inches) shall have forged pressure retaining members, while size 406 mm (16 inches) through 762 mm (30 inches) shall be of one-piece construction.

B. Material:
1. Cast or forged steel pressure containing parts and bolting in accordance with ASME BPVC Section II or ASME B31.1. Retainer may be ductile iron ASTM A536, Grade 65-45-12, or ASME BPVC Section II SA 515, Grade 70.
2. Gaskets: Steam pressure molded composition design for a temperature range of from minus 10 degrees C (50 degrees F) to plus 274 degrees C (525 degrees F).

C. Certificates: Submit qualifications of ball joints in accordance with the following test data:
1. Low pressure leakage test: 41 kPa (6 psig) saturated steam for 60 days.
2. Flex cycling: 800 Flex cycles at 3447 kPa (500 psig) saturated steam.
3. Thermal cycling: 100 saturated steam pressure cycles from atmospheric pressure to operating pressure and back to atmospheric pressure.
4. Environmental shock tests: Forward certificate from a recognized test laboratory, that ball joints of the type submitted has passed shock testing in accordance with Mil. Spec MIL-S-901.

5. Vibration: 170 hours on each of three mutually perpendicular axes at 25 to 125 Hz; 1.3 mm to 2.5 mm (0.05 inch to 0.10 inch) double amplitude on a single ball joint and 3 ball joint off set.

2.10 STEAM SYSTEM COMPONENTS

A. Heat Exchanger (Steam to Hot Water): Shell and tube type, U-bend removable tube bundle, steam in shell, water in tubes, equipped with support cradles.
   1. Maximum tube velocity: 2.3 meter/second (7.5 feet/second).
   2. Tube fouling factor: TEMA Standards, but not less than 0.00018 square meters K/W (0.001 square foot/hour degrees F/Btu).
   3. Materials:
      a. Shell: Steel.
      b. Tube sheet and tube supports: Steel or brass.
      c. Tubes: 20 mm (3/4 inch) OD copper.
      d. Head or bonnet: Steel.
   4. Construction: In accordance with ASME Pressure Vessel Code for 861 kPa (125 psig) working pressure for shell and tubes. Provide manufacturer's certified data report, Form No. U-1.

B. Optional Heat Transfer Package: In lieu of field erected individual components, the Contractor may provide a factory or shop assembled package of heat exchangers, pumps, and other components, pre-piped and pre-wired and supported on a welded steel frame or skid.

C. Steam Pressure Reducing Valves in PRV Stations:
   1. Type: Single-seated, diaphragm operated, spring-loaded, external or internal steam pilot-controlled, normally closed, adjustable set pressure. Pilot shall sense controlled pressure downstream of main valve.
   2. Service: Provide controlled reduced pressure to steam piping systems.
   3. Pressure control shall be smooth and continuous with maximum drop of 10 percent deviation from set pressure. Maximum flow capacity of each valve shall not exceed capacity of downstream safety valve(s).
   4. Main valve and pilot valve shall have replaceable valve plug and seat of stainless steel, Monel, or similar durable material.
      a. Pressure rating for high pressure steam: Not less than 1035 kPa (150 psig) saturated steam.
      b. Connections: Flanged for valves 65 mm (2-1/2 inches) and larger; flanged or threaded ends for smaller valves.
   5. Select pressure reducing valves to develop less than 85 dBA at 1.5-meter (5 feet) elevation above adjacent floor, and 1.5 meter (5 feet) distance in any direction. Inlet and outlet piping for steam pressure reducing valves shall be Schedule 80 minimum for required distance to achieve required levels or sound attenuators shall be applied.
   6. Direct-Digital Control PRV Valves: May be furnished in lieu of steam operated valves. All specification requirements for steam operated valves apply. In the event of signal failure, valve shall remain in last position. Install per manufacturer’s recommendation.

D. Safety Valves and Accessories: Comply with ASME BPVC Section VIII. Capacities shall be certified by National Board of Boiler and Pressure Vessel Inspectors, maximum accumulation 10 percent. Provide lifting lever. Provide drip pan elbow where shown. Valve shall have stainless steel seats and trim.

E. Steam PRV for Individual Equipment: Cast steel body, screwed or flanged ends, rated 861 kPa (125 psig), or 20 percent above the working pressure, whichever is greater. Single-seated, diaphragm operated, spring loaded, adjustable range, all parts renewable.

F. Moisture Separator: Shall be of the high efficiency internal baffle type, with a pressure drop that does not exceed an equivalent length of straight pipe. Body shall be iron, steel or cast steel with screwed, socket weld or flanged connections as detailed on drawing schedule. Steel construction shall be in accordance with Section VIII, Division 1 of the ASME Boiler and

Pressure Vessel Code with ASME Class 150, 300 or 600 RF flange connections. A bottom drain connection shall be provided for the installation of a trap to discharge any accumulated liquid. Separators shall be installed before steam PRV and Control Valves.

G. Flash Tanks: Horizontal or vertical vortex type, constructed of copper bearing steel, ASTM A516/A516M or ASTM A285/A285M, for a steam working pressure of 861 kPa (125 psig) to comply with ASME Code for Unfired Pressure Vessels and stamped with "U" symbol. Perforated pipe inside tank shall be ASTM A53/A53M Grade B, seamless or ERW, or ASTM A106/A106M Grade B seamless, Schedule 80. Corrosion allowance of 1.6 mm (1/16 inch) may be provided in lieu of the copper bearing requirement. Provide data Form No. U-1.

H. Steam Trap: Each type of trap shall be the product of a single manufacturer. Provide trap sets at all low points and at 61 meter (200 feet) intervals on the horizontal main lines.
   1. Floats and linkages shall provide sufficient force to open trap valve over full operating pressure range available to the system. Unless otherwise indicated in the contract documents, traps shall be sized for capacities indicated at minimum pressure drop as follows:
      a. For equipment with modulating control valve: 1.7 kPa (1/4 psig), based on a condensate leg of 300 mm (12 inches) at the trap inlet and gravity flow to the receiver.
      b. For main line drip trap sets and other trap sets at steam pressure: Up to 70 percent of design differential pressure. Condensate may be lifted to the return line.
   2. Trap bodies: Steel and stainless-steel, constructed to permit ease of removal and servicing working parts without disturbing connecting piping. The use of raised face flange is required on pipe sizes 1-1/2 inch and greater. The use of unions is acceptable for pipe sizes less than 1—1/2 inches. For systems without relief valve traps shall be rated for the pressure upstream of the steam supplying the system.
   3. Balanced pressure thermostatic elements: Phosphor bronze, stainless steel or Monel metal.
   4. Valves and seats: Suitable hardened corrosion resistant alloy.
   5. Mechanism: Brass, stainless steel or corrosion resistant alloy.
   6. Floats: Stainless steel.
   7. Inverted bucket traps: Provide bi-metallic thermostatic element for rapid release of non-condensables.
   8. Thermodynamic steam traps: Shall have tight shut-off with no steam loss allowed either by bleed or “controlled leak” and shall have an integral seat design with hardened disc and seating surfaces. Thermodynamic traps for steam pressures below 600 psi shall be all stainless-steel construction with threaded, socket weld or flanged connections on a common centerline, and shall be capable of operating in any position. Traps shall be capable of operating with up to 80% back pressure and shall be standard with insulating cover to reduce heat loss. Thermodynamic traps for steam pressures 600 psi or higher shall be of alloy steel construction with threaded, socket weld or flanged connections on a common centerline, and will operate in any position. Steam trap shall be capable of operating with up to 80% back pressure with operating pressure up to 900 psi. Thermodynamic trap shall have three equidistant discharge ports between seat land surfaces to minimize disc and seat wear.

I. Factory-Packaged Trap Station: As an option for drip points requiring isolation valves, strainer, trap, check-valve, valved test ports, and monitoring provide factory packaged trap station including all these features:
   1. Shall consist of compact stainless steel design comprising upstream and downstream isolation valves, a quick- fit universal trap connector, strainer, and check valve. The trap station shall be single-piece construction. Once installed, the station remains permanently in the line. Steam traps shall be installed and removed from the station by two bolts, facilitating simple and rapid installation and replacement.
   2. Isolation valves, check valve, and strainer shall be maintainable.

3. Steam trap station shall be suitable for use with and shall include thermodynamic, inverted bucket, float & thermostatic, or thermostatic steam traps fitted with universal connectors. The selected steam trap shall be attached to the connector by bolts.
4. Steam Trap Station shall be designed for maximum operating pressure (PMO) with saturated steam of 1751 kPa (254 psig). For ANSI 150 connections PMO shall be 1379 kPa (200 psig).
5. All components of the packaged trap station shall meet specified requirements for individual components specified in this section.

J. Pressure Driven Condensate Pump Trap:
1. Unit shall automatically trap and pump condensate from process and heating equipment under all operating conditions including vacuum.
2. Body shall be constructed of cast iron with all stainless-steel internals. The mechanism shall incorporate stainless steel springs.
3. Motive Force: The pump trap shall utilize steam, to remove condensate from the receiving vessel.
4. Pumps shall require no electricity for operation.
5. The pump trap shall include a bronze water level gauge with shut off valves.
6. Check valves at inlet and outlet shall be stainless steel.
7. ASME BPVC Section VIII.
8. Provide pump trap with removable insulation cove.
9. Manufacturer standard paint finish.

K. Thermostatic Air Vent (Steam): Steel body, balanced pressure bellows, stainless steel (renewable) valve and seat, rated 861 kPa (125 psig) working pressure, 20 mm (3/4 inch) screwed connections. Air vents shall be balanced pressure type that responds to steam pressure-temperature curve and vents air at any pressure.

L. Clean Steam Generator for HVAC Humidification: Factory fabricated; UL listed heat exchanger for the generation of low-pressure clean steam to be used in HVAC humidification. Compatible with softened water or DI/RO water.
1. Steam to steam humidifier: Steam to steam humidifier, 304 stainless steel tank with removable 304 stainless steel cover with gasketed flanges, steam outlet connection on top of tank for hose or pipe.
   a.
   b. Tank: Stainless steel.
   c. Enclosed cabinet, coated steel construction and air gap between cabinet and insulated tank
   d. Steam control valve, steam inlet strainer and steam trap furnished and installed at factory.
   e. Steam outlet on top of tank configured to connect to hose, pipe, or flange connection.
   f. Stainless steel evaporator tank with flat surfaces.
   g. Mounting: Humidifier shall be mounted on painted legs.
2. Electric immersion heated humidifier: 304 stainless steel tank with removable 304 stainless steel cover with gasketed flanges, heater / cover interlock safety switch, power and control wiring terminal strip, steam outlet at top for hose or pipe connection. Factory insulated.
   a. Immersion heater(s): Heater(s) shall be Incoloy alloy-sheathed resistance type designed for no more than 86 watts per square inch. Two threaded ends of each heater element shall pass through the top of the evaporating chamber and be secured and sealed with washer and threaded nuts to evaporating chamber
   b. Temperature sensor: A factory mounted sensor, with a temperature range of -40 to 248 °F (-40 to 120 °C) shall be mounted on the humidifier to maintain evaporating chamber water temperature above freezing.

c. Over-temperature switch: A factory-mounted and -wired UL-listed limit control sensor with manual reset shall sense an over-temperature condition and de-energize heater circuit controls.
d. Indoor Mounting: Humidifier shall be mounted on factory furnished, field installed legs.
e. Drain Positive drainage/blow-down using a drain pump, drawing water from the bottom of the tank, maximizing mineral evacuation.
f. Steam trap and strainer: Humidifier shall include a float/thermostatic steam trap and steam supply line strainer.
g. Water requirements: The humidifier shall be capable of generating steam from softened, or DI/RO water

3. Humidifier shall have a stainless-steel float operated fill valve with an electric solenoid to prevent tank from filling when the tank is not in service Humidifier shall have a field-wired low water float switch to provide water level indication for building management systems.
   a. Factory assembled and tested with the humidifier installed to provide complete weather protection and to operate within the following temperature limits: -40 to 120 degree F (-40 to 50 degrees C).
   b. Frame construction: 5 degree (127 mm), 12-gauge, G-90 galvanized steel formed frame, suitably reinforced and braced to permit loading, shipping, unloading and rigging to the unit destination without damage to external or internal components. The base frame shall be corrosion resistant without painting or further coating.
   c. Housing construction: 16-gauge, G-90 galvanized steel panels fabricated into self-framing, double standing seam-type construction. All joints shall be caulked weather-tight with a silicone sealant. All interior surfaces shall be insulated with 1 inch (25 mm), 2.2 pounds/square feet (10.8 kilogram/square meter) rigid, noncombustible glass fiber insulation. No exposed insulation shall be permitted on the top-wearing surface of the floor of the unit. The floor shall be insulated from underneath. The floor shall have a drain connection.
   d. Access door construction: Access door shall provide access to all internal components, be constructed of 16-gauge, G-90 galvanized steel with a gasket around the full perimeter of the doorframe, with heavy-duty stainless-steel hinges, and latches.
   e. Ventilation fan: wired to a thermostat to ventilate the control cabinet and the enclosure.
   f. The enclosure shall have thermostatically-controlled heaters to ensure proper operation during cold weather.
4. Units for DI / RO water shall be specifically designed for that purpose and shall have a stainless steel manually operated drain valve and a stainless-steel float operated fill valve.
5. Controls: Control subpanel shall be factory-attached to humidifier with all wiring between subpanel and humidifier completed at factory. A wiring diagram shall be included. The controller shall be microprocessor based and shall have the following features or functions:
   a. Web interface shall have same functionality as the unit keypad/display and shall allow multiple remotely located users to simultaneously view system operation and/or change system parameters. Web interface shall have password-protected secure access and shall be compatible with standard Internet browsers. Web interface shall connect directly to a personal computer or through a system network via Ethernet cable and shall be interoperable with any communication network.
   b. Redundant low water safety control.
   c. Fully modulating (0 to 100 percent) control of humidifier outputs.
   d. Water level control: Automatic refill, low water cut-off, field adjustable skimmer bleed-off functions, and automatic drain-down of humidifier.

e. Temperature sensor: A factory mounted sensor, with a temperature range of -40 to 121 degrees C (-40 to 250 degrees F) mounted on the humidifier to enable the following functions:
   1) Maintain the evaporating chamber water temperature above freezing.
   2) Maintain a user-defined preset evaporating chamber water temperature.
   3) Allow rapid warm-up of water in evaporating chamber after a call for humidity, providing 100% operation until steam production occurs.
f. USB port on the control board for software updates, data backups, and data restoration.
g. Up-time optimizer function to keep humidifier(s) operating through conditions such as fill, drain, or run-time faults, as long as safety conditions are met, minimizing production down-time.
h. Real-time clock to allow time-stamped alarm/message tracking, and scheduled events.
i. Factory commissioning of humidifier and control board, including system configuration as-ordered, factory unit testing, and operation with water before shipping.
j. Unit-mounted keypad/display operable within a temperature range of 0 to 70 degrees C (32 to 158 degrees F) and provides backlighting for viewing in low light.
k. Alarms, unit configuration, and usage timer values shall remain in nonvolatile memory indefinitely during a power outage.
l. The controls shall monitor, control, and/or adjust the following parameters:
   1) Relative humidity (RH) set point, actual conditions in the space (from humidity transmitter), RH offset.
   2) Dew point set point, actual conditions in the space (from dew point transmitter), dew point offset.
   3) Relative humidity (RH) duct high limit set point (switch) and actual conditions.
   4) Relative humidity (RH) duct high limit set point, actual conditions (from transmitter), high limit span, and high limit offset.
   5) Total system demand in % of humidifier capacity.
   6) Total system output in kg/hr (lb/hr).
   7) Drain/flush duration, allowed days, and frequency based on usage.
   8) End-of-season drain status (on standard water systems and if ordered as a DI water option) and hours humidifier is idle before end of season draining occurs.
   9) Window glass surface temperature in percent RH offset application using separate sensor with programmable offset.
   10) Air temperature or other auxiliary temperature monitoring with programmable offset.
   11) System alarms and system messages, current and previous.
   12) Adjustable water skim duration.
m. Programmable outputs for remote signaling of alarms and/or messages, device activation (such as a fan), or for signaling tank heating and/or steam production.
n. System diagnostics that include:
   1) Test outputs function to verify component operation.
   2) Test humidifier function by simulating demand to validate performance.
   3) Data collection of RH, air temperature, water use, energy use, alarms, and service messages for viewing from the keypad/display or Web interface.
   4) Service notification scheduling.
   5) Password-protected system parameters.
   6) Keypad/display or Web interface displays in English.
   7) Numerical units displayed in inch-pound or SI units.

6. Other humidifier control features:
   a. Interoperability using BACnet MS/TP.

b. Water level control for DI/RO water: System shall provide for continuous control of water level and shall accommodate the use of deionized or reverse osmosis water with resistance up to 18 M-ohm/cm. System shall include:
   1) Water level sensing unit comprised of a float operated stainless steel valve for water makeup.
   2) Low water cut-off float switch.
   3) Operation within inlet water supply pressure range of 170 to 550 kPa (25 to 80 psig).
c. Access panel interlock switch: The control subpanel shall have an interlock control switch with manual override to remove control voltage when access panel is opened.
d. Removable keypad/display: Provide a keypad/display with cable for remote use.
e. Control input accessory:
   1) Cold snap offset transmitter: A window surface temperature transmitter, operating temperature range -29 to 71 degrees C (-20 to 160 degrees F), shall be provided for field installation. Transmitter shall supply its signal (4 to 20 mA) to the microprocessor control system, which shall lower the indoor RH set point to a level 5 percent or greater below the dew point temperature during a cold spell, thus preventing window condensation. The indoor RH shall be automatically returned to the normal setting when the glass temperature rises.
   2) Airflow proving switch, pressure type: Airflow proving switch shall be diaphragm-operated with pitot tube for field installation. Switch shall have an adjustable control point range of 12.5 to 2988 Pa (0.05 to 12 inch WG) Operating temperature range -40 to 82 degrees C (-40 to 180 degrees F). Compatible with 24, 120, and 240 VAC.

7. Distribution Manifold: Stainless steel, composed of dispersion pipe and surrounding steam jacket, manifold shall span the width of duct or air handler, and shall be multiple manifold type under any of the following conditions:
8. Duct section height exceeds 900 mm (36 inches).
9. Duct air velocity exceeds 5.1 m/s (1000 feet per minute).
10. If within 900 mm (3 feet) upstream of fan, damper or pre-filter.
11. If within 3 m (10 feet) upstream of after-filter.

M. Unfired, Clean, Steam to Steam Generator (for sterilization purposes):
1. Provide a packaged factory assembled, pre-piped unfired steam generator consisting of stainless steel shell, stainless steel tube coil, stainless steel steam piping, valves and controls All stainless-steel piping shall be type 316 factory-fabricated and provided as a part of the complete package. Any make-up water to these units shall be less than 1 ppm hardness. A dual tower water softener with brine tank and automatic regeneration shall be provided, if necessary.
2. Shell: Stainless steel ASME code construction with flanged piping connections, 1035 kPa (150 psig) maximum working steam pressure.
3. Tubes: Stainless Steel tubes suitable for 1035 kPa (150 psig) working pressure.
4. Design: Heated fluid in shell and heating fluid (higher pressure steam) in tubes.
5. Each steam generator shall be furnished with the following accessories:
   a. Resilient insulation.
   b. Pilot operated modulating control valve with pressure controller.
   c. Control pilot to maintain constant steam output.
   d. Pressure relief valve.
   e. Vessel and tube side pressure gauges.
   f. Liquid level controller with brass feed water solenoid valve, in check valve and strainer.
   g. Over-pressure limit system with auto-reset.
   h. Factory packaging.
   i. Dual F&T condensate traps.

j. Manual blow down valve.
k. TDS based automatic blow down of cooled water 38 degrees C (100 degrees F) or less.
l. Low water cut-off and high-pressure cut-off.
m. Fully wired control box.
n. Automatic drain solenoid valve.

6. Provide solid state control module with LED backlit LCD display and LED pilot lights to indicate on-off, high pressure, low pressure, low water and water feed. Control module shall allow the local adjustment of pressure limits on display screen. Control module shall have alarm light and alarm horn with built in alarm silence relay. Control module shall be supplied with dry contact closure outputs to indicate to building automation controls (BAC) the occurrence of power on, high pressure, low pressure, low water and water feed. The control module shall allow the BAC to turn the unfired steam generator on or off through a remote relay suitable for 24 VAC, 1 amp. The control module shall allow the BAC to remotely monitor the operating pressure. Control module shall be supplied with an on-off switch and shall be mounted in a NEMA 4 panel. All solenoids and limits shall be 24 VAC.

N. Steam Hose and Accessories: Hose shall be sufficiently flexible to be placed in a 1.2 meter (4 feet) diameter coil.
1. Furnish and install in the mechanical room housing each PRV station a 7.6 meter (25 feet) length of 15 mm (1/2 inch) ID steam hose, rated 861 kPa (125 psig) and a hose rack. In one end of the hose install a quick-couple device, suitable for steam service, to match corresponding devices in the PRV blowdown connections.
2. Hose storage rack: Wall-mounted, steel, iron or aluminum, semi-circular shape, with capacity to store 7.6 meter (25 feet) of 15 mm (1/2 inch) ID steam hose.

O. Steam Flow Meter/Recorder: Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

P. Steam Exhaust Head: Cast iron, fitted with baffle plates, to trap and drain condensed water.

2.11 GAUGES, PRESSURE AND COMPOUND

A. ASME B40.100, Accuracy Grade 1A, (pressure, vacuum, or compound), initial mid-scale accuracy 1 percent of scale (Qualify grade), metal or phenolic case, 115 mm (4-1/2 inches) in diameter, 6 mm (1/4 inch) NPT bottom connection, white dial with black graduations and pointer, clear glass or acrylic plastic window, suitable for board mounting. Provide red "set hand" to indicate normal working pressure.

B. Provide steel, lever handle union cock. Provide steel or stainless-steel pressure snubber for gauges in water service. Provide steel pigtail syphon for steam gauges.

C. Pressure gauge ranges shall be selected such that the normal operating pressure for each gauge is displayed near the midpoint of each gauge’s range. Gauges with ranges selected such that the normal pressure is displayed at less than 30 percent or greater than 70 percent of the gauge’s range are prohibited. The units of pressure shall be psig.

2.12 PRESSURE/TEMPERATURE TEST PROVISIONS

A. Provide one each of the following test items to the COR:
1. 6 mm (1/4 inch) FPT by 3.2 mm (1/8 inch) diameter stainless steel pressure gauge adapter probe for extra-long test plug. Pressure/temperature plug is an example.
2. 90 mm (3-1/2 inch) diameter, one percent accuracy, compound gauge, 762 mm (30 inches) Hg to 690 kPa (100 psig) range.
3. 0 to 104 degrees C (32 to 220 degrees F) pocket thermometer one-half degree accuracy, 25 mm (1 inch) dial, 125 mm (5 inch) long stainless-steel stem, plastic case.

2.13 FIRESTOPPING MATERIAL

A. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

2.14 ELECTRICAL HEAT TRACING SYSTEMS

A. Systems shall meet requirements of NFPA 70.

B. Provide tracing for outdoor piping subject to freezing temperatures below 3.3 degrees C (38 degrees F) as follows:
   1. Steam piping exposed to weather.
   2. Steam condensate exposed to weather.
   3. Pumped condensate piping exposed to weather.

C. Heat tracing shall be provided to the extent shown in the contract documents (Floor Plans and Elevations). Heat tracing shall extend below grade to below the defined frost line.

D. Heating Cable: Flexible, parallel circuit construction consisting of a continuous self-limiting resistance, conductive inner core material between two parallel copper bus wires, designed for cut-to-length at the job site and for wrapping around valves and complex fittings. Self-regulation shall prevent overheating and burnouts even where the cable overlaps itself.
   1. Provide end seals at ends of circuits. Wires at the ends of the circuits are not to be tied together.
   2. Provide sufficient cable, as recommended by the manufacturer, to keep the pipe surface at 2.2 degrees C (36 degrees F) minimum during winter outdoor design temperature, but not less than the following:
      a. 75 mm (3 inch) pipe and smaller with 25 mm (1 inch) thick insulation: 4 watts per foot of pipe.
      b. 100 mm (4 inch) pipe and larger 40 mm (1-1/2 inch) thick insulation: 8 watts per feet of pipe.

E. Electrical Heating Tracing Accessories:
   1. Power supply connection fitting and stainless-steel mounting brackets. Provide stainless steel worm gear clamp to fasten bracket to pipe.
   2. 15 mm (1/2 inch) wide fiberglass reinforced pressure sensitive cloth tape to fasten cable to pipe at 300 mm (12 inch) intervals.
   3. Pipe surface temperature control thermostat: Cast aluminum, NEMA 4 (watertight) enclosure, 15 mm (1/2 inch) NPT conduit hub, SPST switch rated 20 amps at 480 volts ac, with capillary and copper bulb sensor. Set thermostat to maintain pipe surface temperature at not less than 1 degrees C (34 degrees F).
   4. Signs: Manufacturer's standard (NEC Code), stamped "ELECTRIC TRACED" located on the insulation jacket at 3 meter (10 feet) intervals along the pipe on alternating sides.

PART 3 - EXECUTION

3.1 GENERAL

A. If in the substantiated evaluation of the COR, the installation fails to meet the requirements of the construction documents with respect to function and maintainability, an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no additional cost or time to the Government.

B. The contract documents show the general arrangement of pipe and equipment but do not show all required fittings and offsets that may be necessary to connect pipes to equipment, fan-coils, coils, radiators, etc., and to coordinate with other trades. Provide all necessary fittings, offsets and pipe runs based on field measurements and at no additional cost or time to the Government. Coordinate with other trades for space available and relative location of HVAC equipment and accessories to be connected on ceiling grid. Pipe location in the contract documents shall be altered by contractor where necessary to avoid interferences and clearance difficulties.

C. Store materials to avoid excessive exposure to weather or foreign materials. Keep inside of piping relatively clean during installation and protect open ends when work is not in progress.

D. Support piping securely. Refer to PART 3, Section 23 05 11, COMMON WORK RESULTS FOR HVAC. Install convertors and other heat exchangers at height sufficient to provide gravity flow of condensate to the flash tank and condensate pump.

E. Install piping generally parallel to walls and column center lines, unless shown otherwise in the contract documents. Space piping, including insulation, to provide 25 mm (1 inch) minimum clearance between adjacent piping and another surface. Unless shown otherwise, slope steam, condensate and drain piping down in the direction of flow not less than 25 mm (1 inch) in 12 meter (40 feet). Provide eccentric reducers to keep bottom of sloped piping flat.

F. Locate and orient valves to permit proper operation and access for maintenance of packing, seat and disc. Generally, locate valve stems in overhead piping in horizontal position. Provide a union adjacent to one end of all threaded end valves. Control valves usually require reducers to connect to pipe sizes shown in the contract documents.

G. Offset equipment connections to allow valving off for maintenance and repair with minimal removal of piping. Provide flexibility in equipment connections and branch line take-offs with 3-elbow swing joints where noted in the contract documents.

H. Tee water piping runouts or branches into the side of mains or other branches. Avoid bull-head tees, which are two return lines entering opposite ends of a tee and exiting out the common side.

I. Connect piping to equipment as shown in the contract documents. Install components furnished by others such as flow elements (orifice unions), control valve bodies, flow switches, pressure taps with valve, and wells for sensors.

J. Firestopping: Fill openings around uninsulated piping penetrating floors or fire walls, with firestop material. For firestopping insulated piping refer to Section 23 07 11, HVAC AND BOILER PLANT INSULATION.

K. Pipe vents to the exterior. Where a combined vent is provided, the cross-sectional area of the combined vent shall be equal to sum of individual vent areas. Slope vent piping 25 mm (1 inch) in 12 meter (40 feet) 0.25 percent in direction of flow. Provide a drip pan elbow on relief valve outlets if the vent rises to prevent backpressure. Terminate vent minimum 300 mm (12 inches) above the roof or through the wall minimum 2.4 meter (8 feet) above grade with down turned elbow.

L. Contract documents do not identify all locations where steam trap sets are required. Contractor shall provide at no additional cost as many trap-sets as are necessary for the proper, reliable operation of the system. Provide trap-sets at all low points and at 61 meter (200 feet) intervals on all horizontal main lines.

3.2 WELDING

A. The contractor is entirely responsible for the quality of the welding and shall:
   1. Conduct tests of the welding procedures used on the project, verify the suitability of the procedures used, verify that the welds made will meet the required tests, and also verify that the welding operators have the ability to make sound welds under standard conditions.
   2. Perform all welding operations required for construction and installation of the piping systems.

B. Qualification of Welders: Rules of procedure for qualification of all welders and general requirements for fusion welding shall conform with the applicable portions of ASME B31.1, AWS B2.1/B2.1M, AWS Z49.1, and also as outlined below.

C. Examining Welder: Examine each welder at job site, in the presence of the COR, to determine the ability of the welder to meet the qualifications required. Test welders for piping for all positions, including welds with the axis horizontal (not rolled) and with the axis vertical. Each welder shall be allowed to weld only in the position in which he has qualified and shall be

required to identify his welds with his specific code marking signifying his name and number assigned.

D. Examination Results: Provide the COR with a list of names and corresponding code markings. Retest welders who fail to meet the prescribed welding qualifications. Disqualify welders, who fail the second test, for work on the project.

E. Beveling: Field bevels and shop bevels shall be done by mechanical means or by flame cutting. Where beveling is done by flame cutting, surfaces shall be thoroughly cleaned of scale and oxidation just prior to welding. Conform to specified standards.

F. Alignment: Provide approved welding method for joints on all pipes greater than 50 mm (2 inches) to assure proper alignment, complete weld penetration, and prevention of weld spatter reaching the interior of the pipe.

G. Erection: Piping shall not be split, bent, flattened, or otherwise damaged before, during, or after installation. If the pipe temperature falls to 0 degrees C (32 degrees F) or lower, the pipe shall be heated to approximately 38 degrees C (100 degrees F) for a distance of 300 mm (1 foot) on each side of the weld before welding, and the weld shall be finished before the pipe cools to 0 degrees C (32 degrees F).

H. Non-Destructive Examination of Piping Welds:
   1. Perform radiographic examination of 50 percent of the first 10 welds made and 10 percent of all additional welds made. The COR reserves the right to identify individual welds for which the radiographic examination shall be performed. All welds shall be visually inspected by the COR. The VA reserves the right to require testing on additional welds up to 100 percent if greater than 25 percent of the examined welds fail the inspection.
   2. An approved independent testing firm regularly engaged in radiographic testing shall perform the radiographic examination of pipe joint welds. All radiographs shall be reviewed and interpreted by an ASNT Certified Level III radiographer, employed by the testing firm, who shall sign the reading report.
   3. Comply with ASME B31.1. Furnish a set of films showing each weld inspected, a reading report evaluating the quality of each weld, and a location plan showing the physical location where each weld is to be found in the completed project. The COR and the CxA shall be given a copy of all reports to be maintained as part of the project records and shall review all inspection records.

I. Defective Welds: Replace and reinspect defective welds. Repairing defective welds by adding weld material over the defect or by peening are prohibited. Welders responsible for defective welds shall be requalified prior to resuming work on the project.

J. Electrodes: Electrodes shall be stored in a dry heated area and be kept free of moisture and dampness during the fabrication operations. Discard electrodes that have lost part of their coating.

3.3 PIPE JOINTS

A. Welded: Beveling, spacing and other details shall conform to ASME B31.1 and AWS B2.1/B2.1M. See Welder’s qualification requirements under "Quality Assurance" in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. Screwed: Threads shall conform to ASME B1.20.1; joint compound shall be applied to male threads only and joints made up so no more than three threads show. Coat exposed threads on steel pipe with joint compound, or red lead paint for corrosion protection.

C. 125 Pound Cast Steel Flange (Plain Face): Mating flange shall have raised face, if any, removed to avoid overstressing the cast steel flange.

3.4 EXPANSION JOINTS (BELLOWS AND SLIP TYPE)

A. Anchors and Guides: Provide type, quantity and spacing as recommended by manufacturer of expansion joint and as shown. A professional engineer shall verify in writing that anchors and guides are properly designed for forces and moments which will be imposed.

B. Cold Set: Provide setting of joint travel at installation as recommended by the manufacturer for the ambient temperature during the installation.

C. Preparation for Service: Remove all apparatus provided to restrain joint during shipping or installation. Representative of manufacturer shall visit the site and verify that installation is proper.

D. Access: Expansion joints shall be located in readily accessible space. Locate joints to permit access without removing piping or other devices. Allow clear space to permit replacement of joints and to permit access to devices for inspection of all surfaces and for adding packing.

3.5 STEAM TRAP PIPING

A. Install to permit gravity flow to the trap. Provide gravity flow (avoid lifting condensate) from the trap where modulating control valves are used. Support traps weighing over 11 kg (24 pounds) independently of connecting piping.
   1. On pipe size 1-1/2 inch and greater a raised face flange is required to allow for removal of the steam trap without disturbing surrounding piping.
   2. On pipe size less than 1-1/2inch raised face flanges or unions may be used to allow for removal of the traps.

3.6 SEISMIC BRACING

A. Provide in accordance with Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

3.7 LEAK TESTING

A. Inspect all joints and connections for leaks and workmanship and make corrections as necessary to the satisfaction of the COR in accordance with the specified requirements. Testing shall be performed in accordance with the specification requirements.

B. An operating test at design pressure, and for hot systems, design maximum temperature.

C. A hydrostatic test at 1.5 times design pressure. For water systems, the design maximum pressure would usually be the static head, or expansion tank maximum pressure, plus pump head. Factory tested equipment (convertors, exchangers, coils, etc.) need not be field tested. Avoid excessive pressure on mechanical seals and safety devices.

D. Prepare and submit test and inspection reports to the COR within 5 working days of test completion and prior to covering the pipe.

E. All tests shall be witnessed by the COR, their representative, or the CxA and be documented by each section tested, date tested, and list or personnel present.

3.8 FLUSHING AND CLEANING PIPING SYSTEMS

A. Steam, Condensate and Vent Piping: The piping system shall be flushed clean prior to equipment connection. Cleaning includes pulling all strainer screens and cleaning all scale/dirt legs during startup operation. Contractor shall be responsible for damage caused by inadequately cleaned/flushed systems.

3.9 ELECTRIC HEAT TRACING

A. Install tracing as recommended by the manufacturer.

B. Coordinate electrical connections.

3.10 STARTUP AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

C. The CxA shall observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with COR and CxA. Provide a minimum notice of 10 working days prior to startup and testing.

D. Adjust red set hand on pressure gauges to normal working pressure.

3.11 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

B. Components provided under this section of the specification shall be tested as part of a larger system.

3.12 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative for 16 hours to instruct each VA personnel responsible in operation and maintenance of the system.

B. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

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SECTION 23 22 23

STEAM CONDENSATE PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Steam condensate pumps for Heating, Ventilating and Air Conditioning.

B. Definitions:
1. Capacity: (Gallons per minute (gpm)) of the fluid pumped.
2. Head: Total dynamic head in kPa (feet) of the fluid pumped.

C. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

E. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

F. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

G. Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT.

H. Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.

I. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

J. Section 23 22 13, STEAM AND CONDENSATE HEATING PIPING.

1.3 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 23 22 23, STEAM CONDENSATE PUMPS”, with applicable paragraph identification.

C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
1. Pumps and accessories.
2. Motors and drives.

D. Characteristic Curves: Head-capacity, efficiency-capacity, brake horsepower-capacity, and NPSHR-capacity for each pump and if specified, for dual parallel pump operation.

E. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replacement parts, and troubleshooting guide:
1. Include complete list indicating all components of the systems.
2. Include complete diagrams of the internal wiring for each item of equipment.
3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

F. Completed System Readiness Checklist provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

G. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

1.4 QUALITY ASSURANCE

A. Design Criteria:
1. Pumps design and manufacturer shall conform to Hydraulic Institute Standards.
2. Pump sizes, capacities, pressures, operating characteristics and efficiency shall be as scheduled.
3. Select pumps so that required net positive suction head (NPSHR) does not exceed the net positive head available (NPSHA).
4. Pump Driver: Furnish with pump. Size shall be non-overloading at any point on the head-capacity curve including one pump operation in a parallel or series pumping installation.
5. Provide all electric-powered pumps with motors, impellers, drive assemblies, bearings, coupling guard and other accessories specified. Statically and dynamically balance all rotating parts.
6. Furnish each pump and motor with a nameplate giving the manufacturers name, serial number of pump, capacity in gpm and head in feet at design condition, horsepower, voltage, frequency, speed and full load current and motor efficiency.
7. Test all pumps before shipment. The manufacturer shall certify all pump ratings.
8. After completion of balancing, provide replacement of impellers or trim impellers to provide specified flow at actual pumping head, as installed.
9. Furnish one spare seal and casing gasket for each pump to the COR.

B. Allowable Vibration Tolerance for Pump Units: Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.

1.5 AS-BUILT DOCUMENTATION

A. Submit manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.

B. Submit operation and maintenance data updated to include submittal review comments, VA approved substitutions and construction revisions shall be in electronic version on CD or DVD and also inserted into a three-ring binder. All aspects of system operation and maintenance procedures, including applicable piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.

C. The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. Should the installing contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement. Provide record drawings as follows:
1. Red-lined, hand-marked drawings are to be provided, with one paper copy and a scanned PDF version of the hand-marked drawings provided on CD or DVD.
2. As-built drawings are to be provided, with a copy of them on AutoCAD version 2020 provided on CD or DVD. The CAD drawings shall use multiple line layers with a separate individual layer for each system.

D. The as-built drawings shall indicate the location and type of all lockout/tagout points for all energy sources for all equipment and pumps to include breaker location and numbers, valve tag numbers, etc. Coordinate lockout/tagout procedures and practices with local VA requirements.

E. Certification documentation shall be provided to COR 21 working days prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and provide documentation/certification that all results of tests were within limits specified. Test results shall contain written sequence of test procedure with written test results annotated at each step along with the expected outcome or setpoint. The results shall include all readings, including but not limited to data on device (make, model and performance characteristics), normal pressures, switch ranges, trip points, amp readings, and calibration data to include equipment serial numbers or individual identifications, etc.

1.6 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. The latest edition as of the specification issue date shall govern.

B. American Iron and Steel Institute (AISI):
AISI 1045.....Cold Drawn Carbon Steel Bar, Type 1045

AISI 416.....Type 416 Stainless Steel

C. American National Standards Institute (ANSI):
ANSI B15.1....Safety Standard for Mechanical Power Transmission Apparatus

ANSI B16.1.....Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800

D. American Society for Testing and Materials (ASTM):
A48 .....Standard Specification for Gray Iron Castings

B62 .....Standard Specification for Composition Bronze or Ounce Metal Castings

E. Maintenance and Operating Manuals in accordance with Section 01 00 00, GENERAL REQUIREMENTS.

PART 2 - PRODUCTS

2.1 CONDENSATE PUMP, PAD-MOUNTED

A. General: Factory assembled unit consisting of vented receiver tank, motor-driven pumps, interconnecting piping and wiring, motor controls (including starters, if necessary) and accessories, designed to receive, store, and pump steam condensate.

B. Receiver Tank: Cast iron with threaded openings for connection of piping and accessories and facilities for mounting float switches. Receivers for simplex pumps shall include all facilities for future mounting of additional pump and controls.

C. Furnish seals for condensate pump with a minimum temperature rating of 121 degrees C (250 degrees F).

D. Centrifugal Pumps: Bronze fitted with mechanical shaft seals.
1. Designed to allow removal of rotating elements without disturbing connecting piping or pump casing mounting.
2. Shafts: Stainless steel, Type 416 or alloy steel with bronze shaft sleeves.
3. Bearings: Regreaseable ball or roller type.
4. Casing wearing rings: Bronze.

E. Motors: Refer to Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT.

F. Pump Operation:
   1. Float Switches: NEMA 4, mounted on receiver tank, to start and stop pumps in response to changes in the water level in the receiver and adjustable to permit the controlled water levels to be changed. Floats and connecting rods shall be copper, bronze or stainless steel.
   2. Alternator: Provide for duplex units to automatically start the second pump when the first pump fails in keeping the receiver water level from rising and to alternate the order of starting the pumps to equalize wear. For units 0.25 kW (1/3 hp) and smaller, the alternator may be the mechanical type for use in lieu of float switches.

G. Control Cabinet for 3 Phase (0.37 kW (1/2 hp) and larger) Units: NEMA 4, UL approved, factory wired, enclosing all controls, with indicating lights, manual switches and resets mounted on the outside of the panel. Attach cabinet to the pump set with rigid steel framework, unless remote mounting is noted on the pump schedule.
   1. Motor starters: Magnetic contact types with circuit breakers or combination fusible disconnect switches. Provide low voltage control circuits (120-volt maximum) and HOA switches for each pump.
   2. Indicating lights for each pump: Green to show that power is on, red to show that the pump is running.

H. Electric Wiring: Suitable for 94 degrees C (200 degrees F) service; enclosed in liquid-tight flexible metal conduit where located outside of control cabinet.

I. Receiver Accessories:
   1. Thermometer: 38 to 216 degrees C (100 to 420 degrees F), mounted below minimum water level.
   2. Water level gauge glass: Brass with gauge cocks which automatically stop the flow of water when the glass is broken. Provide drain on the lower gauge cock and protection rods for the glass.

PART 3 - EXECUTION

3.1 INSTALLATION

A. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no additional cost or time to the Government.

B. Follow manufacturer's written instructions for pump mounting and startup. Access/Service space around pumps shall not be less than minimum space recommended by pumps manufacturer.

C. Sequence of installation for base-mounted pumps:
   1. Level and shim the unit base and grout to the concrete pad.
   2. Shim the driver and realign the pump and driver. Correct axial, angular or parallel misalignment of the shafts.
   3. Connect properly aligned and independently supported piping.
   4. Recheck alignment.

D. Pad-mounted Condensate Pump: Level, shim, bolt, and grout the unit base onto the concrete pad.

E. Sump Type Condensate Pump: Apply two coats of asphalt or bituminous compound on the exterior of the receiver tank, and mount level and flush in the floor with waterproofing gaskets and grouting to prevent ground water from entering the building from around the receiver.

F. Coordinate location of thermometer and pressure gauges as per Section 23 22 13, STEAM AND CONDENSATE HEATING PIPING.

3.2 STARTUP AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

C. The Commissioning Agent will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with COR and Commissioning Agent. Provide a minimum notice of 10 working days prior to startup and testing.

D. Verify that the piping system has been flushed, cleaned and filled.

E. Lubricate pumps before startup.

F. Prime the pump, vent all air from the casing and verify that the rotation is correct. To avoid damage to mechanical seals, never start or run the pump in dry condition.

G. Verify that correct size heaters-motor over-load devices are installed for each pump controller unit.

H. Field modifications to the bearings and or impeller (including trimming) are prohibited. If the pump does not meet the specified vibration tolerance send the pump back to the manufacturer for a replacement pump. All modifications to the pump shall be performed at the factory.

3.3 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

B. Components provided under this section of the specification will be tested as part of a larger system.

3.4 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative for 16 hours to instruct each VA personnel responsible in operation and maintenance of the system.

B. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

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SECTION 23 23 00
REFRIGERANT PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Field refrigerant piping for direct expansion HVAC systems.

B. Refrigerant piping shall be sized, selected, and designed either by the equipment manufacturer or in strict accordance with the manufacturer's published instructions. The schematic piping diagram shall show all accessories such as, stop valves, level indicators, liquid receivers, oil separator, gauges, thermostatic expansion valves, solenoid valves, moisture separators and driers to make a complete installation.

C. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

D. Definitions:

1. Refrigerating system: Combination of interconnected refrigerant-containing parts constituting one closed refrigeration circuit in which a refrigerant is circulated for the purpose of extracting heat.
   a. Low side means the parts of a refrigerating system subjected to evaporator pressure.
   b. High side means the parts of a refrigerating system subjected to condenser pressure.
2. Brazed joint: A gas-tight joint obtained by the joining of metal parts with alloys which melt at temperatures higher than 449 degrees C (840 degrees F) but less than the melting temperatures of the joined parts.

1.2 RELATED WORK

A. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

C. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

D. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

E. Section 23 07 11, HVAC, and BOILER PLANT INSULATION.

F. Section 23 21 13, HYDRONIC PIPING.

G. Section 23 64 00, PACKAGED WATER CHILLERS.

H. Section 23 81 00, DECENTRALIZED UNITARY HVAC EQUIPMENT

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards will govern. The latest edition as of the specification issue date shall govern.

B. Air Conditioning, Heating, and Refrigeration Institute (ARI/AHRI):

495 ..... Standard for Refrigerant Liquid Receivers

730 ..... Flow Capacity Rating of Suction-Line Filters and Suction-Line Filter-Driers

750 ..... Thermostatic Refrigerant Expansion Valves

760 ..... Performance Rating of Solenoid Valves for Use with Volatile Refrigerants

C. American Society of Heating Refrigerating and Air Conditioning Engineers (ASHRAE):

15 ..... Safety Standard for Refrigeration Systems (ANSI)

17 ..... Method of Testing Capacity of Thermostatic Refrigerant Expansion Valves (ANSI)

34 ..... Designation and Classification of Refrigerants (ANSI)

63.2 ..... Method of Testing Liquid Line Filter Drier Filtration Capability (ANSI)

D. American National Standards Institute (ANSI):

A13.1 ..... Scheme for Identification of Piping Systems

Z535.1 ..... Safety Color Code

E. American Society of Mechanical Engineers (ASME):

B16.22 ..... Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings (ANSI)

B16.24 ..... Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500 (ANSI)

B31.5 ..... Refrigeration Piping and Heat Transfer Components (ANSI)

B40.100 ..... Pressure Gauges and Gauge Attachments

B40.200 ..... Thermometers, Direct Reading and Remote Reading

F. American Society for Testing and Materials (ASTM)

A126 ..... Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings

B32 ..... Standard Specification for Solder Metal

B88 ..... Standard Specification for Seamless Copper Water Tube

B88M ..... Standard Specification for Seamless Copper Water Tube (Metric)

B280 ..... Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service

G. American Welding Society, Inc. (AWS): Brazing Handbook

A5.8/A5.8M ..... Standard Specification for Filler Metals for Brazing and Braze Welding

H. Underwriters Laboratories (UL):

207 .....Standard for Refrigerant-Containing Components and Accessories, Nonelectrical

429 .....Standard for Electrically Operated Valves

I. Department of Veterans Affairs (VA):

PG-18-10.....HVAC Design Manual

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 23 23 00, REFRIGERAN PIPING”, with applicable paragraph identification.

C. Shop Drawings:

1. Complete information for components noted, including valves and refrigerant piping accessories, clearly presented, shall be included to determine compliance with in the contract documents for components noted below:
   a. Tubing and fittings
   b. Valves
   c. Strainers
   d. Moisture-liquid indicators
   e. Filter-driers
   f. Flexible metal hose
   g. Liquid-suction interchanges
   h. Oil separators (when specified)
   i. Gauges
   j. Pipe and equipment supports
   k. Refrigerant and oil
   l. Pipe/conduit roof penetration cover
   m. Soldering and brazing materials
2. Layout of refrigerant piping and accessories, including flow capacities, valves locations, and oil traps slopes of horizontal runs, floor/wall penetrations, and equipment connection details.

D. Certification: Copies of certificates for welding procedure, performance qualification record and list of welders' names and symbols.

E. Design Manual: Furnish two copies of design manual of refrigerant valves and accessories.

1.5 QUALITY ASSURANCE

A. Refer to specification Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. Comply with ASHRAE Standard 15, Safety Code for Mechanical Refrigeration. The application of this Code is intended to assure the safe design, construction, installation, operation, and

inspection of every refrigerating system employing a fluid which normally is vaporized and liquefied in its refrigerating cycle.

C. Comply with ASME B31.5: Refrigerant Piping and Heat Transfer Components.

D. Products shall comply with UL 207 "Refrigerant–Containing Components and Accessories, "Nonelectrical"; or UL 429 "Electrical Operated Valves."

E. Categorize selected refrigerant with ASHRAE 34-2022. Submit selected refrigerant for information.

1.6 AS-BUILT DOCUMENTATION

A. Comply with requirements in Paragraph “AS-BUILT DOCUMENTATION” in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

PART 2 - PRODUCTS

2.1 PIPING AND FITTINGS

A. Refrigerant Piping: For piping up to 100 mm (4 inch) use Copper refrigerant tube, ASTM B280, cleaned, dehydrated and sealed, marked ACR on hard temper straight lengths. Coils shall be tagged ASTM B280 by the manufacturer. For piping over 100 mm (4 inch) use A53 Black SML steel.

B. Water and Drain Piping: Copper water tube, ASTM B88M, Type B or C (ASTM B88, Type M or L). Optional drain piping material: Schedule 80 flame retardant Polypropylene plastic.

C. Fittings, Valves and Accessories:

1. Copper fittings: Wrought copper fittings, ASME B16.22.
   a. Brazed Joints, refrigerant tubing: Cadmium free, AWS A5.8/A5.8M, 45 percent silver brazing alloy, Class BAg-5.
   b. Solder Joints, water and drain: 95-5 tin-antimony, ASTM B32 (95TA).
2. Steel fittings: ASTM wrought steel fittings.
   a. Refrigerant piping – Welded Joints.
3. Flanges and flanged fittings: ASME B16.24.
4. Refrigeration Valves:
   a. Stop Valves: Brass or bronze alloy, packless, or packed type with gas tight cap, frost proof, back seating.
   b. Pressure Relief Valves: Comply with ASME Boiler and Pressure Vessel Code; UL listed. Forged brass with nonferrous, corrosion resistant internal working parts of high strength, cast iron bodies conforming to ASTM A126, Grade B. Set valves in accordance with ASHRAE Standard 15.
   c. Solenoid Valves: Comply with ARI 760 and UL 429, UL-listed, two-position, direct acting or pilot-operated, moisture and vapor-proof type of corrosion resisting materials, designed for intended service, and solder-end connections. Fitted with suitable NEMA 250 enclosure of type required by location and normally open holding coil.

d. Thermostatic Expansion Valves: Comply with ARI 750. Brass body with stainless-steel or non-corrosive nonferrous internal parts, diaphragm and spring-loaded (direct-operated) type with sensing bulb and distributor having side connection for hot-gas bypass and external equalizer. Size and operating characteristics as recommended by manufacturer of evaporator and factory set for superheat requirements. Solder-end connections. Testing and rating in accordance with ASHRAE Standard 17.

e. Electronic Thermostatic Expansion Valves: Electronic thermal expansion valves shall be stepper motor high resolution drive assembly type for precision control. Valve shall not exceed 6 watts max consumption. Compatibility tested with most HC, CFC, HCFC, and HFC refrigerants and oils. Valve pistons and ports to be characterized to provide improved flow resolution and performance. Valves to be interfaced with microprocessor-based controllers by devise manufacturer with temperature feedback loop. Electric expansion valves to be sized with nominal steps of stroke for tonnage application as recommended by valve manufacture ranging from 500 steps on small tonnage (under 5 tons per circuit) to 6300 on large tonnage circuits (over 100 tons per circuit)

f. Check Valves: Brass or bronze alloy with swing or lift type, with tight closing resilient seals for silent operation; designed for low pressure drop, and with solder-end connections. Direction of flow shall be legibly and permanently indicated on the valve body.

5. Strainers: Designed to permit removing screen without removing strainer from piping system, and provided with screens 80 to 100 mesh in liquid lines DN 25 (NPS 1) and smaller, 60 mesh in liquid lines greater than DN 25 (NPS 1), and 40 mesh in suction lines. Provide strainers in liquid line serving each thermostatic expansion valve, and in suction line serving each refrigerant compressor not equipped with integral strainer.
6. Refrigerant Moisture/Liquid Indicators: Double-ported type having heavy sight glasses sealed into forged bronze body and incorporating means of indicating refrigerant charge and moisture indication. Provide screwed brass seal caps.
7. Refrigerant Filter-Dryers: UL listed, angle or in-line type, as shown in the contract documents. Conform to ARI Standard 730. Heavy gauge steel shell protected with corrosion-resistant paint; perforated baffle plates to prevent desiccant bypass. Size as recommended by manufacturer for service and capacity of system with connection not less than the line size in which installed. Filter driers with replaceable filters shall be furnished with one spare element of each type and size.
8. Flexible Metal Hose: Seamless bronze corrugated hose, covered with bronze wire braid, with standard copper tube ends. Provide in suction and discharge piping of each compressor.
9. Water Piping Valves and Accessories: Refer to specification Section 23 21 13, HYDRONIC PIPING and Section 23 64 00, PACKAGED WATER CHILLERS.

2.2 GAUGES

A. Temperature Gauges: Comply with ASME B40.200. Industrial-duty type and in required temperature range for service in which installed. Gauges shall have Celsius scale in 1-degree (Fahrenheit scale in 2-degree) graduations and with black number on a white face. The pointer shall be adjustable. Rigid stem type temperature gauges shall be provided in thermal wells located within 1525 mm (5 feet) of the finished floor. Universal adjustable angle type or remote element type temperature gauges shall be provided in thermal wells located 1525 to 2135 mm (5 to 7 feet) above the finished floor. Remote element type temperature gauges shall be provided in thermal wells located 2135 mm (7 feet) above the finished floor.

B. Vacuum and Pressure Gauges: Comply with ASME B40.100 and provide with throttling type needle valve or a pulsation dampener and shut-off valve. Gauge shall be a minimum of 90 mm (3-1/2 inches) in diameter with a range from 0 kPa (0 psig) to approximately 1.5 times the maximum system working pressure. Each gauge range shall be selected so that at normal operating pressure, the needle is within the middle-third of the range.

1. Suction: 101 kPa (30 inches Hg) vacuum to 1723 kPa (gauge) (250 psig).
2. Discharge: 0 to 3445 kPa (gauge) (0 to 500 psig).

2.3 THERMOMETERS AND WELLS

A. Refer to specification Section 23 21 13, HYDRONIC PIPING.

2.4 PIPE SUPPORTS

A. Refer to specification Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

2.5 REFRIGERANTS AND OIL

A. Provide EPA approved refrigerant and oil for proper system operation.

2.6 PIPE/CONDUIT ROOF PENETRATION COVER

A. Prefabricated Roof Curb: Galvanized steel or extruded aluminum 300 mm (12 inches) overall height, continuous welded corner seams, treated wood nailer,38 mm (1-1/2 inch) thick, 48 kg/cubic meter (3 pounds/cubic foot) density rigid mineral fiberboard insulation with metal liner, built-in cant strip (except for gypsum or tectum decks). For surface insulated roof deck, provide raised cant strip (recessed mounting flange) to start at the upper surface of the insulation. Curbs shall be constructed for pitched roof or ridge mounting as required to keep top of curb level.

B. Penetration Cover: Galvanized sheet metal with flanged removable top. Provide 38 mm (1-1/2 inch) thick mineral fiber board insulation.

C. Flashing Sleeves: Provide sheet metal sleeves for conduit and pipe penetrations of the penetration cover. Seal watertight penetrations.

2.7 PIPE INSULATION FOR DX HVAC SYSTEMS

A. Refer to specification Section 23 07 11, HVAC, PLUMBING, and BOILER PLANT INSULATION.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install refrigerant piping and refrigerant containing parts in accordance with ASHRAE Standard 15 and ASME B31.5
   1. Install piping as short as possible, with a minimum number of joints, elbow and fittings.
   2. Install piping with adequate clearance between pipe and adjacent walls and hangers to allow for service and inspection. Space piping, including insulation, to provide 25 mm (1 inch) minimum clearance between adjacent piping or other surface. Use pipe sleeves through walls, floors, and ceilings, sized to permit installation of pipes with full thickness insulation.
   3. Locate and orient valves to permit proper operation and access for maintenance of packing, seat and disc. Generally locate valve stems in overhead piping in horizontal position. Provide a union adjacent to one end of all threaded end valves. Control valves usually require reducers to connect to pipe sizes shown in the contract documents.
   4. Use copper tubing in protective conduit when installed below ground.
   5. Install hangers and supports per ASME B31.5 and the refrigerant piping manufacturer's recommendations.

B. Joint Construction:
   1. Brazed Joints: Comply with AWS "Brazing Handbook" and with filler materials complying with AWS A5.8/A5.8M.
      a. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper tubing.
      b. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.
      c. Swab fittings and valves with manufacturer's recommended cleaning fluid to remove oil and other compounds prior to installation.
      d. Pass nitrogen gas through the pipe or tubing to prevent oxidation as each joint is brazed. Cap the system with a reusable plug after each brazing operation to retain the nitrogen and prevent entrance of air and moisture.

C. Protect refrigerant system during construction against entrance of foreign matter, dirt and moisture; have open ends of piping and connections to compressors, condensers, evaporators and other equipment tightly capped until assembly.

D. Pipe relief valve discharge to outdoors for systems containing greater than 45 kg (100 lbs) of refrigerant.

E. Firestopping: Fill openings around uninsulated piping penetrating floors or fire walls, with firestop material. For firestopping insulated piping refer to Section 23 07 11, HVAC, and BOILER PLANT INSULATION.

F. Seismic Bracing: Refer to specification Section 13 05 41, SEISMIC RESTRAINTS REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS, for bracing of piping in seismic areas.

G. If in the substantiated evaluation of the COR, the installation fails to meet the requirements of the construction documents with respect to function and maintainability, an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no additional cost or time to the Government.

3.2 PIPE AND TUBING INSULATION

A. Refer to specification Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. Apply two coats of weather-resistant finish as recommended by the manufacturer to insulation exposed to outdoor weather.

3.3 SIGNS AND IDENTIFICATION

A. Each refrigerating system erected on the premises shall be provided with an easily legible permanent sign securely attached and easily accessible, indicating thereon the name and address of the installer, the kind and total number of pounds of refrigerant required in the system for normal operations, and the field test pressure applied.

B. Systems containing greater than 50 kg (110 lb) of refrigerant shall be provided with durable signs, in accordance with ANSI A13.1 and ANSI Z535.1, having letters not less than 13 mm (1/2 inch) in height designating:

1. Valves and switches for controlling refrigerant flow, the ventilation and the refrigerant compressor(s).
2. Signs on all exposed high pressure and low pressure piping installed outside the machinery room, with name of the refrigerant and the letters "HP" or "LP."
3. Signage and labeling identifying “flammable” or “health hazard” based on chosen refrigerant per requirements and definitions in ASHRAE 34-2022.

3.4 FIELD QUALITY CONTROL

A. Prior to initial operation examine and inspect piping system for conformance to plans and specifications and ASME B31.5. Correct equipment, material, or work rejected because of defects or nonconformance with plans and specifications, and ANSI codes for pressure piping.

B. After completion of piping installation and prior to initial operation, conduct test on piping system according to ASME B31.5. Furnish materials and equipment required for tests. Perform tests in the presence of COR. If the test fails, correct defects and perform the test again until it is satisfactorily done and all joints are proved tight.

1. Every refrigerant-containing parts of the system that is erected on the premises, except compressors, condensers, evaporators, safety devices, pressure gauges, control mechanisms and systems that are factory tested, shall be tested and proved tight after complete installation, and before operation.

2. The high and low side of each system shall be tested and proved tight at not less than the lower of the design pressure or the setting of the pressure-relief device protecting the high or low side of the system, respectively, except systems erected on the premises using non-toxic and non-flammable Group A1 refrigerants with copper tubing not exceeding DN 18 (NPS 5/8). This may be tested by means of the refrigerant charged into the system at the saturated vapor pressure of the refrigerant at 20 degrees C (68 degrees F) minimum.

C. Test Medium: A suitable dry gas such as nitrogen or shall be used for pressure testing. The means used to build up test pressure shall have either a pressure-limiting device or pressure-reducing device with a pressure-relief device and a gauge on the outlet side. The pressure relief device shall be set above the test pressure but low enough to prevent permanent deformation of the system components.

3.5 SYSTEM TEST AND CHARGING

A. Ensure qualified workers are competent in the application of chosen refrigerant per ASHRAE 15 and ASHRAE 34. System Test and Charging: As recommended by the equipment manufacturer or as follows:

1. Connect a drum of refrigerant to charging connection and introduce enough refrigerant into system to raise the pressure to 70 kPa (10 psig) gauge. Close valves and disconnect refrigerant drum. Test system for leaks with halide test torch or other approved method suitable for the test gas used. Repair all leaking joints and retest.
2. Connect a drum of dry nitrogen to charging valve and bring test pressure to design pressure for low side and for high side. Test entire system again for leaks.
3. Evacuate the entire refrigerant system by the triplicate evacuation method with a vacuum pump equipped with an electronic gauge reading in mPa (microns). Pull the system down to 665 mPa (500 microns) 665 mPa (2245.6 inches of mercury at 60 degrees F) and hold for 8 hours then break the vacuum with dry nitrogen (or refrigerant). Repeat the evacuation two more times breaking the third vacuum with the refrigeration to be charged and charge with the proper volume of refrigerant.

3.6 STARTUP AND TESTING

A. The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the COR and CxA. Provide a minimum of 7 days prior notice.

B. Provide services of manufacturer’s technical representative for four hours to instruct VA personnel in operation and maintenance of computer room air conditioning equipment.

3.7 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS for all inspection, start up, and contractor testing required above and required by the System Readiness Checklist provided by the CxA.

B. Components provided under this section of the specification will be tested as part of a larger system. Refer to Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS and related sections for contractor responsibilities for system commissioning.

3.8 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer's technical representative for 4 hours to instruct VA personnel in operation and maintenance of units.

B. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

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SECTION 23 25 00
HVAC WATER TREATMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. This section specifies cleaning and treatment of circulating HVAC water systems, including the following.
   1. Cleaning compounds.
   2. Chemical treatment for closed loop heat transfer systems.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

E. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

F. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

G. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

H. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

I. Section 23 21 13, HYDRONIC PIPING.

J. Section 23 22 13, STEAM and CONDENSATE HEATING PIPING.

1.3 APPLICABLE PUBLICATIONS

A. The publication listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards will govern. The latest edition as of the specification issue date shall govern.

B. American Society of Mechanical Engineers (ASME):
   ASME Boiler and Pressure Vessel Code (BPVC):

   BPVC Section VIII ..... Rules for Construction of Pressure Vessels, Division 1

C. American Society for Testing and Materials (ASTM):
   A666 ..... Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar

   F441/F441M ..... Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80

D. National Fire Protection Association (NFPA):
   70 ..... National Electric Code (NEC)

E. Department of Veterans Affairs (VA):
   ES-2019-01 ..... Cooling Tower Water Systems Policy

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION XX XX XX, SECTION TITLE”, with applicable paragraph identification.

C. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
   1. Cleaning compounds and recommended procedures for their use.
   2. Chemical treatment for closed systems, including installation and operating instructions.
   3. Chemical treatment for open loop systems, including installation and operating instructions.
   4. Glycol-water system materials, equipment, and installation.

D. Water analysis verification.

E. Materials Safety Data Sheet for all proposed chemical compounds, based on U.S. Department of Labor Form No. L5B-005-4.

F. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts, and troubleshooting guide:
   1. Include complete list indicating all components of the systems.
   2. Include complete diagrams of the internal wiring for each item of equipment.
   3. Diagrams shall have their terminals identified to facilitate installation, operation, and maintenance.

G. Completed System Readiness Checklist provided by the CxA and completed by the contractor, signed by a qualified technician, and dated on the date of completion, in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

H. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING of HVAC SYSTEMS.

1.5 QUALITY ASSURANCE

A. Refer to paragraph QUALITY ASSURANCE in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. Technical Services: Provide the services of an experienced water treatment chemical engineer or technical representative to direct flushing, cleaning, pre-treatment, training, debugging, and acceptance testing operations; direct and perform chemical limit control during construction period and monitor systems for a period of 12 months after acceptance, including not less than 6 service calls and written status reports. Emergency calls are not included. Minimum service during construction/startup shall be 6 hours.

C. Chemicals: Chemicals shall be non-toxic approved by local authorities and meeting applicable EPA requirements.

D. Bio-Based Materials: For products designated by the USDA’s Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specification section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

E. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

1.6 AS-BUILT DOCUMENTATION

A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

PART 2 - PRODUCTS

2.1 CLEANING COMPOUNDS

A. Alkaline phosphate or non-phosphate detergent/surfactant/specific to remove organic soil, hydrocarbons, flux, pipe mill varnish, pipe compounds, iron oxide, and like deleterious substances, with or without inhibitor, suitable for system wetted metals without deleterious effects.

B. All chemicals to be acceptable for discharge to sanitary sewer.

C. Refer to Section 23 21 13, HYDRONIC PIPING and Section 23 22 13, STEAM and CONDENSATE HEATING PIPING, PART 3, for flushing and cleaning procedures.

2.2 CHEMICAL TREATMENT FOR CLOSED LOOP SYSTEMS

A. Inhibitor: Provide sodium nitrite/borate, molybdate-based inhibitor or other approved compound suitable for make-up quality and make-up rate and which will cause or enhance bacteria/corrosion problems or mechanical seal failure due to excessive total dissolved solids. Shot feed manually. Maintain inhibitor residual as determined by water treatment laboratory, taking into consideration residual and temperature effect on pump mechanical seals.

B. pH Control: Inhibitor formulation shall include adequate buffer to maintain pH range of 8.0 to 10.5.

C. Performance: Protect various wetted, coupled, materials of construction including ferrous, red and yellow metals. Maintain system essentially free of scale, corrosion, and fouling. Corrosion rate of following metals shall not exceed specified mills per year penetration; ferrous, 0-2; brass, 0-1; copper, 0-1. Inhibitor shall be stable at equipment skin surface temperatures and bulk water temperatures of not less than 121 degrees C (250-degrees F) and 52-degrees C (125-degrees F) respectively. Heat exchanger fouling and capacity reduction shall not exceed that allowed by fouling factor 0.0005.

D. Pot Feeder: Bypass type, complete with necessary shutoff valves, drain and air release valves, and system connections, for introducing chemicals into system, cast-iron or steel tank with funnel or large opening on top for easy chemical addition. Feeders shall be 18.9 L (5 gallon) minimum capacity at 860 kPa (125 psig) minimum working pressure.

E. Side Stream Water Filter for Closed Loop Systems: Stainless-steel housing, and polypropylene filter media with stainless-steel core. Filter media shall be compatible with antifreeze and water treatment chemicals used in the system. Replaceable filter cartridges for sediment removal service with minimum 20 micrometer particulate at 98 percent efficiency for approximately 5 percent of system design flow rate. Filter cartridge shall have a maximum pressure drop of 13.8 kPa (2 psig) at design flow rate when clean, and maximum pressure drop of 172 kPa (25 psig) when dirty. A constant flow rate valve shall be provided in the piping to the filter. Inlet and outlet pressure gauges shall be provided to monitor filter condition.

2.3 EQUIPMENT AND MATERIALS IDENTIFICATION

A. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

PART 3 - EXECUTION

3.1 INSTALLATION

A. If an installation is unsatisfactory to the COR, the contractor shall correct the installation at no additional cost or time to the Government.

B. Delivery and Storage: Deliver all chemicals in manufacturer's sealed shipping containers. Store in designated space and protect from deleterious exposure and hazardous spills.

C. Install equipment furnished by the chemical treatment supplier and charge systems according to the manufacturer's instructions and as directed by the Technical Representative.

D. Refer to Section 23 21 13, HYDRONIC PIPING for chemical treatment piping, installed as follows:
   1. Provide a bypass line around water meters and bleed off piping assembly. Provide ball valves to allow for bypassing, isolation, and servicing of components.
   2. Bleed off water piping with bleed off piping assembly shall be piped from pressure side of circulating water piping to a convenient drain. Bleed off connection to main circulating water piping shall be upstream of chemical injection nozzles.
   3. Provide piping for the flow assembly piping to the main control panel and accessories.
      a. The inlet piping shall connect to the discharge side of the circulating water pump.
      b. The outlet piping shall connect to the water piping serving the cooling tower downstream of the heat source.
      c. Provide inlet Y-strainer and ball valves to isolate and service main control panel and accessories.
   4. Install injection nozzles with corporation stops in the water piping serving the cooling tower downstream of the heat source.
   5. Provide piping for corrosion monitor rack per manufacturer’s installation instructions. Provide ball valves to isolate and service rack.
   6. Provide piping for erosion chemical feeder per manufacturer’s installation instructions. Provide ball valves to isolate and service feeder.
   7. Provide installation supervision, startup and operating instruction by manufacturer's technical representative.

E. Before adding cleaning chemical to the closed system, all air handling coils and fan coil units shall be isolated by closing the inlet and outlet valves and opening the bypass valves. This is done to prevent dirt and solids from lodging the coils.

F. UV-Irradiation Unit Installation: Install UV-Irradiation units on concrete bases level and plumb. Maintain manufacturer's recommended clearances. Arrange units, so controls and devices that require servicing are accessible. Anchor mineral and brine tanks and floor-mounting accessories to substrate.

G. Do not valve in or operate system pumps until after system has been cleaned.

H. After chemical cleaning is satisfactorily completed, open the inlet and outlet valves to each coil and close the bypass valves. Also, clean all strainers.

I. Perform tests and report results in accordance with Section 01 00 00, GENERAL REQUIREMENTS.

J. After cleaning is complete, and water pH is acceptable to manufacturer of water treatment chemical, add manufacturer recommended amount of chemicals to systems.

3.2 STARTUP AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

C. The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the COR and CxA. Provide a minimum notice of 10 working days prior to startup and testing.

3.3 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

B. Components provided under this section of the specification will be tested as part of a larger system.

3.4 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer's technical representative for 4 hours to instruct each VA personnel responsible in operation and maintenance of the system.

B. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

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SECTION 23 31 00
HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. Ductwork and accessories for HVAC including the following:
   1. Supply air, return air, outside air, exhaust, make-up air, and relief systems.
   2. Exhaust duct for kitchen hood exhaust (grease) ducts.

C. Definitions:
   1. Seal or Sealing: Use of liquid or mastic sealant, with or without compatible tape overlay, or gasketing of flanged joints, to keep air leakage at duct joints, seams and connections to an acceptable minimum.
   2. Duct Pressure Classification: SMACNA HVAC Duct Construction Standards, Metal and Flexible.
   3. Exposed Duct: Exposed to view in a finished room.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D. Section 07 84 00, FIRESTOPPING.

E. Section 08 90 00, LOUVERS and VENTS.

F. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

G. Section 22 11 00, FACILITY WATER DISTRIBUTION.

H. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

I. Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.

J. Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC.

K. Section 23 07 11, HVAC and BOILER PLANT INSULATION.

L. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

M. Section 23 34 00, HVAC FANS.

N. Section 23 36 00, AIR TERMINAL UNITS.

O. Section 23 40 00, HVAC AIR CLEANING DEVICES.

P. Section 23 73 00, INDOOR CENTRAL-STATION AIR-HANDLING UNITS.

Q. Section 23 82 00, CONVECTION HEATING and COOLING UNITS.

R. Section 23 82 16, AIR COILS.

S. Section 28 31 00, FIRE DETECTION and ALARM.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.Where conflicts occur these specifications and the VHA standards will govern. The latest edition as of the specification issue date shall govern.

B. American Society of Civil Engineers (ASCE):
7 ..... Minimum Design Loads for Associated Criteria for Buildings and Other Structures

C. American Society for Testing and Materials (ASTM):
A653/A653M..... Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

A1011/A1011..... Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High Strength Low-Alloy with Improved Formability, and Ultra-High Strength

B209 ..... Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

C1071 ..... Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)

E1 ..... Standard Specification for ASTM Liquid-in-Glass Thermometers

E77 ..... Standard Test Method for Inspection and Verification of Thermometers

E84 ..... Standard Test Method for Surface Burning Characteristics of Building Materials

D. National Fire Protection Association (NFPA):
90A ..... Standard for the Installation of Air-Conditioning and Ventilating Systems

96 ..... Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations

E. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
006 ..... HVAC Duct Construction Standards, Metal and Flexible, 4th Edition

016 ..... HVAC Air Duct Leakage Test Manual, 2nd Edition

..... Fibrous Glass Duct Construction Standards, 7th Edition

F. Underwriters Laboratories, Inc. (UL):
181 ..... Standard for Factory-Made Air Ducts and Air Connectors

555 ..... Standard for Fire Dampers

555S ..... Standard for Smoke Dampers

G. Department of Veterans Affairs (VA):
PG-18-10..... Physical Security Design Manual for VA Mission Critical Facilities

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 23 XX XX, SECTION TITLE”, with applicable paragraph identification.

C. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
   1. Rectangular Ducts:
      a. Schedules of duct systems, materials and selected SMACNA construction alternatives for joints, sealing, gauge and reinforcement.
      b. Duct liner.
      c. Sealants and gaskets.
      d. Access doors.
   2. Round and Flat Oval DuctS:
      a. Manufacturer's details for duct fittings.
      b. Sealants and gaskets.
      c. Access sections.
      d. Installation instructions.
   3. Volume dampers, back draft dampers.
   4. Upper hanger attachments.
   5. Fire dampers, fire doors, and smoke dampers with installation instructions.
   6. Sound attenuators, including pressure drop and acoustic performance.
   7. Flexible ducts and clamps, with manufacturer's installation instructions.
   8. Flexible connections.
   9. Instrument test fittings.
   10. Details and design analysis of alternate or optional duct systems.

D. Coordination Drawings: Refer to paragraph SUBMITTALS in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

E. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts, and troubleshooting guide:
   1. Include complete list indicating all components of the systems.
   2. Include complete diagrams of the internal wiring for each item of equipment.
   3. Diagrams shall have their terminals identified to facilitate installation, operation, and maintenance.

1.5 QUALITY ASSURANCE

A. Bio-Based Materials: For products designated by the USDA’s Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

B. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

C. Fire Safety Code: Comply with NFPA 90A.

D. Duct System Construction and Installation: Referenced SMACNA Standards are the minimum acceptable quality.

E. Duct Sealing, Air Leakage Criteria, and Air Leakage Tests: Ducts shall be sealed as per duct sealing requirements of SMACNA HVAC Air Duct Leakage Test Manual for duct pressure classes shown in the contract documents.

F. Duct accessories exposed to the air stream, such as dampers of all types (except smoke dampers) and access openings, shall be of the same material as he duct or provide at least the same level of corrosion resistance.

1.6 AS-BUILT DOCUMENTATION

A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

PART 2 - PRODUCTS

2.1 DUCT MATERIALS AND SEALANTS

A. General: Except for systems specified otherwise, construct ducts, casings, and accessories of galvanized sheet steel, ASTM A653/A653M, coating G90; or, aluminum sheet, ASTM B209, alloy 1100, 3003 or 5052.

B. Specified Corrosion Resistant Systems: Stainless-steel sheet, Class 302 or 304, Condition A (annealed) Finish No. 4 for exposed ducts and Finish No. 2B for concealed duct or ducts located in mechanical rooms.

C. Optional Duct Materials:
   1. Grease Duct: Double wall factory-built grease duct, UL labeled and complying with NFPA 96 may be furnished in lieu of specified materials for kitchen and grill hood exhaust duct. Installation and accessories shall comply with the manufacturers catalog data. Outer jacket of exposed ductwork shall be stainless-steel. Square and rectangular duct shown in the contract documents will have to be converted to equivalent round size.

D. Joint Sealing: Refer to SMACNA HVAC Duct Construction Standards, Metal and Flexible.
   1. Sealant: Elastomeric compound, gun or brush grade, maximum 25 flame spread, and 50 smoke developed (dry state) compounded specifically for sealing ductwork as recommended by the manufacturer. Generally, provide liquid sealant, with or without compatible tape, for low clearance slip joints and heavy, permanently elastic, mastic type where clearances are larger. Oil base caulking and glazing compounds are prohibited because they do not retain elasticity and bond.
   2. Tape: Use only tape specifically designated by the sealant manufacturer and apply only over wet sealant. Pressure sensitive tape shall not be used on bare metal or on dry sealant.
   3. Gaskets in Flanged Joints: Soft neoprene.

E. Approved factory-made joints may be used.

2.2 DUCT CONSTRUCTION AND INSTALLATION

A. Regardless of the pressure classifications outlined in the SMACNA Standards, fabricate and seal the ductwork in accordance with the following pressure classifications:

B. Duct Pressure Classification:
   1. 0 to 13 mm (0 to 1/2 inch)
   2. 13 mm to 25 mm (1/2 inch to 1 inch)
   3. 25 mm to 50 mm (1 inch to 2 inch)
   4. 50 mm to 75 mm (2 inch to 3 inch)
   5. 75 mm to 100 mm (3 inch to 4 inch)

C. Seal Class: All ductwork shall receive Class A Seal.

D. Wet Air Exhaust Ducts and Accessories: Ducts for dishwashers, scullery hood, cart washers, manual cart washers, cage washers, steam sterilizer hoods and orthotics hoods shall be 1.3 mm (18 gauge) stainless-steel made liquid tight with continuous external weld for all seams and joints. Provide neoprene gaskets at flanged connections. Where ducts are not self-draining back

to the equipment, provide low point drain pocket with copper drain pipe to sanitary sewer. Provide access door in side of duct at drain pockets.

E. Kitchen Hood (Ventilator) Exhaust Ducts: Comply with NFPA 96.
   1. Material: 1.6 mm (16 gauge) steel sheet (black iron), ASTM A1011/A1011M, or 1.3 mm (18 gauge) stainless-steel. Use stainless-steel for exposed duct in occupied areas. See Optional Duct Materials.
   2. Construction: Liquid tight with continuous external weld for all seams and joints. Where ducts are not self-draining back to the equipment, provide low point drain pocket with copper drain pipe to sanitary sewer. Provide access doors or panels for duct cleaning inside of horizontal duct at drain pockets, at 6.1 m (20 feet) intervals, and at each change of direction.
   3. Access doors or panels shall be of the same material and thickness of the duct with gaskets and sealants that are rated 815 degrees C (1500 degrees F) and shall be grease-tight.
   4. Grease Duct: Double-wall factory-built grease duct, UL labeled and complying with NFPA 96 may be furnished in lieu of specified materials for kitchen and grill hood exhaust. Installation and accessories shall comply with the manufacturers catalog data. Outer jacket of exposed ductwork shall be stainless-steel. Square and rectangular duct shown in the contract documents will have to be converted to equivalent round size.

F. Round and Flat Oval Ducts: Furnish duct and fittings made by the same manufacturer to ensure good fit of slip joints. When submitted and approved in advance, round and flat oval duct, with size converted on the basis of equal pressure drop, may be furnished in lieu of rectangular duct design shown in the contract documents.
   1. Elbows: Diameters 75 through 203 mm (3 through 8 inches) shall be two sections die stamped, all others shall be gored construction, maximum 18 degree angle, with all seams continuously welded or standing seam. Coat galvanized areas of fittings damaged by welding with corrosion resistant aluminum paint or galvanized repair compound.
   2. Provide bell mouth, conical tees or taps, laterals, reducers, and other low loss fittings as shown in SMACNA HVAC Duct Construction Standards, Metal and Flexible.
   3. Ribbed Duct Option: Lighter gauge round/oval duct and fittings may be furnished provided certified tests indicating that the rigidity and performance is equivalent to SMACNA standard gauge ducts are submitted.
      a. Ducts: Manufacturer's published standard gauge, G90 coating, spiral lock seam construction with an intermediate standing rib.
      b. Fittings: May be manufacturer's standard as shown in published catalogs, fabricated by spot welding and bonding with neoprene base cement or machine formed seam in lieu of continuous welded seams.
   4. Provide flat side reinforcement of oval ducts as recommended by the manufacturer and SMACNA HVAC Duct Construction Standards, Metal and Flexble. Because of high pressure loss, do not use internal tie-rod reinforcement unless approved by the COR.

G. Casings and Plenums: Construct in accordance with SMACNA HVAC Duct Construction Standards, Metal and Flexible, including curbs, access doors, pipe penetrations, eliminators and drain pans. Access doors shall be hollow metal, insulated, with latches and door pulls, 508 mm (20 inches) wide by 1219 to 1372 mm (48 to 54 inches) high. Provide view port in the doors where shown. Provide drain for outside air louver plenum. Outside air plenum shall have exterior insulation. Drain piping shall be routed to the nearest floor drain.

H. Volume Dampers: Single blade or opposed blade, multi-louver type as detailed in SMACNA Standards. Refer to SMACNA for Single Blade and Multi-blade Volume Dampers.

I. Duct Hangers and Supports: Refer to SMACNA Standards. Avoid use of trapeze hangers for round duct.

2.3 DUCT ACCESS DOORS, PANELS AND SECTIONS

A. Provide access doors, sized and located for maintenance work, upstream, in the following locations:
   1. Each duct mounted coil and humidifier.
   2. Each fire damper (for link service), smoke damper and automatic control damper.
   3. Each duct mounted smoke detector.
   4. For cleaning operating room supply air duct and kitchen hood exhaust duct, locate access doors at 6.1 m (20 feet) intervals and at each change in duct direction.

B. Openings shall be as large as feasible in small ducts, 305 mm by 305 mm (12 inch by 12 inch) minimum where possible. Access sections in insulated ducts shall be double-wall, insulated. Transparent shatterproof covers are preferred for uninsulated ducts.
   1. For Rectangular Ducts: Refer to SMACNA HVAC Duct Construction Standards, Metal and Flexible.
   2. For Round and Flat Oval Ducts: Refer to SMACNA HVAC Duct Construction Standards, Metal and Flexible.

2.4 FIRE DAMPERS

A. Galvanized steel, interlocking blade type, UL listing and label, 1-1/2-hour rating, 70 degrees C (158 degrees F) fusible line, 100 percent free opening with no part of the blade stack or damper frame in the air stream.

B. Fire dampers in wet air exhaust shall be of stainless-steel construction, all others may be galvanized steel.

C. Minimum Requirements for Fire Dampers:
   1. The damper frame may be of design and length as to function as the mounting sleeve, thus eliminating the need for a separate sleeve, as allowed by UL 555. Otherwise provide sleeves and mounting angles, minimum 1.9 mm (14 gauge), required to provide installation equivalent to the damper manufacturer's UL test installation.
   2. Submit manufacturer's installation instructions conforming to UL rating test.

2.5 SMOKE DAMPERS

A. Maximum air velocity, through free area of open damper, and pressure loss: Low pressure and medium pressure duct (supply, return, exhaust, outside air): 457 m/min (1500 fpm). Maximum static pressure loss: 32 Pa (0.13 inch WG).

B. Leakage: Class I.

C. Maximum Air Leakage, Closed Damper: 0.32 cubic meters /min/square meter (4.0 cfm per square foot) at 750 Pa (3 inch WG) differential pressure.

D. Minimum Requirements for Dampers:
   1. Shall comply with requirements of UL 555S, except for the Fire Endurance and Hose Stream Test.
   2. Frame: Galvanized steel channel with side, top and bottom stops or seals.
   3. Blades: Galvanized steel, parallel type preferably, 305 mm (12 inch) maximum width, edges sealed with neoprene, rubber or felt, if required to meet minimum leakage. Airfoil (streamlined) type for minimum noise generation and pressure drop are preferred for duct mounted dampers.
   4. Shafts: Galvanized steel.
   5. Bearings: Nylon, bronze sleeve or ball type.
   6. Hardware: Zinc plated.
   7. Operation: Automatic open/close. No smoke damper that requires manual reset or link replacement after actuation is acceptable. See contract documents for required control operation.

E. Motor Operator (Actuator): Provide pneumatic or electric as required by the automatic control system, externally mounted on stand-offs to allow complete insulation coverage.

2.6 FIRE DOORS

A. Galvanized steel, interlocking blade type, UL listing and label, 71 degrees C (160 degrees F) fusible link, 3-hour rating and approved for openings in Class A fire walls with rating up to 4 hours, 100 percent free opening with no part of the blade stack or damper frame in the air stream.

2.7 FLEXIBLE AIR DUCT

A. General: Factory-fabricated, complying with NFPA 90A for connectors not passing through floors of buildings. Flexible ducts shall not penetrate any fire or smoke barrier which is required to have a fire resistance rating of one hour or more. Flexible duct length shall not exceed 1.5 m (5 feet). Provide insulated acoustical air duct connectors in supply air duct systems and elsewhere as shown.

B. Flexible ducts shall be listed by Underwriters Laboratories, Inc., complying with UL 181. Ducts greater than 203 mm (8 inches) in diameter shall be Class 1. Ducts less than 203 mm (8 inches) in diameter shall be Class 1 or Class 2.

C. Insulated Flexible Air Duct: Factory-fabricated including mineral fiber insulation with maximum C factor of 0.25 at 24 degrees C (75 degrees F) mean temperature, encased with a low permeability moisture barrier outer jacket, having a puncture resistance of not less than 50 Beach Units. Acoustic insertion loss shall not be less than 3 dB per 300 mm (foot) of straight duct, at 500 Hz, based on 152 mm (6 inch) duct, of 762 m/min (2500 fpm).

D. Application Criteria:
   1. Temperature Range: -18 to 93 degrees C (0 to 200 degrees F) internal.
   2. Maximum Working Velocity: 1219 m/min (4000 fpm).
   3. Minimum Working Pressure, Inches of Water Gauge: 2500 Pa (10 inches WG) positive, 500 Pa (2 inches WG) negative.

E. Duct Clamps: 100 percent nylon strap, 80 kg (176 pounds) minimum loop tensile strength manufactured for this purpose or stainless-steel strap with cadmium plated worm gear tightening device. Apply clamps with sealant and as approved for UL 181, Class 1 installation.

F. Flexible air duct is prohibited in operating room suites, SPS processing spaces, Pharmacy compounding spaces, Protective Environment spaces, Isolation Rooms, Clean Rooms, Bio-containment Laboratories, Research Laboratories, and Clinical Laboratories.

2.8 FLEXIBLE DUCT CONNECTIONS

A. Where duct connections are made to fans, air terminal units, and air handling units, install a non-combustible flexible connection of 822 g (29 ounces) neoprene coated fiberglass fabric approximately 152 mm (6 inches) wide. For connections exposed to sun and weather provide hypalon coating in lieu of neoprene. Burning characteristics shall conform to NFPA 90A. Securely fasten flexible connections to round ducts with stainless-steel or zinc-coated iron draw bands with worm gear fastener. For rectangular connections, crimp fabric to sheet metal and fasten sheet metal to ducts by screws 50 mm (2 inches) on center. Fabric shall not be stressed other than by air pressure. Allow at least 25 mm (one inch) slack to ensure that no vibration is transmitted.

2.9 SOUND ATTENUATING UNITS

A. Casing, not less than 1.0 mm (20 gauge) galvanized sheet steel, or 1.3 mm (18 gauge) aluminum fitted with suitable flanges to make clean airtight connections to ductwork. Sound-absorbent material faced with glass fiber cloth and covered with not less than 0.6 mm (24 gauge) or heavier galvanized perforated sheet steel, or 0.85 mm (22 gauge) or heavier perforated aluminum. Perforations shall not exceed 4 mm (5/32 inch) diameter, approximately

25 percent free area. Sound absorbent material shall be long glass fiber acoustic blanket meeting requirements of NFPA 90A.

B. Entire unit shall be completely air tight and free of vibration and buckling at internal static pressures up to 2000 Pa (8 inches WG) at operating velocities.

C. Pressure drop through each unit: Not to exceed indicated value at design air quantities indicated.

D. Submit complete independent laboratory test data showing pressure drop and acoustical performance.

E. Cap open ends of attenuators at factory with plastic, heavy duty paper, cardboard, or other appropriate material to prevent entrance of dirt, water, or any other foreign matter to inside of attenuator. Caps shall not be removed until attenuator is installed in duct system.

2.10 FIRESTOPPING MATERIAL

A. Refer to Section 07 84 00, FIRESTOPPING.

2.11 SEISMIC RESTRAINT FOR DUCTWORK

A. Refer to Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

2.12 DUCT MOUNTED THERMOMETER (AIR)

A. Stem Type Thermometers: ASTM E1, 7 inch scale, red appearing mercury, lens front tube, cast aluminum case with enamel finish and clear glass or polycarbonate window, brass stem, 2 percent of scale accuracy to ASTM E77 scale calibrated in degrees Fahrenheit.

B. Thermometer Supports:
   1. Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.
   2. Flange: 75 mm (3 inch) outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

2.13 DUCT MOUNTED TEMPERATURE SENSOR (AIR)

A. Refer to Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

2.14 INSTRUMENT TEST FITTINGS

A. Manufactured type with a minimum 50 mm (2 inch) length for insulated duct, and a minimum 25 mm (1 inch) length for duct not insulated. Test hole shall have a flat gasket for rectangular ducts and a concave gasket for round ducts at the base, and a screw cap to prevent air leakage.

B. Provide instrument test holes at each duct or casing mounted temperature sensor or transmitter, and at entering and leaving side of each heating coil, cooling coil, and heat recovery unit.

2.15 AIR FLOW CONTROL VALVES (AFCV)

A. Refer to Section 23 36 00, AIR TERMINAL UNITS and Section 23 82 00, CONVECTION HEATING and COOLING UNITS.

PART 3 - EXECUTION

3.1 INSTALLATION

A. If an installation is unsatisfactory to the COR, the contractor shall correct the installation at no additional cost or time to the Government.

B. Comply with provisions of Section 23 05 11, COMMON WORK RESULTS FOR HVAC, particularly regarding coordination with other trades and work in existing buildings.

C. Fabricate and install ductwork and accessories in accordance with referenced SMACNA Standards:
   1. Contract documents show the general layout of ductwork and accessories but do not show all required fittings and offsets that may be necessary to connect ducts to equipment, boxes, diffusers, grilles, etc., and to coordinate with other trades. Fabricate ductwork based on field measurements. Provide all necessary fittings and offsets at no additional cost to the Government. Coordinate with other trades for space available and relative location of HVAC equipment and accessories on ceiling grid. Duct sizes in the contract documents are inside dimensions which shall be altered by Contractor to other dimensions with the same air handling characteristics where necessary to avoid interferences and clearance difficulties.
   2. Provide duct transitions, offsets and connections to dampers, coils, and other equipment in accordance with SMACNA Standards. Provide streamliner, when an obstruction cannot be avoided and must be taken in by a duct. Repair galvanized areas with galvanizing repair compound.
   3. Provide bolted construction and tie-rod reinforcement in accordance with SMACNA Standards.
   4. Construct casings, eliminators, and pipe penetrations in accordance with SMACNA Standards. Design casing access doors to swing against air pressure so that pressure helps to maintain a tight seal.

D. Install duct hangers and supports in accordance with SMACNA Standards.

E. Install fire dampers and smoke dampers in accordance with the manufacturer's instructions to conform to the installation used for the rating test. Install fire dampers and smoke dampers at locations indicated and where ducts penetrate fire rated and/or smoke rated walls, shafts and where required by the COR. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges per UL and NFPA. Demonstrate resetting of fire dampers and operation of smoke dampers to the COR.

F. Seal openings around duct penetrations of floors and fire rated partitions with fire stop material as required by NFPA 90A.

G. Flexible Duct Installation: Refer to SMACNA Standards. Ducts shall be continuous, single pieces not over 1.5 m (5 feet) long per NFPA 90A, as straight and short as feasible, adequately supported. Centerline radius of bends shall be not less than two duct diameters. Make connections with clamps as recommended by SMACNA. Clamp per SMACNA with one clamp on the core duct and one on the insulation jacket. Flexible ducts shall not penetrate floors, or any chase or partition designated as a fire or smoke barrier, including corridor partitions fire rated one hour or two hours. Support ducts SMACNA Standards.

H. Where diffusers, registers and grilles cannot be installed to avoid seeing inside the duct, paint the inside of the duct with flat black paint to reduce visibility.

I. Control Damper Installation:
   1. Provide necessary blank-off plates required to install dampers that are smaller than duct size. Provide necessary transitions required to install dampers larger than duct size.
   2. Assemble multiple sections dampers with required interconnecting linkage and extend required number of shafts through duct for external mounting of damper motors.
   3. Provide necessary sheet metal baffle plates to eliminate stratification and provide air volumes specified. Locate baffles by experimentation, and affix and seal permanently in place, only after stratification problem has been eliminated.
   4. Install all damper control/adjustment devices on stand-offs to allow complete coverage of insulation.

J. Air Flow Measuring Devices: Install units with minimum straight run distances, upstream and downstream as recommended by the manufacturer.

K. Low Pressure Duct Liner: Install in accordance with SMACNA Standards.

L. Protection and Cleaning: Adequately protect equipment and materials against physical damage. Place equipment in first class operating condition or return to source of supply for repair or replacement, as determined by COR. Protect equipment and ducts during construction against entry of foreign matter to the inside and clean both inside and outside before operation and painting. When new ducts are connected to existing ductwork, clean both new and existing ductwork by mopping and vacuum cleaning inside and outside before operation.

3.2 DUCT LEAKAGE TESTS AND REPAIR

A. Ductwork leakage testing shall be performed by the Testing and Balancing Contractor directly contracted by the General Contractor and independent of the Sheet Metal Contractor.

B. Ductwork leakage testing shall be performed for the entire air distribution system (including all supply, return, exhaust and relief ductwork), section by section, including fans, coils and filter sections..

C. Test procedure, apparatus and report shall conform to SMACNA HVAC Air Duck Leakage Test Manual. The maximum leakage rate allowed is 4 percent of the design air flow rate.

D. All ductwork shall be leak tested first before enclosed in a shaft or covered in other inaccessible areas.

E. All tests shall be performed in the presence of the COR and the Test and Balance agency. The Test and Balance agency shall measure and record duct leakage and report to the COR and identify leakage source with excessive leakage.

F. If any portion of the duct system tested fails to meet the permissible leakage level, the Contractor shall rectify sealing of ductwork to bring it into compliance and shall retest it until acceptable leakage is demonstrated to the COR.

G. All tests and necessary repairs shall be completed prior to insulation or concealment of ductwork.

H. Make sure all openings used for testing flow and temperatures by TAB Contractor are sealed properly.

3.3 TESTING, ADJUSTING, AND BALANCING (TAB)

A. Refer to Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC.

3.4 OPERATING AND PERFORMANCE TESTS

A. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

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SECTION 23 34 00
HVAC FANS

PART 1 - GENERAL

1.1 DESCRIPTION

A. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. Fans for heating, ventilating and air conditioning.

C. Product Definitions: AMCA 99.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

E. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

F. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

G. Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC and STEAM GENERATION EQUIPMENT.

H. Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.

I. Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC.

J. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

K. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

L. Section 23 73 00, INDOOR CENTRAL-STATION AIR-HANDLING UNITS.

M. Section 23 82 16, AIR COILS.

N. Section 26 29 11, MOTOR CONTROLLERS.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards will govern. The latest edition as of the specification issue date shall govern.

B. Air Movement and Control Association International, Inc. (AMCA):
99 ..... Standards Handbook
210 ..... Laboratory Methods of Testing Fans for Aerodynamic Performance Rating
300 ..... Reverberant Room Method for Sound Testing of Fans

C. American Society for Testing and Materials (ASTM):
B117 ..... Standard Practice for Operating Salt Spray (Fog) Apparatus
D1735 ..... Standard Practice for Testing Water Resistance of Coatings Using Water Fog Apparatus

D3359 ..... Standard Test Methods for Rating Adhesion by Tape Test

G152 ..... Standard Practice for Operating Open Flame Carbon Arc Light Apparatus for Exposure of NonMetallic Materials

G153 ..... Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of NonMetallic Materials

D. National Fire Protection Association (NFPA):
NFPA 96 ..... Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations

E. National Sanitation Foundation (NSF):
37 ..... Air Curtains for Entranceways in Food and Food Service Establishments

F. Underwriters Laboratories, Inc. (UL):
181 ..... Standard for Factory-Made Air Ducts and Air Connectors

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 23 XX XX, SECTION TITLE”, with applicable paragraph identification.

C. Manufacturers Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
1. Plenum fan, motors, and drives.
2. Centrifugal fans, motors, drives, accessories, and coatings.
   a. Inline centrifugal fans.
   b. Tubular Centrifugal Fans.
   c. Up-blast kitchen hood exhaust fans.
   d. Industrial fans.
   e. Utility fans and vent sets.
3. Tube-axial fans.
4. Belt guards.

D. Certified sound power levels for each fan.

E. Motor ratings, types, electrical characteristics, and accessories.

F. Certified fan performance curves for each fan showing cubic feet per minute (CFM) versus static pressure, efficiency, and horsepower for design point of operation.

G. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts, and troubleshooting guide:
1. Include complete list indicating all components of the systems.
2. Include complete diagrams of the internal wiring for each item of equipment.
3. Diagrams shall have their terminals identified to facilitate installation, operation, and maintenance.

H. Completed System Readiness Checklist provided by the CxA and completed by the contractor, signed by a qualified technician, and dated on the date of completion, in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

I. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

1.5 QUALITY ASSURANCE

A. Fans and power ventilators shall bear the AMCA performance seal.

B. Operating Limits for Centrifugal Fans: AMCA 99 (Class I, II, and III).

C. Fans and power ventilators shall comply with the following standards:
   1. Testing and Rating: AMCA 210.
   2. Sound Rating: AMCA 300.

D. Vibration Tolerance for Fans and Power Ventilators: Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.

E. Performance Criteria:
   1. The fan schedule shall show the design air volume and static pressure. Select the fan motor hp by increasing the fan bhp by 10 percent to account for the drive losses and field conditions.
   2. Select the fan operating point as follows:
      a. Forward Curve and Axial Flow Fans: Right hand side of peak pressure point.
      b. Air Foil, Backward Inclined, or Tubular: At or near the peak static efficiency.

F. Safety Criteria: Provide manufacturer's standard screen on fan inlet and discharge where exposed to operating and maintenance personnel.

G. Corrosion Protection:
   1. Except for fans in fume hood exhaust service, all steel shall be mill-galvanized, or phosphatized and coated with minimum two coats, corrosion resistant enamel paint. Manufacturer’s paint and paint system shall meet the minimum requirements of ASTM D1735 water fog, ASTM B117 salt spray, ASTM D3359 adhesion, and ASTM G152 and ASTM G153 for carbon arc light apparatus for exposure of non-metallic material.
   2. Fans for general purpose fume hoods, or chemical hoods, and radioisotope hoods shall be constructed of materials compatible with the chemicals being transported in the air through the fan.

H. Spark resistant construction: If flammable gas, vapor or combustible dust is present in concentrations above 20 percent of the Lower Explosive Limit (LEL), the fan construction shall be as recommended by AMCA's Classification for Spark Resistant Construction. Drive set shall be comprised of non-static belts for use in an explosive.

I. Bio-Based Materials: For products designated by the USDA’s Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

J. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

1.6 AS-BUILT DOCUMENTATION

A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

1.7 EXTRA MATERIALS

A. Provide one additional set of belts for all belt-driven fans.

PART 2 - PRODUCTS

2.1 PLENUM FAN

A. Plenum Fans – Single and/or Multiple Fans in an Array:
   1. General: Fans shall be Class II (minimum) construction with single inlet, aluminum wheel and stamped air-foil aluminum bladed. The fan wheel shall be mounted on the directly-driven motor shaft in AMCA Arrangement 4. Fans shall be dynamically balanced and internally isolated to minimize the vibrations. Provide a steel inlet cone for each wheel to

match with the fan inlet. Locate fan in the air stream to assure proper flow. The fan performance shall be rated in accordance with AMCA 210 or ASHRAE 51.

2. Allowable vibration tolerances for fan shall not exceed a self-excited vibration maximum velocity of 0.005 m/s (0.20 inch per second) RMS, filter in, when measured with a vibration meter on bearing caps of machine in vertical, horizontal and axial directions or measured at equipment mounting feet if bearings are concealed. After field installation, compliance to this requirement shall be demonstrated with field test in accordance with Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT and Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC. Following fan assembly, the complete fan assembly balance shall be tested using an electronic balance analyzer with a tunable filter and stroboscope. Vibration measurements shall be taken on each motor bearing housing in the vertical, horizontal, and axial planes (5 total measurements, 2 each motor bearing and 1 axial).
3. The plenum fans shall be driven by variable speed drives with at least one back-up drive as shown in the design documents. Use of a drive with bypass is not permitted.
4. Multiple fans shall be installed in a pre-engineered structural frame to facilitate fan stacking. All fans shall modulate in unison, above or below the synchronous speed within the limits specified by the manufacturer, by a common control sequence. Staging of the fans is not permitted. Redundancy requirement shall be met by all operating fans in an array and without the provision of an idle standby fan.
5. Fan Accessories
   a. Fan Isolation: Provide an actuator-controlled damper to isolate the fan not in operation due to failure.
   b. Fan Airflow Measurement: Provide an airflow measuring device integral to the fan to measure air volume within +/- 5 percent accuracy. The probing device shall not be placed in the airflow path to stay clear of turbulence and avoid loss of performance.

2.2 CENTRIFUGAL FANS

A. Record factory vibration test results on the fan or furnish to the Contractor.

B. Fan arrangement, unless noted or approved otherwise:
   1. DWDI fans: Arrangement 3.
   2. SWSI fans: Arrangement 1, 3, 9 or 10.

C. Construction: Wheel diameters and outlet areas shall be in accordance with AMCA standards.
   1. Housing: Low carbon steel, arc welded throughout, braced and supported by structural channel or angle iron to prevent vibration or pulsation, flanged outlet, inlet fully streamlined. Provide lifting clips, and casing drain. Provide manufacturer's standard access door. Provide 13 mm (1/2 inches) wire mesh screens for fan inlets without duct connections.
   2. Wheel: Steel plate with die formed blades welded or riveted in place, factory balanced statically and dynamically.
   3. Shaft: Designed to operate at no more than 70 percent of the first critical speed at the top of the speed range of the fans class.
   4. Bearings: Heavy duty ball or roller type sized to produce a B10 life of not less than 50,000 hours, and an average fatigue life of 200,000 hours. Extend filled lubrication tubes for interior bearings or ducted units to outside of housing.
   5. Belts: Oil resistant, non-sparking and non-static.
   6. Belt Drives: Factory installed with final alignment belt adjustment made after installation.
   7. Motors and Fan Wheel Pulleys: Adjustable pitch for use with motors through 15 hp, fixed pitch for use with motors greater than 15 hp. Select pulleys so that pitch adjustment is at the middle of the adjustment range at fan design conditions.
   8. Motor, adjustable motor base, drive and guard: Furnish from factory with fan. Provide protective sheet metal enclosure for fans located outdoors. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC for specifications.

9. Furnish variable speed fan motor controllers where shown in the contract documents. Refer to Section 26 29 11, MOTOR CONTROLLERS. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC for controller/motor combination requirements.

D. Inline Centrifugal Fans: Provide minimum 18 Gauge galvanized steel housing with inlet and outlet flanges, backward inclined aluminum centrifugal fan wheel, bolted access door and supports as required. Motors shall be factory pre-wired to an external junction box.

E. Tubular Centrifugal Fans: Provide hot rolled steel, one-piece design housing incorporating integral guide vanes, motor mounts, bolted access hatch and end flanges. Provide spun inlet bell and screen for unducted inlet and screen for unducted outlet. Provide welded steel, flanged inlet and outlet cones for ducted connection. Provide mounting legs or suspension brackets as required for support. Guide vanes shall straighten the discharge air pattern to provide linear flow.

F. Industrial Fans: Use where scheduled or in lieu of centrifugal fans for low volume high static service. Provide material handling flat blade type fan wheel.

G. Utility Fans, Vent Sets and Small Capacity Fans: Class I design, arc welded housing, spun intake cone. Requirement for AMCA seal is waived for wheel diameters less than 300 mm (I2 inches) and housings may be cast-iron.

H. Spark Resistant/Explosion Proof Fans: If flammable gas, vapor, or combustible dust is present in concentrations above 20 percent of the Lower Explosive Limit (LEL), provide AMCA construction option: A, B or C as indicated. Drive set shall be comprised of non-static belts for use in an explosive atmosphere. Motor shall be explosion proof type if located in air stream.

2.3 PROPELLER FANS

A. Belt-driven or direct-driven fans as indicated in the contract documents.

B. Square steel panel, deep drawn venturi, arc welded to support arms and fan/motor support brackets, baked enamel finish. Provide wall collar for thru-wall installations.

C. Motor, Motor Base and Drive: Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC. Motor shall be totally enclosed type.

D. Wall Shutter: Fan manufacturer's standard, steel frame, aluminum blades, heavy duty stall type electric damper motor, spring closed.

E. Wire Safety Guards: Provide on exposed inlet and outlet.

PART 3 - EXECUTION

3.1 INSTALLATION

A. If an installation is unsatisfactory to the COR, the contractor shall correct the installation at no additional cost or time to the Government.

B. Install fan, motor and drive in accordance with manufacturer's instructions.

C. Align fan and motor sheaves to allow belts to run true and straight.

D. Bolt equipment to curbs with galvanized lag bolts.

E. Install vibration control devices as shown in the contract documents and specified in Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.

3.2 PRE-OPERATION MAINTENANCE

A. Lubricate bearings, pulleys, belts and other moving parts with manufacturer recommended lubricants.

B. Rotate impeller by hand and check for shifting during shipment and check all bolts, collars, and other parts for tightness.

C. Clean fan interiors to remove foreign material and construction dirt and dust.

3.3 STARTUP AND TESTING

A. Verify operation of motor, drive system and fan wheel according to the contract documents.

B. Check vibration and correct as necessary for air balance work.

C. After air balancing is complete and permanent sheaves are in place perform necessary field mechanical balancing to meet vibration tolerance in Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.

D. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

E. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

F. The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the COR and CxA. Provide a minimum notice of 10 working days prior to startup and testing.

3.4 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

B. Components provided under this section of the specification will be tested as part of a larger system.

3.5 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative for 16 hours to instruct each VA personnel responsible in operation and maintenance of the system.

B. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

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SECTION 23 36 00
AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 DESCRIPTION

A. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. Air terminal units and air flow control valves.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

E. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

F. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

G. Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.

H. Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC.

I. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

J. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

K. Section 23 31 00, HVAC DUCTS and CASINGS.

L. Section 23 34 00, HVAC FANS

M. Section 23 82 16, AIR COILS.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards will govern. The latest edition as of the specification issue date shall govern.

B. Air Conditioning, Heating, and Refrigeration Institute (AHRI):
880-2017 ..... Performance Rating of Air Terminals

C. American Society for Testing and Materials (ASTM):
C665-2024..... Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing

D. National Fire Protection Association (NFPA):
90A2024 ..... Standard for the Installation of Air-Conditioning and Ventilating Systems

E. Underwriters Laboratories, Inc. (UL):
181-2013(R2017) ..... Standard for Factory-Made Air Ducts and Air Connectors

F. Department of Veterans Affairs (VA):
PG-18-10-2017(R2025) ..... HVAC Design Manual

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 23 XX XX, SECTION TITLE”, with applicable paragraph identification.

C. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
   1. Air flow control valves.

D. Samples: Provide one typical air terminal unit for approval by the COR. This unit will be returned to the Contractor after all similar units have been shipped and deemed acceptable at the job site.

E. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts, and troubleshooting guide:
   1. Include complete list indicating all components of the systems.
   2. Include complete diagrams of the internal wiring for each item of equipment.
   3. Diagrams shall have their terminals identified to facilitate installation, operation, and maintenance.

F. Completed System Readiness Checklist provided by the CxA and completed by the contractor, signed by a qualified technician, and dated on the date of completion, in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

G. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

1.5 QUALITY ASSURANCE

A. Bio-Based Materials: For products designated by the USDA’s Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

B. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

1.6 AS-BUILT DOCUMENTATION

A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

PART 2 - PRODUCTS

2.1 GENERAL

A. Coils:
   1. All Air Terminal Units: Provide aluminum fins and copper coils for all hot water reheat coils.
   2. Water Heating Coils:
      a. AHRI certified, continuous plate or spiral fin type, leak tested at 2070 kPa (300 psig).
      b. Capacity: As indicated, based on scheduled entering water temperature.
      c. Headers: Copper or Brass.
      d. Fins: Aluminum, maximum 315 fins per meter (8 fins per inch).
      e. Tubes: Copper, arrange for counter-flow of heating water.
      f. Water Flow Rate: Minimum 0.032 Liters/second (0.5 gpm).

g. Provide vent and drain connection at high and low point, respectively of each coil.
h. Coils shall be guaranteed to drain.

B. Labeling: Control box shall be clearly marked with an identification label that lists such information as nominal CFM, maximum and minimum factory-set airflow limits, coil type and coil connection orientation, where applicable.

C. Factory-calibrate air terminal units to air flow rate indicated. All settings including maximum and minimum air flow shall be field adjustable.

D. Dampers with internal air volume control, see Section 23 31 00, HVAC DUCTS and CASINGS.

E. Terminal sound attenuators, see Section 23 31 00, HVAC DUCTS and CASINGS.

F. Air terminal performance shall be in compliance with AHRI 880.

2.2 AIR TERMINAL UNITS (BOXES)

A. General: Factory-built, pressure independent units, factory set-field adjustable air flow rate, suitable for single duct applications. Use of dual-duct air terminal units is prohibited. Clearly show on each unit the unit number and factory set air volumes corresponding to the contract drawings. Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC work assumes factory set air volumes. Coordinate flow controller sequence and damper operation details with the contract drawings and Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC. All air terminal units shall be brand new products of the same manufacturer.

B. Capacity and Performance: The maximum capacity of a single terminal unit shall not exceed 566 Liters/second (1,200 cfm) with the exception of operating rooms and Cystoscopy rooms, which shall be served by a single air terminal unit at a maximum of 1,250 Liters/second (2,649 CFM).

C. Sound Power Levels: Acoustic performance of the air terminal units shall be based on the design noise levels for the spaces stipulated in Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT. Equipment schedule shall show the sound power levels in all octave bands. Terminal sound attenuators shall be provided, as required, to meet the intent of the design.

D. Casing: Unit casing shall be constructed of galvanized steel no lighter than 0.85 mm (22 Gauge). Air terminal units serving the operating rooms and Cystoscopy rooms shall be fabricated without lining. Provide hanger brackets for attachment of supports.

1. Lining Material: Suitable to provide required acoustic performance, thermal insulation and prevent sweating. Meet the requirements of NFPA 90A and comply with UL 181 for erosion as well as ASTM C665 antimicrobial requirements. Insulation shall consist of 13 mm (1/2 inch) thick non-porous foil faced rigid fiberglass insulation of 4-lb/cu.ft, secured by full length galvanized steel z-strips which enclose and seal all edges. Tape and adhesives shall not be used. Materials shall be non-friable and with surfaces, including all edges, fully encapsulated and faced with perforated metal or coated so that the air stream will not detach material. No lining material is permitted in the boxes serving operating rooms and Cystoscopy rooms.
2. Access Panels (or doors): Provide panels large enough for inspection, adjustment and maintenance without disconnecting ducts, and for cleaning heating coils attached to unit, even if there are no moving parts. Panels shall be insulated to same standards as the rest of the casing and shall be secured and gasketed airtight. It shall require no tool other than a screwdriver to remove.
3. Total leakage from casing, not to exceed 2 percent of the nominal capacity of the unit when subjected to a static pressure of 750 Pa (3 inches WG), with all outlets sealed shut and inlets fully open.
4. Octopus Connector: Factory installed, lined air distribution terminal. Provide where flexible duct connections are shown on the contract drawings connected directly to terminals. Provide butterfly-balancing damper, with locking means in connectors with

more than one outlet. Octopus connectors and flexible connectors are prohibited in the Surgical Suite.

E. Construct dampers and other internal devices of corrosion resisting materials which do not require lubrication or other periodic maintenance.
   1. Damper Leakage: Not greater than 2 percent of maximum rated capacity, when closed against inlet static pressure of 1 kPa (4 inches WG).

F. Provide multi-point velocity pressure sensors with external pressure taps. Provide direct reading air flow rate table pasted to box.

G. Provide static pressure tubes.

H. Externally powered DDC variable air volume controller and damper actuator to be furnished under Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC for factory mounting on air terminal units. The DDC controller shall be electrically actuated.

2.3 AIR FLOW CONTROL VALVE (AFCV)

A. Airflow control device shall be a venturi valve type air flow control valve.

B. Pressure independent over a 150 Pa - 750 Pa (0.6 inch WG – 3 inch WG) drop across valve.

C. Volume control accurate to plus or minus 5 percent of airflow over an airflow turndown range of 16 to 1. No minimum entrance or exit duct diameters shall be required to ensure accuracy or pressure independence.

D. Response time to change in command signal and duct static pressure within three seconds.

E. 16 gauge spun aluminum valve body and control device with continuous welded seam and 316 stainless-steel shaft and shaft support brackets. Pressure independent springs shall be stainless-steel. Shaft bearing surfaces shall be Teflon or polyester.

F. 316 stainless-steel continuous welded seam valve body, control device, shaft, shaft support bracket, pivot arm and internal mounting link. The control device shall have a baked on corrosion resistant phenolic coating. The shaft shall have a Teflon coating and all shaft bearing surfaces shall be made of Teflon. The pressure independent springs shall be made of stainless-steel.

G. The airflow device shall have no exposed aluminum or stainless-steel components. The shaft support brackets, pivot arm, internal mounting link, and pressure independent springs shall have a baked-on corrosion resistant phenolic coating. Internal nuts, bolts, and rivets shall be titanium or phenolic coated stainless-steel.

H. Constant Volume Units:
   1. Actuator to be factory mounted to the valve.
   2. Closed loop control of airflow by way of flow feedback signal with less than 1 second response time.
   3. Shaft positioned using direct potentiometer measurement to produce a linear factory calibrated feedback.
   4. The maximum and minimum airflows shall be as scheduled.

I. Variable Volume Units:
   1. Actuator to be factory mounted to the valve.
   2. Closed loop control of airflow by way of flow feedback signal with less than 1 second response time.
   3. Shaft positioned using direct potentiometer measurement to produce a linear factory calibrated feedback.

J. Certification:
   1. Control Device: Factory calibrated to airflows detailed on plans using NIST traceable air stations and instrumentation having a combined accuracy of plus or minus 1 percent of signal over the entire range of measurement.

2. Electronic Airflow Control Devices: Further calibrated and their accuracy verified to plus or minus 5 percent of signal at a minimum of eight different airflows across the full operating range of the device.
3. All Airflow Control Devices: Individually marked with device specific, factory calibration data to include tag number, serial number, model number, eight point characterization information (for electronic devices), and quality control inspection numbers.

K. Airflow measuring devices and airflow control devices that are not venturi valves (e.g., Pitot tube, flow cross, air bar, orifice ring, vortex shedder, etc.) are acceptable, provided the following conditions are met:
1. They meet the performance and construction characteristics stated throughout this section of the specification.
2. Suppliers of airflow control devices or airflow measuring devices requiring minimum duct diameters shall provide revised duct layouts showing the required straight duct runs upstream and downstream of these devices.
3. Supplier of the airflow control system shall submit coordination drawings reflecting these changes and include static pressure loss calculations as part of submittal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. If an installation is unsatisfactory to the COR, the contractor shall correct the installation at no additional cost or time to the Government.

B. Work shall be installed as shown and according to the manufacturer’s diagrams and recommendations.

C. Handle and install units in accordance with manufacturer's written instructions.

D. Support units rigidly so they always remain stationary. Cross-bracing or other means of stiffening shall be provided as necessary. Method of support shall be such that distortion and malfunction of units cannot occur.

E. Locate air terminal units to provide a straight section of inlet duct for proper functioning of volume controls.

3.2 STARTUP AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

C. The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the COR and CxA. Provide a minimum notice of 10 working days prior to startup and testing.

3.3 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

B. Components provided under this section of the specification will be tested as part of a larger system.

3.4 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative for 4 hours to instruct each VA personnel responsible in operation and maintenance of the system.

B. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

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SECTION 23 37 00
AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 DESCRIPTION

A. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. Air Outlets and Inlets: Diffusers, registers, and grilles.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D. Section 08 90 00, LOUVERS and VENTS.

E. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

F. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

G. Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.

H. Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards will govern. The latest edition as of the specification issue date shall govern.

B. Air Duct Council:
Flexible Duct Performance & Installation Standards (Manual), 5th Edition Green Book

C. American Society of Civil Engineers (ASCE):
7 ..... Minimum Design Loads and Associated Criteria for Buildings and Other Structures

D. American Society for Testing and Materials (ASTM):
B209/B209M..... Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

E. National Fire Protection Association (NFPA):
90A ..... Standard for the Installation of Air-Conditioning and Ventilating Systems

F. Underwriters Laboratories, Inc. (UL):
181 ..... Standard for Factory-Made Air Ducts and Air Connectors

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 23 XX XX, SECTION TITLE”, with applicable paragraph identification.

C. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
   1. Air intake/exhaust hoods.
   2. Diffusers, registers, grilles, and accessories.

D. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts, and troubleshooting guide:
   1. Include complete list indicating all components of the systems.
   2. Include complete diagrams of the internal wiring for each item of equipment.
   3. Diagrams shall have their terminals identified to facilitate installation, operation, and maintenance.

1.5 QUALITY ASSURANCE

A. Fire Safety Code: Comply with NFPA 90A.

B. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

C. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

1.6 AS-BUILT DOCUMENTATION

A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

PART 2 - PRODUCTS

2.1 EQUIPMENT SUPPORTS

A. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

2.2 AIR OUTLETS AND INLETS

A. Materials:
   1. Steel or aluminum =Exhaust air registers located in combination toilets and shower stalls shall be constructed from aluminum. Provide manufacturer's standard gasket.
   2. Exposed Fastenings: The same material as the respective inlet or outlet. Fasteners for aluminum may be stainless-steel.
   3. Contractor shall review all ceiling drawings and details and provide all ceiling mounted devices with appropriate dimensions and trim for the specific locations.

B. Performance Test Data: In accordance with Air Duct Council "Flexible Duct Performance & Installation Standards (Manual), Green Book". Refer to Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT for NC criteria.

C. Air Supply Outlets:
   1. Ceiling Diffusers: Suitable for surface mounting, exposed T-bar or special tile ceilings, off-white finish, square or round neck connection as shown on the contract drawings. Provide plaster frame for units in plaster ceilings.
      a. Square, Louver, Fully Adjustable Pattern: Round neck, surface mounting unless shown otherwise on the contract drawings. Provide equalizing or control grid and volume control damper.
      b. Louver Face Type: Square or rectangular, removable core for 1, 2, 3, or 4 way directional pattern. Provide equalizing or control grid and opposed blade damper.

c. Perforated Face Type: Manual adjustment for one-, two-, three-, or four-way horizontal air distribution pattern without change of air volume or pressure. Provide equalizing or control grid and opposed blade over overlapping blade damper. Perforated face diffusers for VAV systems shall have the pattern controller on the inner face, rather than in the neck and designed to discharge air horizontally at the ceiling maintaining a Coanda effect.

2. Supply Registers: Double deflection type with horizontal face bars and opposed blade damper with removable key operator.
   a. Margin: Flat, 32 mm (1-1/4 inches) wide.
   b. Bar Spacing: 19 mm (3/4 inch) maximum.
   c. Finish: Off white baked enamel for ceiling mounted units. Wall units shall have a prime coat for field painting or shall be extruded with manufacturer's standard finish.
3. Supply Grilles: Same as registers but without the opposed blade damper.

D. Return and Exhaust Registers and Grilles: Provide opposed blade damper without removable key operator for registers.
1. Finish: Off-white baked enamel for ceiling mounted units. Wall units shall have a prime coat for field painting or shall be extruded aluminum with manufacturer's standard aluminum finish.
2. Standard Type: Fixed horizontal face bars set at 30 to 45 degrees, approximately 32 mm (1-1/4 inch) margin.
3. Perforated Face Type: To match supply units.
4. Grid Core Type: 13 mm by 13 mm (1/2 inch by 1/2 inch) core with 32 mm (1-1/4 inch) margin.
5. Linear Type: To match supply units.
6. Door Grilles: Are furnished with the doors.
7. Egg Crate Grilles: Aluminum or Painted Steel 13 mm by 13 mm by 13 mm (1/2 inch by 1/2 inch by 1/2) inch grid providing 90 percent free area.
   a. Heavy extruded aluminum frame shall have countersunk screw mounting. Unless otherwise indicated, register blades and frame shall have factory applied white finish.
   b. Grille shall be suitable for duct or surface mounting as indicated on the contract drawings. All necessary appurtenances shall be provided to allow for mounting.

2.3 WIRE MESH GRILLE

A. Fabricate grille with 2 by 2 inch mesh 13 mm (1/2 inch) galvanized steel or aluminum hardware cloth in a spot welded galvanized steel frame with approximately 38 mm (1-1/2 inch) margin.

B. Use grilles where shown in unfinished areas such as mechanical rooms.

2.4 FILTER RETURN/EXHAUST GRILLE

A. Provide grille within stream 25 mm (1 inch) deep MERV 7 filter and removable face.
1. Finish: Off-white baked enamel for ceiling mounted units. Wall units shall have a prime coat for field painting or shall be extruded aluminum with manufacturer's standard aluminum finish. Stainless-steel shall be No. 4 finish.
2. Standard Type: Fixed horizontal face bars set at 30 to 45 degrees, approximately 32 mm (1-1/4 inch) margin.
3. Steel, aluminum, or stainless-steel as scheduled.
4. Standard face connected to a mounting frame with space for a throwaway filter. Hold face closed by a locking screw. Provide retaining clips to hold filter in place. Provide fiberglass throwaway filter.

PART 3 - EXECUTION

3.1 INSTALLATION

A. If an installation is unsatisfactory to the COR, the contractor shall correct the installation at no additional cost or time to the Government.

B. Comply with provisions of Section 23 05 11, COMMON WORK RESULTS FOR HVAC, particularly regarding coordination with other trades and work in existing buildings.

C. Protection and Cleaning: Protect equipment and materials against physical damage. Place equipment in first class operating condition or return to source of supply for repair or replacement, as determined by COR. Protect equipment during construction against entry of foreign matter to the inside and clean both inside and outside before operation and painting.

3.2 TESTING, ADJUSTING, AND BALANCING (TAB)

A. Refer to Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC.

3.3 STARTUP AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

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SECTION 23 38 13
COMMERCIAL-KITCHEN HOODS

PART 1 - GENERAL

1.1 DESCRIPTION

A. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. This section specifies kitchen exhaust hood and fan for service with residential style kitchen appliances.

C. Definitions:
   1. Ventilator, kitchen hood, hood and canopy; for purposes of this section, these terms all have the same definition.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

E. Section 05 50 00, METAL FABRICATIONS.

F. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

G. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

H. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

I. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

J. Section 23 34 00, HVAC FANS.

K. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards will govern. The latest edition as of the specification issue date shall govern.

B. American Welding Society (AWS):
   D9.1/D9.1M ..... Sheet Metal Welding Code

C. National Fire Protection Association (NFPA):
   17A ..... Standard for Wet Chemical Extinguishing Systems
   70 ..... National Electrical Code (NEC)
   96 ..... Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations

D. National Sanitation Foundation International/American National Standards Institute (NSF/ANSI):
   2 ..... Food Equipment

4 .....Commercial Cooking, Rethermalization, and Powered Hot Food Holding and Transportation Equipment

E. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
.....Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines

F. Underwriters Laboratories, Inc. (UL):
710 .....Exhaust Hoods for Commercial Cooking Equipment

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 23 XX XX, SECTION TITLE”, with applicable paragraph identification.

C. Manufacturer’s Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
1. Include manufacturer's address and telephone number.
2. Include catalog or model numbers, and illustrations and descriptions of ventilators and accessories.

D. Installation Drawings: Show dimensions; method of assembly; and details of installation, adjoining construction, coordination with service utilities, and other work required for a complete installation.

E. Field Test Reports: Indicate dates and times of tests and certify test results.

F. Operating Instructions: Include operating instructions covering operation of all components and maintenance procedures covering proper cleaning and necessary lubrication or adjustments to controls.

G. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts, and troubleshooting guide:
1. Include complete list indicating all components of the systems.
2. Include complete diagrams of the internal wiring for each item of equipment.
3. Diagrams shall have their terminals identified to facilitate installation, operation, and maintenance.

H. Completed System Readiness Checklist provided by the CxA and completed by the contractor, signed by a qualified technician, and dated on the date of completion, in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

I. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

1.5 QUALITY ASSURANCE

A. UL Listing: Equipment has been evaluated according to UL 300A, and is labeled for intended use.

B. Fire Protection Systems: Comply with NFPA 101 and NFPA 17A.

C. Welding: Perform welding according to AWS D9.1/D9.1M.

D. Seismic Restraint:
1. Comply with requirements in Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

E. In-Use Service: At least one factory-authorized service agency for equipment shall be located in the geographical area of the installation and shall have the ability to provide service within 24 hours after receiving a service call.

F. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

G. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

1.6 WARRANTY

A. Warrant food service equipment to be free from defects in materials and workmanship in accordance with requirements of "Warranty of Construction" article in FAR clause 52.246-21.

1.7 AS-BUILT DOCUMENTATION

A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

PART 2 - PRODUCTS

2.1 EXHAUST HOODS

A. The hood shall be constructed of a minimum of 18 gauge, 300 series stainless steel. Hood shell shall be manufactured and assembled with no visible outer welds or weld marks. All internal seams shall be sealed with NSF-approved caulk, standard.

B. Vapor proof, UL Listed, recessed LED light fixtures. Wiring shall conform to the requirements of NFPA 70.

C. Fire Protection Systems: Wet chemical integral to hood .
   1. Fire protection system to provide duct, plenum, and surface protection for ventilator and equipment located below ventilator.
   2. System interwired with shunt trip breaker of equipment located below ventilator for power shutoff during system actuation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. If an installation is unsatisfactory to the COR, the contractor shall correct the installation at no additional cost or time to the Government.

B. Install ventilators level and plumb with access clearances required for operation, maintenance, and cleaning and in accordance with the manufacturer's published documentation.

C. Coordinate installation of ventilators with overhead supports; Refer to Section 05 50 00, METAL FABRICATIONS.

D. Interconnect ventilators to service utilities.

E. Install seismic restraints for equipment.

3.2 FIELD TESTING

A. General: Following installation, test ventilators for compliance with specified requirements and those of authorities having jurisdiction. Perform testing after air-handling systems have been balanced and adjusted.

B. Wet Fire Extinguishing System: Test system to verify that equipment operation complies with NFPA 101 and NFPA 17A.

3.3 CLEAN-UP

A. At completion of the installation, clean and adjust equipment as required to produce ready-for-use condition.

B. Where stainless-steel surfaces are damaged during installation procedures, repair finishes to match adjoining undamaged surfaces.

3.4 STARTUP AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

C. The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the COR and CxA. Provide a minimum notice of 10 working days prior to startup and testing.

3.5 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

B. Components provided under this section of the specification will be tested as part of a larger system.

3.6 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative for 4 hours to instruct each VA personnel responsible in operation and maintenance of the system.

B. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

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SECTION 23 40 00
HVAC AIR CLEANING DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION

A. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. Air filters for heating, ventilating and air conditioning.

C. Definitions: Refer to ASHRAE 52.2 for definitions of face velocity, net effective filtering area, media velocity, initial resistance (pressure drop), MERV (Minimum Efficiency Reporting Value), PSE (Particle Size Efficiency), particle size ranges for each MERV number, dust holding capacity and explanation of electrostatic media based filtration products versus mechanical filtration products. Refer to ASHRAE 52.2 for definition of MERV-A.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

E. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

F. Section 23 37 00, AIR OUTLETS AND INLETS.

G. Section 23 73 00, INDOOR CENTRAL-STATION AIR-HANDLING UNITS

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only. Where conflicts occur these specifications and the VHA standards will govern. The latest edition as of the specification issue shall govern.

B. Air-Conditioning, Heating, and Refrigeration Institute (AHRI):
850 ..... Performance Rating of Commercial and Industrial Air Filter Equipment

C. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE):
52.2..... Method of Testing General Ventilation Air Cleaning Devices for Removal Efficiency by Particle Size

170 ..... Ventilation of Health Care Facilities

D. American Society of Mechanical Engineers (ASME):
ASME Boiler and Pressure Vessel Code -

BPVC Section IX ..... Welding, Brazing, and Fusing Qualifications

E. American Welding Society (AWS):
D9.1/D9.1M ..... Sheet Metal Welding Code

F. International Organization for Standardization (ISO):
9001 .....Quality Management Systems - Requirements

G. Underwriters Laboratories, Inc. (UL):
586 .....Standard for High-Efficiency, Particulate, Air Filter Units

900 .....Standard for Air Filter Units

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 23 XX XX, SECTION TITLE”, with applicable paragraph identification.

C. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
1. Extended surface filters.
2. Holding frames. Identify locations.
3. Side access housings. Identify locations, verify insulated doors.
4. HEPA filters.
5. Magnehelic gauges.

D. Air Filter performance reports.

E. Suppliers warranty.

F. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts, and troubleshooting guide:
1. Include complete list indicating all components of the systems.
2. Include complete diagrams of the internal wiring for each item of equipment.
3. Diagrams shall have their terminals identified to facilitate installation, operation, and maintenance.

1.5 QUALITY ASSURANCE

A. Air Filter Performance Report for Extended Surface Filters:
1. Submit a test report for each Grade of filter being offered. The report shall not be more than three (3) years old and prepared by using test equipment, method and duct section as specified by ASHRAE 52.2 for type filter under test and acceptable to COR, indicating that filters comply with the requirements of this specification. Filters utilizing partial or complete synthetic media will be tested in compliance with pre-conditioning steps as stated in ASHRAE 52.2. All testing is to be conducted on filters with a nominal 610 mm by 610 mm (24 inch by 24 inch) face dimension. Test for 150 m/min (500 fpm) will be accepted for lower velocity rated filters provided the test report of an independent testing laboratory complies with all the requirements of this specification.

B. Filter Warranty for Extended Surface Filters: Guarantee the filters against leakage, blow-outs, and other deficiencies during their normal useful life, up to the time that the filter reaches the final pressure drop. Defective filters shall be replaced at no additional cost or time to the Government.

C. Comply with UL 900 for flame test.

D. Nameplates: Each filter shall bear a label or name plate indicating manufacturer's name, filter size, rated efficiency, UL classification, and file number.

E. Bio-Based Materials: For products designated by the USDA’s Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as

products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

F. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

1.6 AS-BUILT DOCUMENTATION

A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

PART 2 - PRODUCTS

2.1 REPLACEMENT FILTER ELEMENTS TO BE FURNISHED

A. To allow temporary use of HVAC systems for testing and in accordance with Paragraph, TEMPORARY USE OF MECHANICAL AND ELECTRICAL SYSTEMS in Section 01 00 00, GENERAL REQUIREMENTS. Provide one complete set of additional filters to the COR.

B. The COR will direct whether these additional filters will either be installed as replacements for dirty units or turned over to VA for future use as replacements.

2.2 EXTENDED SURFACE AIR FILTERS

A. Use factory assembled air filters of the extended surface type with supported or non-supported cartridges for removal of particulate matter in air conditioning, heating and ventilating systems. Filter units shall be of the extended surface type fabricated for disposal when the contaminant load limit is reached as indicated by maximum (final) pressure drop.

B. Filter Classification: UL listed and approved conforming to UL 900.

C. HVAC Filter Types:

HVAC Filter Types				
MERV Value ASHRAE 52.2	MERV-A Value ASHRAE 62.2 Appendix J	Application	Particle Size	Thickness /Type
8	8-A	Pre-Filter	3 to 10 Microns	50 mm (2 inch) Throwaway
11	11-A	After-Filter	1 to 3 Microns	152 mm (6 inch) or 305 mm (12 inch) Rigid Cartridge
13	13-A	(Alternate) After-Filter	0.3 to 1 Microns	152 mm (6 inch) or 305 mm (12 inch) Rigid Cartridge
14	14-A	After-Filter	0.3 to 1 Microns	152 mm (6 inch) or 305 mm (12 inch) Rigid Cartridge

2.3 MEDIUM EFFICIENCY PLEATED PANEL PRE-FILTERS (50 MM (2 INCH); MERV 8; UL 900 CLASS 2)

A. Construction: Air filters shall be medium efficiency ASHRAE pleated panels consisting of cotton and synthetic or 100 percent virgin synthetic media, self-supporting media with required media stabilizers, and beverage board enclosing frame. Filter media shall be lofted to a uniform depth and formed into a uniform radial pleat. The media stabilizers shall be bonded to the downstream

side of the media to maintain radial pleats and prevent media oscillation. An enclosing frame of no less than 28-point high wet-strength beverage board shall provide a rigid and durable enclosure. The frame shall be bonded to the media on all sides to prevent air bypass. Integral diagonal support members on the air entering and air exiting side shall be bonded to the apex of each pleat to maintain uniform pleat spacing in varying airflows.

B. Performance: The filter shall have a Minimum Efficiency Reporting Value of MERV 8 when evaluated under the guidelines of ASHRAE 52.2. The media shall maintain or increase in efficiency over the life of the filter. All testing is to be conducted on filters with a nominal 610 mm by 610 mm (24 inch by 24 inch) face dimension.

Minimum Efficiency Reporting (MERV)	8
Dust Holding Capacity (Grams)	105
Nominal Size (Inches Width x Height x Depth)	24x24x2
Rated Air Flow Capacity (cfm)	2,000
Rated Air Flow Rate (fpm)	500
Final Resistance (Inches WG) Maximum Recommended Change-Out Resistance (Inches WG)	1.0 0.66
Rated Initial Resistance (Inches WG)	0.33

C. The filters shall be approved and listed by Underwriters Laboratories, Inc. as Class 2 when tested according to UL 900.

2.4 HIGH EFFICIENCY EXTENDED SURFACE (INTERMEDIATE/AFTER (FINAL)) CARTRIDGE FILTERS (305 MM (12 INCH); MERV 14/13/11; UL 900 CLASS 2)

A. Construction: Air filters shall consist of 8 pleated media packs assembled into 4 V-banks within a totally plastic frame. The filters shall be capable of operating at temperatures up to 80 degrees C (176 degrees F). The filters shall either fit without modification or be adaptable to the existing holding frames. The molded end panels are to be made of high impact polystyrene plastic. The center support members shall be made of ABS plastic. No metal components are to be used.

B. Media: The media shall be made of micro glass fibers with a water repellent binder. The media shall be a dual density construction, with coarser fibers on the air entering side and finer fibers on the air leaving side. The media shall be pleated using separators made of continuous beads of low profile thermoplastic material. The media packs shall be bonded to the structural support members at all points of contact, this improves the rigidity as well as eliminates potential air bypass in the filter.

C. Performance: Filters of the size, air flow capacity and nominal efficiency (MERV) shall meet the following rated performance specifications based on the ASHRAE 52.2 test method. All testing is to be conducted on filters with a nominal 610 mm by 610 mm (24 inch by 24 inch) header dimension.

Minimum Efficiency Reporting Value (MERV)	14	13	11
Gross Media Area (sf) Dust Holding Capacity (Grams)	197 486	197 430	197 465
Nominal Size (Inches Width x Height x Depth)	24x24x12	24x24x12	24x24x12
Rated Air Flow Capacity (cfm)	2,000	2,000	2,000
Rated Air Flow Rate (fpm)	500	500	500
Final Resistance (Inches WG) Maximum Recommended Change-Out Resistance (Inches WG)	2.0 0.74	2.0 0.68	2.0 0.54
Rated Initial Resistance (Inches WG)	0.37	0.34	0.27

2.5 FILTER HOUSINGS/SUPPORT FRAMES

A. Side Servicing Housings (HVAC Grade):
   1. Filter housing shall be two-stage filter system consisting of 1.6 mm (16 gauge) galvanized steel enclosure, aluminum filter mounting track, universal filter holding frame, insulated dual-access doors, static pressure tap, filter gaskets and seals. Inline housing depth shall not exceed 533 mm (21 inches). Sizes shall be as noted on enclosed drawings or other supporting materials.
   2. Construction: The housing shall be constructed of 1.6 mm (16 gauge) galvanized steel with pre-drilled standing flanges to facilitate attachment to other system components. Corner posts of Z-channel construction shall ensure dimensional adherence The housing shall incorporate the capability of two stages of filtration without modification to the housing. A filter track, of aluminum construction shall be an integral component of housing construction. The track shall accommodate a 50 mm (2 inch) deep prefilter, a 152 mm (6 inch) or 305 mm (12 inch) deep rigid final filter, or a pocket filter with header. Insulated dual access doors, swing-open type, shall include high-memory sponge neoprene gasket to facilitate a door-to-filter seal. Each door shall be equipped with adjustable and replaceable positive sealing UV-resistant star-style knobs and replaceable door hinges. A universal holding frame constructed of 1.3 mm (18 gauge) galvanized steel, equipped with centering dimples, multiple fastener lances, and polyurethane filter sealing gasket, shall be included to facilitate installation of high-efficiency filters. The housing shall include a pneumatic pressure fitting to allow the installation of a static pressure gauge to evaluate pressure drop across a single filter or any combination of installed filters.
   3. Performance: Leakage at rated airflow, upstream to downstream of filter, holding frame, and slide mechanism shall be less than 1 percent at 750 Pa (3 inches WG). Leakage in to or out of the housing shall be less than one half of 1 percent at 750 Pa (3 inches WG). Accuracy of pneumatic pressure fitting, when to evaluate a single-stage, or multiple filter stages, shall be accurate within ± 3 percent at 150 Pa (0.6 inch WG).
   4. Manufacturer shall provide evidence of facility certification to ISO 9001.

B. Equipment Identification: Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

2.6 INSTRUMENTATION

A. Magnehelic Differential Pressure Filter Gauges: Nominal 100 mm (4 inch) diameter, 0 to 500 Pa (0 to 2 inches WG), 3 inch for HEPA range. Gauges shall be flush-mounted in aluminum panel board, complete with static tips, copper or aluminum tubing, and accessory items to provide zero adjustment.

B. DDC Static (Differential) Air Pressure Measuring Station: Refer to Section 23 09 23, DIRECT DIGITAL CONTROL SYSTEM FOR HVAC.

C. Provide one DDC sensor across each extended surface filter. Provide Petcocks for each gauge or sensor.

D. Provide one common filter gauge for two-stage filter banks with isolation valves to allow differential pressure measurement.

2.7 HVAC EQUIPMENT FACTORY FILTERS

A. Manufacturer standard filters within fabricated packaged equipment should be specified with the equipment and should adhere to industry standard.

B. Cleanable filters are prohibited.

C. Automatic roll type filters are prohibited.

2.8 FILTER RETURN GRILLES

A. Refer to Section 23 37 00, AIR OUTLETS AND INLETS.

PART 3 - EXECUTION

3.1 INSTALLATION

A. If an installation is unsatisfactory to the COR, the contractor shall correct the installation at no additional cost or time to the Government.

B. Install supports, filters, and gauges in accordance with manufacturer's instructions.

3.2 STARTUP AND TESTING

A. Clean and vacuum air handling units and plenums prior to starting air handling systems.

B. Replace pre-filters and install clean filter units prior to final inspection as directed by the COR.

C. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

D. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

E. The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the COR and CxA. Provide a minimum notice of 10 working days prior to startup and testing.

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SECTION 23 64 00
PACKAGED WATER CHILLERS

PART 1 - GENERAL

1.1 DESCRIPTION

A. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. This section covers Scroll air-cooled chillers complete with accessories.

1.2 DEFINITIONS

A. Engineering Control Center (ECC): The centralized control point for the intelligent control network. The ECC comprises of personal computer and connected devices to form a single workstation.

B. BACNET: Building Automation Control Network Protocol, ASHRAE 135.

C. Ethernet: A trademark for a system for exchanging messages between computers on a local area network using coaxial, fiber optic, or twisted-pair cables.

D. FTT-10: Echelon Transmitter-Free Topology Transceiver.

1.3 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

E. Section 03 30 00, CAST-IN-PLACE CONCRETE.

F. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

G. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

H. Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC and STEAM GENERATION EQUIPMENT.

I. Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.

J. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

K. Section 23 21 13, HYDRONIC PIPING.

L. Section 23 21 23, HYDRONIC PUMPS.

M. Section 23 23 00, REFRIGERANT PIPING.

N. Section 23 31 00, HVAC DUCTS and CASINGS

O. Section 23 81 00, DECENTRALIZED UNITARY HVAC EQUIPMENT.

P. Section 26 29 11, MOTOR CONTROLLERS.

1.4 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur

these specifications and the VHA standards will govern. The latest edition as of the specification issue date shall govern.

B. Air Conditioning, Heating, and Refrigeration Institute (AHRI):
495 ..... Performance Rating of Refrigerant Liquid Receivers

550/590 ..... Performance Rating of Water-Chilling and Heat Pump Water-Heating Packages Using the Vapor Compression Cycle

560 ..... Absorption Water Chilling and Water Heating Packages

575 ..... Method of Measuring Machinery Sound Within an Equipment Space

C. American Bearing Manufacturers Association (ABMA):
9 ..... Load Ratings and Fatigue Life for Ball Bearings

11 ..... Load Ratings and Fatigue Life for Roller Bearings

D. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE):
15 ..... Safety Standard for Refrigeration Systems

34 ..... Designation and Classification of Refrigerants (ANSI)

135 ..... BACnet - A Data Communication Protocol for Building Automation and Control Networks

E. American Society of Mechanical Engineers (ASME):
ASME Boiler and Pressure Vessel Code -

BPVC Section VIII ..... Rules for Construction of Pressure Vessels, Division 1

F. American Society of Testing Materials (ASTM):
B117 ..... Standard Practice for Operating Salt Spray (Fog) Apparatus

C534/C534M ..... Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form

C612 ..... Standard Specification for Mineral Fiber Block and Board Thermal Insulation

D4587 ..... Standard Practice for Fluorescent UV-Condensation Exposures of Paint and Related Coatings

G. Occupational Safety and Health Administration (OSHA):
29 CFR 1910.95 ..... Occupational Noise Exposure

H. Department of Veterans Affairs (VA):
H-18-8 ..... Seismic Design Requirements

PG-18-10 ..... HVAC Design Manual

1.5 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 23 XX XX, SECTION TITLE”, with applicable paragraph identification.

C. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
   1. Scroll water chillers, including motor starters, control panels, and vibration isolators, and remote condenser data shall include the following:
      a. Rated capacity.
      b. Pressure drop.
      c. Efficiency at full load and part load WITHOUT applying any tolerance indicated in the AHRI 550/590.
      d. Refrigerant
      e. Fan performance (Air-Cooled Chillers only.)
      f. Accessories.
      g. Installation instructions.
      h. Startup procedures.
      i. Wiring diagrams, including factory-installed and field-installed wiring.
      j. Sound/Noise data report. Manufacturer shall provide sound ratings. Noise warning labels shall be posted on equipment.
      k. Refrigerant vapor detectors and monitors.

D. Run test report for all chillers.

E. Product Certificate: Signed by chiller manufacturer certifying that chillers furnished comply with AHRI requirements. The test report shall include calibrated curves, calibration records, and data sheets for the instrumentation used in factory tests.

F. Provide seismic restraints for refrigeration equipment to withstand seismic forces.

G. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts, and troubleshooting guide:
   1. Include complete list indicating all components of the systems.
   2. Include complete diagrams of the internal wiring for each item of equipment.
   3. Diagrams shall have their terminals identified to facilitate installation, operation, and maintenance.

H. Completed System Readiness Checklist provided by the CxA and completed by the contractor, signed by a qualified technician, and dated on the date of completion, in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

I. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

1.6 QUALITY ASSURANCE

A. Comply with AHRI requirements for testing and certification of the chillers.

B. Refer to paragraph, WARRANTY, Section 01 00 00, GENERAL REQUIREMENTS, except as noted below:
   1. Provide a 5-year motor and compressor warranty to include materials, parts and labor.

C. Refer to OSHA 29 CFR 1910.95(a) and (b) for Occupational Noise Exposure Standard.

D. Refer to ASHRAE 15 for refrigerant vapor detectors and monitor.

E. Bio-Based Materials: For products designated by the USDA’s Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

F. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

1.7 AS-BUILT DOCUMENTATION

A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

PART 2 - PRODUCTS

2.1 SCROLL AIR-COOLED WATER CHILLERS

A. General: Factory assembled and factory tested rotary-screw or scroll water chillers, complete with evaporator, compressors, motor, starters, integral condenser, and controls mounted on a welded steel base. The chiller unit shall consist of two compressors minimum, but not more than eight, mounted on a single welded steel base. Where compressors are paralleled, not more than two shall be so connected and not less than two independent refrigerant circuits shall be provided. Provide chiller with refrigerant type R454B. EPA approved refrigerants are listed at https://www.epa.gov/snap/. Submit proposed refrigerant for government approval.

B. Performance: Provide the capacity as shown on the contract drawings. Part load and full load efficiency ratings of the chiller shall not exceed those shown on the contract drawings.

C. Capacity of a single air-cooled chiller shall not exceed 250 Tons (Standard AHRI Conditions).

D. Applicable Standard: Chillers shall be rated and certified according to AHRI 550/590, and shall be stamped in compliance with AHRI certification.

E. Acoustics: Sound pressure levels shall not exceed the following specified levels. The manufacturer shall provide sound treatment if required to comply with the specified maximum levels. Testing shall be in accordance with AHRI requirements. See schedule on drawings.

F. Compressor (Scroll Type): Three dimensional, positive-displacement, hermetically sealed design, with suction and discharge valves, crankcase oil heater and suction strainer. Compressor shall be mounted on vibration isolators. Rotating parts shall be factory balanced. Lubrication system shall consist of reversible, positive displacement pump, strainer, oil level sight glass, and oil charging valve. Capacity control shall be by on-off compressor cycling of single and multiple compressors.

G. Refrigerants Circuit: Each circuit shall contain include an expansion valve, refrigerant charging connections, hot-gas muffler, compressor suction and discharge shutoff valves, replaceable-core filter drier, sight glass with moisture indicator, liquid-line solenoid valve and insulated suction line.

H. Refrigerant and Oil: Sufficient volume of dehydrated refrigerant and lubricating oil shall be provided to permit maximum unit capacity operation before and during tests. Replace refrigerant charge lost during the warranty period, due to equipment failure, without cost to the Government.

I. Condenser:
   1. Air-cooled integral condenser as shown on the contract drawings and specified hereinafter.
   2. Integral Condenser: Condenser coils shall be extended surface fin and tube type, seamless copper tubes with aluminum fins. Refer to paragraph CORROSION PROTECTION. Condenser coils shall be factory air tested at 3102 kPa (450 psig). Condenser fans shall be propeller type, directly connected to motor shaft. Fans shall be statically and dynamically balanced, with wire safety guards. Condenser fan motors with permanently lubricated ball bearings and three phase thermal overload protection. Unit shall start -18 degrees C (0 degrees F) with external damper assemblies. Units shall have grilles factory mounted to prevent damage to coil surfaces.

J. Evaporator:

1. Brazed plate and frame type heat exchanger design. Brazed plate evaporator shall be constructed of stainless-steel with copper brazing material. The evaporator shall be designed for a minimum of 1.5 times the working pressure produced by the water system, but not less than 1034 kPa (150 psig). Refrigerant side working pressure shall comply with ASHRAE 15.

K. Evaporator for packaged air-cooled chiller units designed for outdoor installation shall be protected against freeze-up in ambient temperature down to -30 degrees C (-22 degrees F) by a resistance heater cable under insulation with thermostat set to operate below 3 degrees C (37.4 degrees F) ambient. If electric resistance heater is required and the chiller is connected to emergency power, provide emergency power to the heater cable.

L. Insulation: Evaporator, suction piping, compressor, and all other parts subject to condensation shall be insulated with 19 mm (3/4 inch) minimum thickness of flexible-elastomeric thermal insulation, complying with ASTM C534/C534M.

M. Refrigerant Receiver: Provide a liquid receiver for chiller units when system refrigerant charge exceeds 80 percent of condenser refrigerant volume. Liquid receivers shall be horizontal type, designed, fitted, and rated in conformance with AHRI 495. Receiver shall be constructed and tested in conformance with ASME BPVC Section VIII. Each receiver shall have a storage capacity not less than 20 percent in excess of that required for fully charged system. Each receiver shall be equipped with inlet, outlet drop pipes, drain plug, purging valve, and relief devices as required by ASHRAE 15.

N. Controls: Chiller shall be furnished with unit mounted, stand-alone, microprocessor-based controls in NEMA 4 enclosure, hinged and lockable, factory wired with a single point power connection and separate control circuit. The control panel provide chiller operation, including monitoring of sensors and actuators, and shall be furnished with light emitting diodes or liquid-crystal display keypad.

1. The following shall display as a minimum on the panel:
   a. Date and time.
   b. Outdoor air temperature.
   c. Operating and alarm status.
   d. Entering and leaving water temperature-chilled water.
   e. Operating set points-temperature and pressure.
   f. Refrigerant temperature and pressure.
   g. Operating hours.
   h. Number of starts.
   i. Current limit set point.
   j. Maximum motor amperage (percent).
2. Control Functions:
   a. Manual or automatic startup and shutdown time schedule.
   b. Condenser water temperature.
   c. Entering and leaving chilled water temperature and control set points.
   d. Automatic lead-lag switch.
3. Safety Functions: The following conditions shall shut down the chiller and require manual reset to start.
   a. Loss of chilled water flow.
   b. Loss of condenser water flow (for water-cooled chillers only).
   c. Low chilled water temperature.
   d. Compressor motor current-overload protection.
   e. Freeze protection (for air-cooled chillers).
   f. . Starter fault.
   g. High or low oil pressure.
   h. Recycling pumpdown.

O. The chiller control panel shall provide leaving chilled water temperature reset based on return water temperature 4-20 ma or 0-10 VDC signal from Energy Control Center (ECC).

P. Provide contacts for remote start/stop, alarm for abnormal operation or shutdown, and for Engineering Control Center (ECC).

Q. Auxiliary hydronic system and the chiller(s) shall be interlocked to provide time delay and start sequencing as indicated on control drawings.

R. Motor: Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC. Compressor motor furnished with the chiller shall be in accordance with the chiller manufacturer and Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC and STEAM GENERATION EQUIPMENT. Starting torque of motors shall be suitable for driven machines.

S. Motor Starter: Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC. Provide a starter in NEMA 1 enclosure, designed for floor or unit mounted chiller using multiple compressors, with the lead compressor starting at its minimum capacity shall be provided with across-the-line starter. See Section 26 29 11, MOTOR CONTROLLERS for additional requirements.

2.2 CONDENSING UNITS FOR AIR CONDITIONING SERVICE

A. Refer to Section 23 81 00, DECENTRALIZED UNITARY HVAC EQUIPMENT.

PART 3 - EXECUTION

3.1 EXAMINATION

A. If an installation is unsatisfactory to the COR, the contractor shall correct the installation at no additional cost or time to the Government.

B. Examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations, piping and electrical to verify actual locations and sizes before chiller installation and other conditions that might affect chiller performance, maintenance, and operation. Equipment locations shown on the contract drawings are approximate. Determine exact locations before proceeding with installation.

3.2 EQUIPMENT INSTALLATION

A. Install chiller on concrete base with isolation pads or vibration isolators.
   1. Concrete base is specified in Section 03 30 00, CAST-IN-PLACE CONCRETE.
   2. Vibration isolator types and installation requirements are specified in Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.
   3. Anchor chiller to concrete base according to manufacturer’s written instructions and for seismic restraint on vibration isolators.
   4. Charge the chiller with refrigerant, if not factory charged.
   5. manufacturer, including remote starter, remote control panel, and remote flow switches, according to the manufacturer written instructions and electrical requirements.
   6. Chillers shall be installed in a manner as to provide easy access for tube pull and removal of compressor and motors etc.

B. Install refrigerant monitoring and safety equipment in accordance with ASHRAE 15.

C. Install refrigerant piping as specified in Section 23 23 00, REFRIGERANT PIPING and ASHRAE 15.

D. Install thermometers and gges as recommended by the manufacturer and/or as shown on the contract drawings.

E. Piping Connections:
   1. Make piping connections to the chiller for chilled water and automatic tube brush cleaning system and other connections as necessary for proper operation and maintenance of the equipment.

2. Make equipment connections with flanges and couplings for easy removal and replacement of equipment from the equipment room.

3.3 STARTUP AND TESTING

A. Engage manufacturer's factory-trained representative to perform startup and testing service.

B. Inspect, equipment installation, including field-assembled components, and piping and electrical connections.

C. After complete installation startup checks, according to the manufacturers written instructions, do the following to demonstrate to the COR that the equipment operate and perform as intended.
1. Check refrigerant charge is sufficient and chiller has been tested for refrigerant leak.
2. Check bearing lubrication and oil levels.
3. Verify proper motor rotation.
4. Verify pumps associated with chillers are installed and operational.
5. Verify thermometers and gauges are installed.
6. Verify purge system, if installed, is functional and relief piping is routed outdoor.
7. Operate chiller for run-in-period in accordance with the manufacturer’s instruction and observe its performance.
8. Check and record refrigerant pressure, water flow, water temperature, and power consumption of the chiller.
9. Test and adjust all controls and safeties. Replace or correct all malfunctioning controls, safeties and equipment as soon as possible to avoid any delay in the use of the equipment.
10. Prepare a written report outlining the results of tests and inspections, and submit it to the COR.

D. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

E. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

F. The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the COR and CxA. Provide a minimum notice of 10 working days prior to startup and testing.

3.4 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

B. Components provided under this section of the specification will be tested as part of a larger system.

3.5 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative for 32 hours to instruct each VA personnel responsible in operation and maintenance of the system. Coordinate this training with that of the cooling tower, if furnished together.

B. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

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SECTION 23 72 00
AIR-TO-AIR ENERGY RECOVERY EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. This section specifies air-to-air fixed plate enthalpy heat exchangers.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

E. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

F. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

G. Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC and STEAM GENERATION EQUIPMENT.

H. Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC.

I. Section 23 07 11, HVAC and BOILER PLANT INSULATION.

J. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

K. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

L. Section 23 31 00, HVAC DUCTS and CASINGS.

M. Section 23 40 00, HVAC AIR CLEANING DEVICES.

N. Section 23 82 16, AIR COILS.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards will govern. The latest edition as of the specification issue date shall govern.

B. Air Conditioning, Heating, and Refrigeration Institute (AHRI):
1060 ..... Performance Rating of Air-to-Air Heat Exchangers for Energy Recovery Ventilation Equipment

C. American Society of Civil Engineers (ASCE):
7 ..... Minimum Design Loads for Associated Criteria for Buildings and Other Structures

D. American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE):
15 ..... Safety Standard for Refrigeration Systems

34 ..... Designation and Classification of Refrigerants (ANSI)

52.2 ..... Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size

62.1 ..... Ventilation for Acceptable Indoor Air Quality

84 ..... Method of Testing Air-to-Air Heat/Energy Exchangers

E. American Society for Testing and materials (ASTM):
D635 ..... Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position

E84 ..... Standard Test Method for Surface Burning Characteristics of Building Materials

F. Underwriters Laboratories, Inc (UL):
1812 ..... Standard for Ducted Heat Recovery Ventilators

1815 ..... Standard for Nonducted Heat Recovery Ventilators)

G. Department of Veterans Affairs (VA):
PG-18-10 ..... HVAC Design Manual

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 23 XX XX, SECTION TITLE”, with applicable paragraph identification.

C. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
1. Air-to-air fixed plate enthalpy Heat Exchanger

D. Certificate: Submit, simultaneously with shop drawings, an evidence of satisfactory service of the equipment on three similar installations.

E. Submit type, size, arrangement, and performance details. Present application ratings in the form of tables, charts, or curves.

F. Submit scheduled performance data at both summer and winter conditions.

G. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts, and troubleshooting guide:
1. Include complete list indicating all components of the systems.
2. Include complete diagrams of the internal wiring for each item of equipment.
3. Diagrams shall have their terminals identified to facilitate installation, operation, and maintenance.

H. Completed System Readiness Checklist provided by the CxA and completed by the contractor, signed by a qualified technician, and dated on the date of completion, in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

I. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

1.5 WARRANTY

A. Manufacturer’s standard warranty or 1-year entire unit parts and labor, whichever is greater

B. 10-year warranty for ERV core.

1.6 QUALITY ASSURANCE

A. Refer to Section 01 00 00, GENERAL REQUIREMENTS for performance tests and instructions to VA personnel.

B. Performance Criteria: Heat recovery equipment shall be provided by a manufacturer who has been manufacturing such equipment and the equipment has a good track record for at least 3 years.

C. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

D. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

1.7 AS-BUILT DOCUMENTATION

A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

PART 2 - PRODUCTS

2.1 AIR-TO-AIR PLATE HEAT EXCHANGER

A. Comply with UL Standard~~s~~ 1812.

B. B. Access doors: Hinged with airtight closed cell gaskets.

C. C. Fans and motors: Premium Efficiency, TEFC, supplied with factory installed motor starters. Fan shall be statically and dynamically balanced.

D. D. Casing: Double wall 20-gauge G90 galvanized steel. Insulation shall be minimum 1" thick with minimum R-value of 4.3.

E. E. Casings and ERV core shall not allow cross contamination between airstreams.

F. F. Enthalpy core: Energy recovery core shall be of the total enthalpy type, capable of transferring both sensible and latent energy between airstreams. Latent energy transfer shall be accomplished by direct water vapor transfer from one airstream to the other, without exposing transfer media in succeeding cycles directly to the exhaust air and then to the fresh air. No condensate drains shall be allowed. The energy recovery core shall be designed and constructed to permit cleaning and removal for servicing. The energy recovery core shall have a ten year warranty. Performance criteria are to be as specified in AHRI Standard 1060.

G. G. Accessories: Furnish where indicated on the drawings.

1. Face and Bypass Dampers: Manufacturer's standard, complete with operators, with factory-installed controls to operate face-and-bypass dampers during summer and winter.

2.2 PASSIVE FROST CONTROL: THE ERV CORE SHALL PERFORM WITHOUT CONDENSING OR FROSTING UNDER NORMAL OPERATING CONDITIONS (DEFINED AS OUTSIDE

TEMPERATURES ABOVE -10ºF AND INSIDE RELATIVE HUMIDITY BELOW 40%).AIR FILTERS

A. Air Filters: Disposable air filters, with a MERV rating of 7, shall be provided standard on all air entering sides of air-to-air heat exchangers, and as indicated on the contract drawings. Comply with requirements in Section 23 40 00, HVAC AIR CLEANING DEVICES.

PART 3 - EXECUTION

3.1 INSTALLATION

A. If an installation is unsatisfactory to the COR, the contractor shall correct the installation at no additional cost or time to the Government.

B. Follow the equipment manufacturer's instructions for handling and installation and setting up of ductwork for makeup and exhaust air steamers for maximum efficiency.

C. Seal ductwork tightly to avoid air leakage.

D. Install units with adequate spacing and access for cleaning and maintenance of heat recovery coils as well as filters.

E. Brace heat recovery equipment installed in projects in the seismic area according to Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

3.2 FIELD QUALITY CONTROL

A. Operational Test: Perform tests as per manufacturer’s written instructions for proper and safe operation of the heat recovery system.
   1. After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   2. Adjust seals and purge.
   3. Test and adjust controls and safeties.

B. Replace damaged and malfunctioning controls and equipment.

C. Set initial temperature and humidity set points. Set field-adjustable switches and circuit breaker trip ranges as indicated.

D. Prepare test and inspection reports to the COR in accordance with Section 01 00 00, GENERAL REQUIREMENTS.

3.3 STARTUP AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

C. The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the COR and CxA. Provide a minimum notice of 10 working days prior to startup and testing.

3.4 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

B. Components provided under this section of the specification will be tested as part of a larger system.

3.5 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer's technical representative for 16 hours to instruct each VA personnel responsible in operation and maintenance of the system.

B. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

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SECTION 23 73 00
INDOOR CENTRAL-STATION AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 DESCRIPTION

A. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. Air handling units including integral components specified herein.

C. Definition of Air Handling Unit (AHU): A factory-fabricated and tested assembly of modular sections consisting of multiple plenum fans with direct-drive, coils, filters, and other necessary equipment to perform one or more of the following functions of circulating, cleaning, heating, cooling, humidifying, dehumidifying, and mixing of air. Design capacities of units shall be as scheduled in the contract documents.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

E. Section 09 91 00, PAINTING.

F. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

G. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

H. Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT.

I. Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.

J. Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

K. Section 23 07 11, HVAC AND BOILER PLANT INSULATION.

L. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

M. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

N. Section 23 21 13, HYDRONIC PIPING.

O. Section 23 22 13, STEAM AND CONDENSATE HEATING PIPING.

P. Section 23 31 00, HVAC DUCTS and CASINGS.

Q. Section 23 34 00, HVAC FANS.

R. Section 23 40 00, HVAC AIR CLEANING DEVICES.

S. Section 23 82 16, AIR COILS.

T. Section 26 29 11, MOTOR CONTROLLERS.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards will govern. The latest edition as of the specification issue date shall govern.

B. Air-Conditioning, Heating, and Refrigeration Institute (AHRI):
260 ..... Sound Rating of Ducted Air Moving and Conditioning Equipment

410 ..... Forced-Circulation Air-Cooling and Air-Heating Coils with Addenda 1, 2 and 3

430 ..... Performance Rating of Central Station Air-Handling Unit Supply Fans

C. Air Movement and Control Association International, Inc. (AMCA):
99 ..... Standards Handbook

210 ..... Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating

D. American Bearing Manufacturers Association (ABMA):
9 ..... Load Ratings and Fatigue Life for Ball Bearings

E. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE):
51 ..... Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating

170 ..... Ventilation of Health Care Facilities

F. American Society for Testing and Materials (ASTM):
A653/A653M..... Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

B117 ..... Standard Practice for Operating Salt Spray (Fog) Apparatus

D1654..... Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments

D1735..... Standard Practice for Testing Water Resistance of Coatings Using Water Fog Apparatus

D3359..... Standard Test Methods for Rating Adhesion by Tape Test

G152..... Standard Practice for Operating Open Flame Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials

G. Energy Policy Act of 2005 (P.L.109-58)

H. Military Specifications (Mil. Spec.):
P-21035B ..... Paint, High Zinc Dust Content, Galvanizing Repair (Metric)

I. National Fire Protection Association (NFPA):
70 ..... National Electrical Code

90A ..... Standard for Installation of Air-Conditioning and Ventilating Systems

J. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):

016 .....HVAC Air Duct Leakage Test Manual, 2nd Edition

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 23 XX XX, SECTION TITLE”, with applicable paragraph identification.

C. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
   1. Submittals for AHUs shall include fans, drives, motors, coils, humidifiers, filter housings, and all other related accessories. The contractor shall provide custom drawings showing total air handling unit assembly including dimensions, operating weight, access sections, flexible connections, door swings, controls penetrations, electrical disconnect, lights, duplex receptacles, switches, wiring, utility connection points, unit support system, vibration isolators, drain pan, pressure drops through each component (filter, coil etc).
   2. Submittal drawings of section or component only will not be acceptable. Contractor shall also submit performance data including performance test results, charts, curves, or certified computer selection data; data sheets; fabrication and insulation details. If the unit cannot be shipped in one piece, the contractor shall indicate the number of pieces that each unit will have to be broken into to meet shipping and job site rigging requirements.
   3. Submit sound power levels in each octave band for the inlet and discharge of the fan and at entrance and discharge of AHUs at scheduled conditions. In absence of sound power ratings refer to Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.
   4. Provide fan curves showing Liters/Second (cubic feet per minute), static pressure, efficiency, and horsepower for design point of operation and at maximum design Liters/Second (cubic feet per minute).
   5. Submit total fan static pressure, external static pressure, for AHU including total, inlet and discharge pressures, and itemized specified internal losses and unspecified internal losses. Refer to air handling unit schedule in the contract documents.

D. Submit written test procedures two weeks prior to factory testing. Submit written results of factory tests for approval prior to shipping.

E. Submit shipping information that clearly indicates how the units will be shipped in compliance with the descriptions below.
   1. Units shall be shipped in one (1) piece where possible and in shrink wrapping to protect the unit from dirt, moisture and/or road salt.
   2. If not shipped in one (1) piece, provide manufacturer approved shipping splits where required for installation or to meet shipping and/or job site rigging requirements in modular sections. Indicate clearly that the shipping splits shown in the submittals have been verified to accommodate the construction constraints for rigging as required to complete installation and removal of any section for replacement through available access without adversely affecting other sections.
   3. If shipping splits are provided, each component shall be individually shrink wrapped to protect the unit and all necessary hardware (e.g., bolts, gaskets etc.) will be included to assemble unit onsite.
   4. Lifting lugs will be provided to facilitate rigging on shipping splits and joining of segments. If the unit cannot be shipped in one piece, the contractor shall indicate the number of pieces that each unit will have to be broken into to meet shipping and job site rigging requirements.

F. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts, and troubleshooting guide:

1. Include complete list indicating all components of the systems.
2. Include instructions for lubrication, filter replacement, motor and drive replacement, and spare parts list.
3. Include complete diagrams of the internal wiring for each item of equipment.
4. Diagrams shall have their terminals identified to facilitate installation, operation, and maintenance.

G. Completed System Readiness Checklist provided by the CxA and completed by the contractor, signed by a qualified technician, and dated on the date of completion, in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

H. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

1.5 QUALITY ASSURANCE

A. Comply with requirements in paragraph QUALITY ASSURANCE of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. Air Handling Units Certification:
1. Air Handling Units with Housed Centrifugal Fans: The air handling units shall be certified in accordance with AHRI 430 and tested/rated in accordance with AHRI 260.
2. Air Handling Units with Plenum Fans:
   a. Air Handling Units with a single Plenum Fan shall be certified in accordance with AHRI 430 and tested/rated in accordance with AHRI 260.
   b. Air handling Units with Multiple Fans in an Array shall be tested and rated in accordance with AHRI 430 and AHRI 260.

C. Heating, Cooling, and Air Handling Capacity and Performance Standards: AHRI 430, AHRI 410, ASHRAE 51, and AMCA 210.

D. Performance Criteria:
1. The fan BHP shall include all system effects for all fans and v-belt drive losses for housed centrifugal fans.
2. The fan motor shall be selected within the rated nameplate capacity, without relying upon NEMA Standard Service Factor.
3. Select the fan operating point as follows:
   a. Forward Curve and Axial Flow Fans: Right hand side of peak pressure point.
   b. Air Foil, Backward Inclined, or Tubular Fans Including Plenum Fans: At or near the peak static efficiency but at an appropriate distance from the stall line.
4. Operating Limits: AMCA 99 and manufacturer's recommendations.

E. Units shall be factory-fabricated, assembled, and tested by a manufacturer, in business of manufacturing similar air-handling units for at least five (5) years.

F. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

G. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

1.6 AS-BUILT DOCUMENTATION

A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

PART 2 - PRODUCTS

2.1 AIR HANDLING UNITS

A. General:
1. AHUs shall be fabricated from insulated, solid double-wall galvanized steel without any perforations in draw-through configuration. Galvanizing shall be hot dipped conforming to ASTM A653/A653M and shall provide a minimum of 0.275 kg of zinc per square meter (0.97 oz. of zinc per square foot) (G90). Aluminum constructed units, subject to VA approval, may be used in place of galvanized steel. The unit manufacturer shall provide published documentation confirming that the structural rigidity of aluminum air-handling units is equal or greater than the specified galvanized steel.
2. The contractor and the AHU manufacturer shall be responsible for ensuring that the unit will not exceed the allocated space shown in the contract documents, including required clearances for service and future overhaul or removal of unit components. All structural, piping, wiring, and ductwork alterations of units, which are dimensionally different than those specified, shall be the responsibility of the contractor at no additional cost or time to the Government.
3. AHUs shall be fully assembled by the manufacturer in the factory in accordance with the arrangement shown in the contract documents. The unit shall be assembled into the largest sections possible subject to shipping and rigging restrictions. The correct fit of all components and casing sections shall be verified in the factory for all units prior to shipment. All units shall be fully assembled, tested, and then split to accommodate shipment and job site rigging. On units not shipped fully assembled, the manufacturer shall tag each section and include air flow direction to facilitate assembly at the job site. Lifting lugs or shipping skids shall be provided for each section to allow for field rigging and final placement of unit.
4. The AHU manufacturer shall provide the necessary gasketing, caulking, and all screws, nuts, and bolts required for assembly. The manufacturer shall provide a factory-trained and qualified local representative at the job site to supervise the assembly and to assure that the units are assembled to meet manufacturer's recommendations and requirements noted in the contract documents. Provide documentation to the Contracting Officer that the local representative has provided services of similar magnitude and complexity on jobs of comparable size. If a local representative cannot be provided, the manufacturer shall provide a factory representative.
5. Gaskets: All door and casing and panel gaskets and gaskets between air handling unit components, if joined in the field, shall be high quality which seal airtight and retain their structural integrity and sealing capability after repeated assembly and disassembly of bolted panels and opening and closing of hinged components. Bolted sections may use a more permanent gasketing method provided they are not disassembled.
6. Structural Rigidity: Provide structural reinforcement when required by span or loading so that the deflection of the assembled structure shall not exceed 1/200 of the span based on a differential static pressure of 2000 Pa (8 inch WG) or higher.

B. Base:
1. Provide a heavy duty steel base for supporting all major AHU components. Bases shall be constructed of wide-flange steel I-beams, channels, or minimum 127 mm (5 inch) high 3.5 mm (10 Gauge) steel base rails. Welded or bolted cross members shall be provided as required for lateral stability. Contractor shall provide supplemental steel supports as required to obtain proper operation heights for cooling coil condensate drain trap and humidifier condensate return trap as shown in the contract documents.
2. AHUs shall be completely self-supporting for installation on concrete housekeeping pad, steel support pedestals, or suspended as shown in the contract documents.
3. The AHU bases not constructed of galvanized steel shall be cleaned, primed with a rust inhibiting primer, and finished with rust inhibiting exterior enamel.

C. Casing (Including Wall, Floor, and Roof):

1. General: AHU casing shall be constructed as solid double wall, galvanized steel insulated panels without any perforations, integral of or attached to a structural frame. The thickness of insulation, mode of application and thermal breaks shall be such that there is no visible condensation on the exterior panels of the AHU located in the non-conditioned spaces.
2. Casing Construction:

Outer Panel	0.8 mm (22 Gauge) Minimum
Inner Panel	0.8 mm (22 Gauge) Minimum
Insulation Thickness Density	Foam 4 inch Minimum 48 kg/m^3 (3.0 lb/ft^3) Minimum
Total R Value	30.0 ft^2.^{O}F.hr/Btu Minimum

3. Blank-Off: Provide blank-offs as required to prevent air bypass between the AHU sections, around coils, and filters.
4. Casing panels shall be secured to the support structure with stainless-steel or zinc-chromate plated screws and gaskets installed around the panel perimeter. Panels shall be completely removable to allow removal of fan, coils, and other internal components for future maintenance, repair, or modifications. Welded exterior panels are prohibited.
5. Access Doors: Provide in each access section and where shown in the contract documents. Show single-sided and double-sided access doors with door swings on the floor plans. Doors shall be a minimum of 50 mm (2 inch) thick with same double wall construction as the unit casing. Doors shall be a minimum of 610 mm (24 inches) wide, unless shown of different size in the contract documents, and shall be the full casing height up to a maximum of 1829 mm (6 feet). Doors shall be gasketed, hinged, and latched to provide an airtight seal. The access doors for fan section, mixing box, humidifier coil section shall include a minimum 152 mm x 152 mm (6 inch x 6 inch) double thickness, with air space between the glass panes tightly sealed, reinforced glass or Plexiglas window in a gasketed frame.
   a. Hinges: Manufacturer's standard, designed for door size, weight and pressure classifications. Hinges shall hold door completely rigid with minimum 45 kg (100 lb) weight hung on latch side of door.
   b. Latches: Non-corrosive alloy construction, with operating levers for positive cam action, operable from either inside or outside. Doors that do not open against unit operating pressure shall allow the door to ajar and then require approximately 0.785 radian (45 degrees) further movement of the handle for complete opening. Latch shall be capable of restraining explosive opening of door with a force not less than 2000 Pa (8 inch WG).
   c. Gaskets: Neoprene, continuous around door, positioned for direct compression with no sliding action between the door and gasket. Secure with high quality mastic to eliminate possibility of gasket slipping or coming loose.
6. Provide sealed sleeves, metal or plastic escutcheons or grommets for penetrations through casing for power and temperature control wiring and pneumatic tubing. Coordinate with electrical and temperature control subcontractors for number and location of penetrations. Coordinate lights, switches, and duplex receptacles and disconnect switch location and mounting. All penetrations and equipment mounting may be provided in the factory or in the field. All field penetrations shall be performed neatly by drilling or saw cutting. No cutting by torches will be allowed. Neatly seal all openings airtight.

D. Floor:
1. Unit floor shall be level without offset space or gap and designed to support a minimum of 488 kg/square meter (91 lbs per square foot) distributed load without permanent deformation or crushing of internal insulation. Provide adequate structural base members

beneath floor in service access sections to support typical service foot traffic and to prevent damage to unit floor or internal insulation. Unit floors in casing sections, which may contain water or condensate, shall be watertight with drain pan.

2. Where indicated, furnish and install floor drains flush with the floor, with nonferrous grate cover and stub through floor for external connection.

E. Condensate Drain Pan: Drain pan shall be designed to extend entire length of cooling coils including headers and return bends. Depth of drain pan shall be at least 43 mm (1.7 inches) and shall handle all condensate without overflowing. Drain pan shall be double-wall, double sloping type, and fabricated from stainless-steel (304) with at least 50 mm (2 inch) thick insulation sandwiched between the inner and outer surfaces. Drain pan shall be continuous metal or welded watertight. No mastic sealing of joints exposed to water will be permitted. Drain pan shall be placed on top of casing floor or integrated into casing floor assembly. Drain pan shall be pitched in all directions to drain line.

1. An intermediate, stainless-steel (304) condensate drip pan with copper downspouts shall be provided on stacked cooling coils. Use of intermediate condensate drain channel on upper casing of lower coil is permissible provided it is readily cleanable. Design of intermediate condensate drain shall prevent upper coil condensate from flowing across face of lower coil.
2. Drain pan shall be piped to the exterior of the unit. Drain pan shall be readily cleanable.
3. Installation, including frame, shall be designed and sealed to prevent blow-by.

F. Housed Centrifugal Fan Sections:

1. Fans shall be minimum Class II construction, double width, double inlet centrifugal, air foil or backward inclined type as indicated in the contract documents, factory balanced and rated in accordance with AMCA 210 or ASHRAE 51. Provide self-aligning, pillow block, regreasable ball-type bearings selected for a B (10) life of not less than 50,000 hours and an L (50) average fatigue life of 200,000 hours per ABMA 9. Extend bearing grease lines to motor and drive side of fan section. Fan shall be located in airstream to assure proper air flow.
2. Provide internally vibration isolated fan, motor and drive, mounted on a common integral bolted or welded structural steel base with adjustable motor slide rail with locking device. Provide vibration isolators and flexible duct connections at fan discharge to completely isolate fan assembly. Refer to Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT, for additional requirements.
3. Allowable vibration tolerances for fan shall not exceed a self-excited vibration maximum velocity of 0.005 m/s (0.20 inch per second) RMS, filter in, when measured with a vibration meter on bearing caps of machine in vertical, horizontal, and axial directions or measured at equipment mounting feet if bearings are concealed. After field installation, compliance to this requirement shall be demonstrated with field test in accordance with Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT and Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC. Following fan assembly, the complete fan assembly balance shall be tested using an electronic balance analyzer with a tunable filter and stroboscope. Vibration measurements shall be taken on each motor bearing housing in the vertical, horizontal, and axial planes (5 total measurements, 2 each motor bearing and 1 axial).

G. Fan Motor, Drive, and Mounting Assembly (Housed Centrifugal Fans):

1. Fan Motor and Drive: Motors shall be premium energy efficient type, as mandated by the Energy Policy Act of 2005, with efficiencies as shown in Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION, in the contract documents and suitable for use in variable frequency drive applications on AHUs where this type of drive is indicated. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC, for additional motor and drive specifications. Refer to Section 26 29 11, MOTOR CONTROLLERS.
2. Fan drive and belts shall be factory mounted with final alignment and belt adjustment to be made by the Contractor after installation. Drive and belts shall be as specified in

Section 23 05 11, COMMON WORK RESULTS FOR HVAC. Provide additional drive(s) if required during balancing, to achieve desired airflow.

H. Plenum Fans – Single and/or Multiple Fans in an Array:
1. General: Fans shall be Class II (minimum) construction with single inlet, aluminum wheel and stamped air-foil aluminum bladed. The fan wheel shall be mounted on the directly-driven motor shaft in AMCA Arrangement 4. Fans shall be dynamically balanced and internally isolated to minimize the vibrations. Provide a steel inlet cone for each wheel to match with the fan inlet. Locate fan in the air stream to assure proper flow. The fan performance shall be rated in accordance with AMCA 210 or ASHRAE 51.
2. Allowable vibration tolerances for fan shall not exceed a self-excited vibration maximum velocity of 0.005 m/s (0.20 inch per second) RMS, filter in, when measured with a vibration meter on bearing caps of machine in vertical, horizontal, and axial directions or measured at equipment mounting feet if bearings are concealed. After field installation, compliance to this requirement shall be demonstrated with field test in accordance with Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT and Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC. Following fan assembly, the complete fan assembly balance shall be tested using an electronic balance analyzer with a tunable filter and stroboscope. Vibration measurements shall be taken on each motor bearing housing in the vertical, horizontal, and axial planes (5 total measurements, 2 each motor bearing and 1 axial).
3. The plenum fans shall be driven by variable speed drives with at least one back-up drive as shown in the design documents. Use of a drive with bypass is prohibited.
4. Multiple fans shall be installed in a pre-engineered structural frame to facilitate fan stacking. All fans shall modulate in unison, above or below the synchronous speed within the limits specified by the manufacturer, by a common control sequence. Staging of the fans is prohibited. Redundancy requirement shall be met by all operating fans in an array and without the provision of an idle standby fan.
5. Fan Accessories:
   a. Fan Isolation: Provide an automatic back draft damper to isolate the fan not in operation due to failure.
   b. Fan Airflow Measurement: Provide an airflow measuring device integral to the fan to measure air volume within +/- 5 percent accuracy. The probing device shall not be placed in the airflow path to stay clear of turbulence and avoid loss of performance.

I. Fan Motor and Drive (Plenum Fans): Motors shall be premium energy efficient type, as mandated by the Energy Policy Act of 2005, with efficiencies as shown in Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT, in the contract documents and suitable for use in variable frequency drive applications. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC, for additional motor and drive specifications. Refer to Section 26 29 11, MOTOR CONTROLLERS.

J. Filter Section: Refer to Section 23 40 00, HVAC AIR CLEANING DEVICES, for filter requirements.
1. Filters including one complete set for temporary use at site shall be provided independent of the AHU. The AHU manufacturer shall install filter housings and racks in filter section compatible with filters furnished. The AHU manufacturer shall be responsible for furnishing temporary filters (pre-filters and after-filters, as shown in the contract documents) required for AHU testing.
2. Factory-fabricated filter section shall be of the same construction and finish as the AHU casing including filter racks and hinged double wall access doors. Filter housings shall be constructed in accordance with side service or holding frame housing requirements in Section 23 40 00, HVAC AIR CLEANING DEVICES.

K. Coils: Coils shall be mounted on hot dipped galvanized steel supports to assure proper anchoring of coil and future maintenance. Coils shall be face or side removable for future replacement thru the access doors or removable panels. Each coil shall be removable without

disturbing adjacent coil. Cooling coils shall be designed and installed to ensure no condensate carry over. Provide factory-installed extended supply, return, drain, and vent piping connections. Refer to the contract documents and Section 23 82 16, AIR COILS for additional coil requirements.

L. Humidifier: Coordinate the humidification requirements with Section 23 22 13 STEAM AND CONDENSATE HEATING PIPING. Provide air-handling unit-mounted humidification section with stainless-steel drain pan of adequate length to allow complete absorption of water vapor. Provide stainless-steel dispersion panel or distributors as indicated, with stainless-steel supports and hardware.

M. Discharge Section: Provide aerodynamically designed framed discharge openings or spun bellmouth fittings to minimize pressure loss.

N. Electrical and Lighting: Wiring and equipment specifications shall conform to Division 26, ELECTRICAL.
   1. Vapor-proof lights using cast aluminum base style with glass globe and cast aluminum guard shall be installed in access sections for fan, mixing box, humidifier, and any section over 305 mm (12 inch) wide. A switch shall control the lights in each compartment with pilot light mounted outside the respective compartment access door. Wiring between switches and lights shall be factory-installed. All wiring shall run in neatly installed electrical conduits and terminate in a junction box for field connection to the building system. Provide single point 115 volt - one phase connection at junction box.
   2. Install compatible LED bulb in each light fixture.
   3. Provide a convenience duplex receptacle next to the light switch.
   4. Disconnect switch and power wiring: Provide factory or field mounted disconnect switch. Coordinate with Division 26, ELECTRICAL.
   5. Provide single point power connection. Coordinate with Division 26, ELECTRICAL.

PART 3 - EXECUTION

3.1 INSTALLATION

A. If an installation is unsatisfactory to the COR, the contractor shall correct the installation at no additional cost or time to the Government.

B. Install air handling unit in conformance with AHRI 430.

C. Assemble air handling unit components following manufacturer's instructions for handling, testing and operation. Repair damaged galvanized areas with paint in accordance with Mil. Spec. P-21035B. Repair painted units by touch up of all scratches with finish paint material. Vacuum the interior of air handling units clean prior to operation.

D. Install seismic restraints for roof top units. Refer to Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

E. Leakage and test requirements for air handling units shall be the same as specified for ductwork in Section 23 31 00, HVAC DUCTS AND CASINGS except leakage shall not exceed Leakage Class (C_L) 12 listed in SMACNA HVAC Air Duct Leakage Test Manual when tested at 1.5 times the design static pressure. Repair casing air leaks that can be heard or felt during normal operation and to meet test requirements.

F. Perform field mechanical (vibration) balancing in accordance with Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT.

G. Seal and/or fill all openings between the casing and AHU components and utility connections to prevent air leakage or bypass.

3.2 STARTUP AND TESTING

A. The air handling unit shall not be operated for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings are lubricated, and the fan has been test run under observation.

B. After the air handling unit is installed and tested, provide startup and operating instructions to VA personnel.

C. An authorized factory representative should startup, test, and certify the final installation and application specific calibration of control components. Items to be verified include fan performance over entire operating range, noise and vibration testing, verification of proper alignment, overall inspection of the installation, Owner/Operator training, etc.

D. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

E. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

F. The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the COR and CxA. Provide a minimum notice of 10 working days prior to startup and testing.

3.3 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

B. Components provided under this section of the specification will be tested as part of a larger system.

3.4 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative for 32 hours to instruct each VA personnel responsible in operation and maintenance of the system.

B. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

- - - E N D - - -

SECTION 23 81 00
DECENTRALIZED UNITARY HVAC EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies split-systems.

B. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

C. Definitions:

1. Energy Efficiency Ratio (EER): The ratio of net cooling capacity is Btu/h to total rate of electricity input in watts under designated operating conditions (Btu hour/Watt).
2. Seasonal Energy Efficiency Ratio (EER): The ratio of the total cooling output of an air conditioner during its normal annual usage period for cooling in Btu/h divided by total electric energy input in watts during the same period (Btu hour/Watt).
3. Unitary: A Unitary Air Conditioner consists of one or more factory-made assemblies which normally include an evaporator or cooling coil, a compressor and condenser combination, and may include a heating function as well.
4. Where such equipment is provided in greater than one assembly the separated assemblies are to be designed to be used together and the requirements of rating are based upon use of matched assemblies.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D. Section 03 30 00, CAST-IN-PLACE CONCRETE.

E. Section 07 72 00, ROOF ACCESSORIES.

F. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

G. Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC and STEAM GENERATION EQUIPMENT.

H. Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.

I. Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC.

J. Section 23 07 11, HVAC and BOILER PLANT INSULATION.

K. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

L. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

M. Section 23 23 00, REFRIGERANT PIPING.

N. Section 23 31 00, HVAC DUCTS and CASINGS.

O. Section 23 72 00, AIR-TO-AIR ENERGY RECOVERY EQUIPMENT.

P. Section 23 73 00, INDOOR CENTRAL-STATION AIR-HANDLING UNITS.

Q. Section 23 82 16, AIR COILS.

R. Section 28 31 00, FIRE DETECTION and ALARM.

1.3 SUBMITTALS

A. Submit in accordance with specification Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 23 81 00, DECENTRALIZED UNITARY HVAC EQUIPMENT”, with applicable paragraph identification.

C. Manufacturer’s literature and data Including:

1. Sufficient information, including capacities, pressure drops, and piping connections clearly presented, shall be included to determine compliance with contract documents for units noted below:
   a. Unitary air conditioners:
      1) Split systems
2. Unit Dimensions required clearances, operating weights accessories and start-up instructions.
3. Electrical requirements, wiring diagrams, interlocking and control wiring showing factory installed and portions to be field installed.
4. Mounting and flashing of the roof curb to the roofing structure with coordinating requirements for the roof membrane system.

D. Certification: Submit proof of specified ARI Certification.

E. Performance Rating: Submit catalog selection data showing equipment ratings and compliance with required sensible-to-heat-ratio, integrated energy efficiency ratio (IEER), and coefficient of performance (COP).

F. Operating and Maintenance Manual: Submit three copies of Operating and Maintenance manual to COR three weeks prior to final inspection.

G. Completed System Readiness Checklists provided by the CxA and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 23 08 00 COMMISSIONING OF HVAC SYSTEMS.

1.4 QUALITY ASSURANCE

A. Refer to specification Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. Safety Standards: ASHRAE Standard 15, Safety Code for Mechanical Refrigeration.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards will govern. The latest edition as of the specification issue date shall govern.

B. Air-Conditioning, Heating, and Refrigeration Institute (AHRI):

210/240 ..... Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment

270 ..... Sound Rating of Outdoor Unitary Equipment

310/380 ..... Standard for Packaged Terminal Air-Conditioners and Heat Pumps (CSA-C744-04)

340/360 ..... Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment

520 ..... Performance Rating of Positive Displacement Condensing Units

C. Air Movement and Control Association (AMCA):

210 ..... Laboratory Methods of Testing Fans for Aerodynamic Performance Rating (ANSI)

410 ..... Recommended Safety Practices for Users and Installers of Industrial and Commercial Fans

D. American National Standards Institute (ANSI):

S12.51 ..... Acoustics - Determination of Sound Power Levels of Noise Sources Using Sound Pressure - Precision Method for Reverberation Rooms (same as ISO 3741:1999)

E. American Society of Civil Engineers (ASCE)

ASCE 7..... Minimum Design Loads for Buildings and Other Structures

F. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE):

Handbook..... HVAC Systems and Equipment

15 ..... Safety Standard for Refrigeration Systems (ANSI)

34 ..... Designation and Classification of Refrigerants (ANSI)

62.1 ..... Ventilation for Acceptable Indoor Air Quality (ANSI)

G. American Society of Testing and Materials (ASTM):

B117..... Standard Practice for Operating Salt Spray (Fog) Apparatus

H. Military Specifications (Mil. Specs.):

MIL-PRF-26915D ..... Primer Coating, for Steel Surfaces

I. National Electrical Manufacturer's Association (NEMA):

ICS 1 ..... Industrial Controls and Systems: General Requirements

MG 1..... Motors and Generators (ANSI)

J. National Fire Protection Association (NFPA) Publications:

90A..... Standard for the Installation of Air-Conditioning and Ventilating Systems

K. Department of Veterans Affairs (VA):

PG-18-10..... HVAC Design Manual

1.6 **AS-BUILT DOCUMENTATION**

A. Comply with requirements in Paragraph “AS-BUILT DOCUMENTATION” in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

PART 2 - PRODUCTS

2.1 **UNITARY AIR CONDITIONERS - GENERAL**

A. Applicable ARI Standards:

1. Cooling Capacity Less Than 39.6 kW (135,000 Btu/hour): AHRI 210/240. Units shall be listed in the ARI Directory of Certified Unitary Air-Conditioners.

B. Performance Rating: Cooling capacity of units shall meet the sensible heat and total heat requirements shown in the contract documents. In selecting unit size, make true allowance for "sensible to total heat ratio" to satisfy required sensible cooling capacity.

C. Machinery Guards: Provide guards as shown in AMCA 410 for belts, chains, couplings, pulleys, sheaves, shafts, gears and other moving parts regardless of height above the floor. Drive guards may be excluded where motors and drives are inside factory fabricated casings.

D. Corrosion Prevention: Unless specified otherwise, equipment fabricated from ferrous metals that do not have a zinc coating or a duplex coating of zinc and paint shall be treated for prevention of rust with a factory coating or paint system that will withstand 125 hours in a salt-spray fog test, except that equipment located outdoors shall be tested for 500 hours. The salt-spray fog test shall be in accordance with ASTM B117 using a 20 percent sodium chloride solution. Immediately after completion of the test, the coating shall show no signs of blistering, wrinkling or cracking, no loss of adhesion, and the specimen shall show no signs of rust beyond 3 mm (1/8-inch) on both sides from the scratch mark.

2.2 **SPLIT-SYSTEM AIR CONDITIONERS**

A. Description: Factory assembled and tested, wall-mounted unit, with an air-cooled remote condensing unit, and field-installed refrigeration piping.

B. Concealed Evaporator Components:

1. Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.
2. Insulation: Factory-applied duct liner.
3. Drain Pans: Galvanized steel, with connection for drain; insulated and complying with ASHRAE 62.1.
4. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
5. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with AHRI 210/240, and with thermal-expansion valve.
6. Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.

7. Fan Motors: Comply with requirements in Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC and STEAM GENERATION EQUIPMENT for multi-tapped, multi-speed motors with internal thermal protection and permanent lubrication.

8. Disposable Filters: 25 mm (1 inch) thick, in fiberboard frames with MERV rating of 7 or higher according to ASHRAE 52.2.

9. Wiring Terminations: Connect motor to chassis wiring with plug connection.

C. Wall-Mounting, Evaporator-Fan Components:

1. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.

2. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

3. Drain Pan and Drain Connection: Comply with ASHRAE 62.1-2007.

4. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with AHRI 210/240, and with thermal-expansion valve.

5. Fan: Direct drive, centrifugal fan.

6. Fan Motors: Comply with requirements in Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC and STEAM GENERATION EQUIPMENT for multi-tapped, multi-speed motors with internal thermal protection and permanent lubrication.

7. Filters: Disposable, with MERV rating of 7 or higher according to ASHRAE 52.2.

8. Drain pans: Furnish galvanized steel with solderless drain connections and molded polystyrene foam insulating liner:

a. Auxiliary drain pan: Located under control valve and piping within the unit enclosure to prevent dripping.

b. Secondary Drain Pan: Where the unit is located such that drain pan overflow will damage the building, provide a secondary drain pan located underneath the unit, constructed to extend a minimum of 50 mm (2 inches) beyond the edges of the unit and be a minimum of 38 mm (1-1/2 inches deep) provided with a separate drain line discharging to conspicuous point or water detection device to deactivate the cooling in the unit.

D. Air-Cooled, Compressor-Condenser Components:

1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Service valves, fittings, and gauge ports shall be brass and located outside of the casing.

2. Compressor: Hermetically sealed scroll with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

3. Compressor motor with manual-reset, high-pressure switch and automatic-reset, low-pressure switch.
4. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with AHRI 210/240, and with liquid subcooler.
5. Fan: Aluminum, propeller type, directly connected to motor.
6. Motor: Permanently lubricated, with integral thermal-overload protection.
7. Low Ambient Kit: Permit operation down to minus 18 degrees C (0 degrees F).
8. Mounting Base: Polyethylene.

9. Minimum Energy Efficiency: Comply with ASHRAE/IESNA 90.1 "Energy Standard for Buildings except Low-Rise Residential Buildings."

PART 3 - EXECUTION

3.1 INSTALLATION

A. .

B. Install wind and seismic restraints according to manufacturer's written instructions. Wind and seismically restrained vibration isolation roof-curb rails are specified in Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.

C. Install units level and plumb maintaining manufacturer’s recommended clearances and tolerances.

D. Install vibration spring isolators under base of self-contained unit, with minimum static deflection of 25 mm (1 inch) unless otherwise indicated. Refer to Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT

E. Install ground-mounting, compressor-condenser components on 100 mm (4-inch) thick, reinforced concrete base; 100 mm (4 inches) greater on each side than unit. Concrete, reinforcement, and formwork are specified in Section 03 30 00, CAST-IN-PLACE CONCRETE. Coordinate anchor installation with concrete base.

F. Install ground-mounting, compressor-condenser components on polyethylene mounting base.

G. Install roof-mounting compressor-condenser components on equipment supports specified in Section 07 72 00, ROOF ACCESSORIES. Anchor units to supports with removable, cadmium-plated fasteners.

H. Install seismic restraints.

I. Install compressor-condenser components on restrained, spring isolators with a minimum static deflection of 25 mm (1 inch) unless otherwise indicated. Refer to Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.

J. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

K. Install wall sleeves in finished wall assembly and weatherproof. Install and anchor wall sleeves to withstand, without damage seismic forces as required by code.

3.2 CONNECTIONS

A. Verify condensate drainage requirements.

B. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.

C. Install piping adjacent to units to allow service and maintenance.

D. Install ducts to termination at top of roof curb. Cut roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.

E. Connect supply ducts to units with flexible duct connectors specified in Section 23 31 00, HVAC DUCTS and CASINGS.

F. Install return-air duct continuously through roof structure.

G. Install normal-weight, 20.7-MPa (3000-psi), compressive strength (28-day) concrete mix inside roof curb, 100 mm (4 inches) thick.

H. Ground equipment and install power wiring, switches, and controls for self-contained and split systems.

I. Connect refrigerant piping to coils with shutoff valves on the suction and liquid lines at the coil and a union or flange at each connection at the coil and condenser.

J. Install ducts to the units with flexible duct connections.

K. Connect piping with shutoff duty valves on the supply and return side of the coil and unions at all connections and with a throttling valve on the return piping near the coil.

L. Connect piping with shutoff duty valves on the supply and return side of the water-cooled condenser and unions at all connections and with a throttling valve on the return piping near the condenser

M. Connect piping with shutoff duty valves and unions on the steam supply and condensate side of the steam coil. On the condensate line near the coil provide a strainer, trap and shutoff valve.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections: After installing units and after electrical circuitry has been energized, test units for compliance with requirements. Inspect for and remove shipping bolts, blocks, and tie-down straps. After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment. Remove and replace malfunctioning units and retest as specified above.

3.4 STARTUP AND TESTING

A. The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the COR and CxA. Provide a minimum of 7 days prior notice.

B. Provide services of manufacturer's technical representative for four hours to instruct VA personnel in operation and maintenance of units.

3.5 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00 – COMMISSIONING OF HVAC SYSTEMS for all inspection, start up, and contractor testing required above and required by the System Readiness Checklist provided by the CxA.

B. Components provided under this section of the specification will be tested as part of a larger system. Refer to Section 23 08 00 – COMMISSIONING OF HVAC SYSTEMS and related sections for contractor responsibilities for system commissioning.

3.6 **DEMONSTRATION AND TRAINING**

A. Provide services of manufacturer's technical representative 8 hours to instruct VA personnel in operation and maintenance of units.

B. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00 – COMMISSIONING OF HVAC SYSTEMS.

---END---

SECTION 23 81 43
AIR-SOURCE UNITARY HEAT PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section specifies electrically operated air-source unitary heat pumps.

B. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

C. Definitions:
1. Coefficient of Performance (COP) - Cooling: The ratio of the rate of heat removed to the rate of energy input in consistent units, for a complete refrigerating system or some specific portion of that system under designated operating conditions.
2. Coefficient of Performance (COP) - Heating: The ratio of the rate of heat delivered to the rate of energy input is consistent units for a complete heat pump system, including the compressor and, if applicable, auxiliary heat under designated operating conditions.
3. Energy Efficiency Ratio (EER): The ratio of net cooling capacity is Btu/h to total rate of electricity input in watts under designated operating conditions.
4. Heating Seasonal Performance Factor (HSPF) - Total heating output of heat pump during its normal annual usage period for heating in Btu/h divided by total electric energy input in watts during the same period.
5. Seasonal Energy Efficiency Ratio (SEER) - Total cooling output of an air conditioner during its normal annual usage period for cooling in Btu/h divided by total electric energy input in watts during the same period.
6. Air-Source Unitary Heat Pump: One or more factory made assemblies that normally include an indoor conditioning coil, compressor(s) and an outdoor refrigerant-to-air coil. These units provide both heating and cooling functions.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D. Section 01 91 00 – GENERAL COMMISSIONING REQUIREMENTS.

E. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON–STRUCTURAL COMPONENTS.

F. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

G. Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

H. Section 23 08 00 – COMMISSIONING OF HVAC SYSTEMS.

I. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

J. Section 23 23 00, REFRIGERANT PIPING.

K. Section 23 31 00, HVAC DUCTS AND CASINGS.

1.3 QUALITY ASSURANCE

A. Refer to specification Section 23 05 11, COMMON WORK RESULTS FOR HVAC

B. Comply with ASHRAE Standard 15, Safety Code for Mechanical Refrigeration.

C. Comply with ASHRAE Standard 90.1, Energy Standard for Buildings except Low-Rise Residential Buildings for cooling and heating performance requirements when tested in accordance with AHRI 210/240and UL 1995.

D. Heating Performance shall conform to ASHRAE requirements when tested in accordance with AHRI 210/240 and UL 1995.

E. Comply with requirements in Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

1.4 SUBMITTALS

A. Submit in accordance with specification Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Manufacturer's Literature and Data Including:
   1. Air-Source Unitary Heat pump:
      a. Packaged units
      b. Split system

C. Certification: Submit, simultaneously with shop drawings, a proof of certification that this product has been certified by AHRI.

D. Performance Rating: Submit catalog selection data showing equipment ratings and compliance with required cooling and heating capacities EER and COP values as applicable.

E. Completed System Readiness Checklists provided by the CxA and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 23 08 00 COMMISSIONING OF HVAC SYSTEMS.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards will govern. The latest edition as of the specification issue date shall govern.

B. Federal Specification (Fed. Spec.):
   A-A-50502 ..... Air-conditioner (UNITARY HEAT PUMP), AIR TO AIR (3000 TO 300,000 BTUH)

C. Air-Conditioning Heating and Refrigeration Institute (AHRI) Standards:
   DCPP(Web-based) ..... Directory of Certified Product Performance - Applied Directory of Certified Products

   210/240 ..... Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment

   270 ..... Sound Rating of Outdoor Unitary Equipment

   310/380 ..... Standard for Packaged Terminal Air-Conditioners and Heat Pumps (CSA-C744-04)

   340/360 ..... Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment

D. Air Movement and Control Association (AMCA):
   210 ..... Laboratory Methods of Testing Fans for Aerodynamic Performance Rating (ANSI)

   410 ..... Recommended Safety Practices for Users and Installers of Industrial and Commercial Fans

E. American National Standards Institute (ANSI):
S12.51 ..... Acoustics - Determination of Sound Power Levels of Noise Sources Using Sound Pressure - Precision Method for Reverberation Rooms (same as ISO 3741:1999)

F. American Society of Heating, Refrigerating and Air-Conditioning Engineers Inc. (ASHRAE):
15 ..... Safety Standard for Refrigeration Systems (ANSI)

62.1 ..... Ventilation for Acceptable Indoor Air Quality (ANSI)

90.1 ..... Energy Standard for Buildings except Low-Rise Residential Buildings

..... HVAC Systems and Equipment Handbook

G. American Society of Testing and Materials (ASTM):
B117 ..... Standard Practice for Operating Salt Spray (Fog) Apparatus

D4587 ..... Standard Practice for Fluorescent UV-Condensation Exposures of Paint and Related Coatings

H. National Electrical Manufacturer's Association (NEMA):
ICS 1 ..... Industrial Controls and Systems: General Requirements

MG 1 ..... Motors and Generators (ANSI)

I. National Fire Protection Association (NFPA):
90A ..... Standard for the Installation of Air-Conditioning and Ventilating Systems

J. Underwriters Laboratory (UL):
1995 ..... Heating and Cooling Equipment

1.6 AS-BUILT DOCUMENTATION

A. Comply with requirements in Paragraph AS-BUILT DOCUMENTATION of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

PART 2 - PRODUCTS

2.1 UNITARY HEAT PUMPS, AIR TO AIR

A. Units shall comply with Fed Spec A-A-50502Type II, (Split System) having remote outdoor section separate from indoor Section, Class 1, "Department of Energy" (DOE) covered products (units with cooling capacity up to 65000 Btu/hr.
1. Unitary heat pumps shall bear the United States Environmental Protection Agency, Energy Star label and shall have a minimum Heating Season Performance Factor (HSPF) of 8.2 (Type II – Split System), and a minimum Seasonal Energy Efficiency Ratio (SEER) of 14.5 (Type II – Split System).

B. Applicable AHRI Standards: Units shall be listed in the corresponding ARI Directory of Certified products shown in paragraph, APPLICABLE PUBLICATIONS:
1. Air Source Unitary heat pumps with capacity less than 19 KW (65,000 Btu/hr), Comply with AHRI 210/240.
2. Air Source heat pump with capacity above 19KW (above 65,000 Btu/hr, Comply with AHRI 340/360.

C. Casing: Unit shall be constructed of zinc coated, heavy-gage galvanized steel. Exterior surfaces shall be cleaned, phosphatized, and finished with a weather-resistant baked enamel finish. Unit

surfaces shall be tested 500 hours in a salt spray test in compliance with ASTM B117. Cabinet panels shall have lifting handles and shall be water- and air-tight seal. All exposed vertical, top covers and base pan shall be insulated with 25-mm (1-inch) matt-faced, fire-resistant, odorless, glass fiber material. Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1. The base of the unit shall have provisions for forklift and crane lifting.

D. Filters: One inch, MERV 7, throwaway filter shall be standard on all units below 19kW (6 Tons). Filter rack can be converted to two-inch capability. Two inch, MERV 8, throwaway filters shall be factory supplied on all units above 19 kW (6 Tons).

E. Compressors: Compressors shall be direct-drive, hermetic scroll type with centrifugal type oil pumps. Motor shall be suction gas-cooled. Internal overloads and crankcase heaters shall be utilized with all compressors.

F. Refrigerant Circuit: A minimum of two circuits is required. Each refrigerant circuit shall have independent fixed orifice or thermostatic expansion devices, service pressure ports, and refrigerant line filter driers factory installed as standard. An area shall be provided for replacement suction line driers.

G. Evaporator and Condenser Coils: Internally finned, DN 10 (NPS 3/8) copper tubes mechanically bonded to a configured aluminum plate fin shall be standard. The evaporated coil and condenser coil shall be leak tested at the factory to 1378 kPa (200 psig) and pressure tested to 2756 kPa (400 psig). All dual compressor units shall have intermingled evaporator coils. Sloped condensate drain pans shall be provided.

H. Outdoor fans: Direct driven, statically and dynamically balanced, draw-through in the vertical discharge position. The fan motors shall be permanently lubricated and shall have built-in thermal overload protection.

I. Indoor Fan:
   1. Plenum Fans Provide direct-drive, Arrangement 4, plenum fan(s) equipped with variable-speed drives. Maximum fans in an array shall not exceed four.

J. Defrost Controls: A time initiated, temperature terminated defrost system shall ship with a setting of 70-minute cycle, with a choice of 50- or 90-minute cycle. Timed override limits defrost cycle to 10 minutes shall be available on units from 35- to 70-kW (10 to 20 tons). Adaptive demand defrost shall be provided on units below 35 kW (10 Tons).

K. Unit Electrical
   1. Provide single point unit power connection.
   2. Unit control box shall be located within the unit and shall contain controls for compressor, reversing valve and fan motor operation and shall have a 50 VA 24-volt control circuit transformer and a terminal block for low voltage field wiring connections.
   3. Safety Controls - High pressure, low temperature, and low-pressure safety switches shall be wired through a latching lockout circuit to hold the conditioner off until it is reset electrically be interrupting the power supply to the conditioner. All safety switches shall be normally closed, opening upon fault detection.

L. Operating Controls
   1. Provide unit with factory supplied DDC control system.
   2. Low voltage, adjustable room thermostat to control heating and cooling in sequence with delay between stages, compressor and supply fan to maintain temperature setting. Include system selector switch(off-heat-auto-coo-dry) and fan control switch (auto-on).
   3. Unit DDC Controller:
      a. Unit controller shall include input, output and self-contained programming as needed for complete control of unit.
      b. Unit controller shall be BAC net compliant and utilize BAC net operating protocol.
      c. Control system shall seamlessly interface with temperature control system as specified in Section 23 09 23, DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC without requiring gateways or any other interface devices.

d. All program sequences shall be stored on board in EEPROM. No batteries shall be needed to retain logic program. All program sequences shall be executed by controller 10 times per second and shall be capable of multiple PID loops for control of multiple devices. Programming of logic controller shall be completely modifiable in the field over installed BACnet LANs.

e. Temperature Control System Interface: Points shall be available from the unit controller for service access and display and/or control.

f. Space Temperature Sensor: The wall mounted sensor shall include occupied and unoccupied setpoint control, pushbutton unoccupied override, space temperature offset and space temperature indication. Refer to Section 23 09 23, DIRECT DIGITAL CONTROL SYSTEM FOR HVAC for additional requirements.

M. Accessories:

1. Electric Heater: Constructed of heavy-duty nickel chromium elements. Staging shall be achieved through the unit control processor. Each heater shall have automatically reset high limit control. Heaters shall be individually fused from the factory and shall comply with NEC and CEC requirements. Power assemblies shall provide single point connection. Electric heat modules shall be listed and labeled by a national recognized testing laboratory acceptable to authorities having jurisdiction. Electric heater controls shall confirm the supply fan is operating before electric elements are energized. Operate electric heater in 2 stages when outdoor ambient is too low to maintain space thermostat setting with compressor operation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. If in the substantiated evaluation of the COR, the installation fails to meet the requirements of the construction documents with respect to function and maintainability, an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no additional cost or time to the Government.

B. Install heat pumps according to manufacturers printed instructions.

C. Install electrical and control devices furnished by the manufacturer but not specified to be factory mounted. All electrical work shall comply with Division 26 Sections.

D. Ductwork: Comply with requirements in Section 23 31 00, HVAC DUCTS AND CASINGS.

E. Piping: Comply with requirements in Section 23 23 00, REFRIGERANT PIPING.

3.2 STARTUP AND TESTING

A. Perform startup checks according to manufacturer’s written instructions.

B. The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the COR and CxA. Provide a minimum notice of 7 working days prior to startup and testing.

C. Test controls and demonstrate its compliance with project requirements. Replace damaged or malfunctioning controls and equipment and retest the equipment to the satisfaction of the COR.

D. Furnish test reports to the COR in accordance with specification Section 01 00 00, GENERAL REQUIREMENTS.

3.3 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS for all inspection, start up, and contractor testing required above and required by the System Readiness Checklist provided by the CxA.

B. Components provided under this section of the specification will be tested as part of a larger system. Refer to Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS and related sections for contractor responsibilities for system commissioning.

3.4 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer's technical representative for 8 hours to instruct VA personnel in operation and maintenance of units.

B. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

- - - E N D - - -

SECTION 23 82 00
CONVECTION HEATING AND COOLING UNITS

PART 1 - GENERAL

1.1 DESCRIPTION

A. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. This section specifies room fan-coil units, radiant ceiling panels, and finned-tube radiation.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

E. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

F. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

G. Section 23 05 41, NOISE and VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.

H. Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC.

I. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

J. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

K. Section 23 21 13, HYDRONIC PIPING.

L. Section 23 31 00, HVAC DUCTS and CASINGS.

M. Section 23 82 16, AIR COILS.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards will govern. The latest edition as of the specification issue date shall govern.

B. Air-Conditioning, Heating, and Refrigeration Institute (ANSI/AHRI):
440 ..... Performance Rating of Fan-Coil Units

C. National Fire Protection Association (NFPA):
70 ..... National Electrical Code
90A ..... Standard for the Installation of Air-Conditioning and Ventilating Systems

D. Underwriters Laboratories, Inc. (UL):
181 ..... Standard for Factory-Made Air Ducts and Air Connectors
1995 ..... Heating and Cooling Equipment

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 23 XX XX, SECTION TITLE”, with applicable paragraph identification.

C. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
   1. Room Fan-Coil units.
   2. Finned-tube radiation.
   3. Radiant ceiling panels.

D. Certificates:
   1. Compliance with paragraph QUALITY ASSURANCE.
   2. Compliance with specified standards.

E. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts, and troubleshooting guide:
   1. Include complete list indicating all components of the systems.
   2. Include complete diagrams of the internal wiring for each item of equipment.
   3. Diagrams shall have their terminals identified to facilitate installation, operation, and maintenance.

F. Completed System Readiness Checklists provided by the CxA and completed by the contractor, signed by a qualified technician, and dated on the date of completion, in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

G. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

1.5 QUALITY ASSURANCE

A. Refer to paragraph QUALITY ASSURANCE of Section 23 05 11, COMMON WORK RESULTS FOR HVAC. Provide guarantee in accordance with FAR clause 52.246-21.

B. Bio-Based Materials: For products designated by the USDA’s Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

C. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

1.6 AS-BUILT DOCUMENTATION

A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

PART 2 - PRODUCTS

2.1 ROOM FAN-COIL UNITS

A. Capacity Certification: AHRI 440.

B. Safety Compliance: NEC compliant and UL listed.

C. Noise Levels: Operating at full cooling capacity, sound power level shall not exceed by more than 5 dB the numerical value of sound pressure levels associated with noise criteria specified

in Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT. Select units at intermediate speed, for compliance with the noise criteria.

D. Chassis: Galvanized steel, acoustically and thermally insulated to attenuate noise and prevent condensation.

E. Cabinet: Minimum 1.3 mm (l8 gauge) steel reinforced and braced. Arrange components and provide adequate space for installation of piping package and control valves. Finish shall be factory-baked enamel color as selected by the architect on all exposed surfaces.
   1. Vertical Recessed Cabinet Unit: Provide 1.6 mm (l6 gauge) steel front panel with 13 mm (l/2 inch) thick fiberglass insulation and provide screw-type levelers. Provide low-silhouette type where required based on approved coordination drawings.
      a. Air Outlet Grilles: Adjustable four-way air deflection located in the top panel.
      b. Provide two hinged access doors (one each side) equipped with key operated cam-lock fasteners in the unit top panel located to provide access to the unit controls.
   2. Horizontal Unit: Provide recessed type as shown. Provide supports and vibration isolators for horizontal units as recommended by the manufacturer.
      a. Recessed Units: Provide hinged access door with //stamped integral air inlet/outlet grille// //outlet duct collar connection//.

F. Fans: Centrifugal, forward curved, double width type wheels, galvanized steel or polyester resin construction, statically and dynamically balanced, direct driven.
   1. Motors: Premium efficiency, 3-speed permanent split capacitor type with integral thermal overload protection, for operation at no greater than l200 RPM.
   2. Provide a fan speed selector switch, with off, low, medium, and high positions. Switch shall have a set of auxiliary contacts which are open when the switch is in the “off” position and closed when the switch in any of the other positions. On vertical units, mount switch in a junction box in the cabinet of each unit. On ceiling-suspended horizontal and concealed units, switch shall be wall mounted.

G. Cooling and Heating Coils:
   1. Hydronic (two separate coils for cooling and heating): Copper tubes, 10 mm (3/8 inch) minimum inside diameter, not less than 0.43 mm (0.0l7 inch) thick with copper or aluminum fins. Coils shall be pressure tested for bursting and strength in accordance with Underwriters Laboratories, Inc., requirements for pressure tested coils, and shall be designed to provide adequate heat transfer capacity. Provide manual air vent at high point of each coil and drain at each low point.

H. Piping Package: Factory furnished with unit by the manufacturer or field-installed by the contractor to fit control valves provided by the controls’ supplier. Submit manufacturer’s detailed drawings of the piping in the end compartments for approval prior to fabrication of the piping packages. Provide ball stop valves on the supply and return pipes and balancing fittings on the return pipes.

I. Drain Pans: Furnish galvanized steel with solderless drain connections and molded polystyrene foam insulating liner:
   1. Auxiliary Drain Pan: Located under control valve and piping within the unit enclosure to prevent dripping.
   2. Secondary Drain Pan: provide a secondary drain pan located underneath the unit, constructed to extend a minimum of 50 mm (2 inches) beyond the edges of the unit and be a minimum of 38 mm (1-1/2 inches deep) provided with a separate drain line discharging to conspicuous point and water detection device to deactivate the cooling in the unit.

J. Air Filter: Manufacturer’s standard throwaway type, not less than 25 mm (1 inch) thick, MERV 7, supported to be concealed from sight and be tight fitting to prevent air by-pass. Filters shall have slide out frames and be easily replaced without removing enclosure or any part thereof.

K. Control valves and remote wall mounted space thermostats are to be field installed. Provide two-way modulating control valves unless shown or specified otherwise.

2.2 FINNED-TUBE RADIATION UNITS

A. Ratings: Certified under the I=B=R program of the Gas Appliance Manufacturer's Association.

B. Enclosures: 1.6 mm (l6 gauge) steel, sloping top, designed for wall mounting. Provide baked enamel finish in standard manufacturer's colors as selected by the Architect. End plates and corner pieces shall be die-formed with round edges and fit flush with enclosure surface. Where continuous wall-to-wall installations are shown in the contract documents provide all fillers, corner fittings, sleeves, end caps and other accessories, which shall have the same profile as the basic unit. Provide access panels or extensions where required for access to valves, or traps shown in the contract documents.

C. Hydronic Heating Elements: Steel pipe or nonferrous tubing with fins mechanically bonded by mechanical expansion of the tube. Elements shall be positively positioned front-to-back with provisions for silent horizontal expansion and contraction.

2.3 RADIANT CEILING PANELS

A. Hydronic Radiant Panels: Lay-in type, 1 mm (0.04) inch aluminum faceplate with 13 mm (l/2 inch) I.D copper serpentine water coil mechanically bonded to faceplate, finished with two coats baked white polyester finish with a light reflection value of 70 to 80 percent. Panels shall weigh no greater than 0.68 kg (l.5 pounds) per square foot when filled with water. Provide 75 mm (3 inch) un-faced fiberglass blanket insulation pre-cut for installation above panels. Panels shall be continuous linear arranged as shown in the contract documents. Radiant panel to include access panel with security scews.

PART 3 - EXECUTION

3.1 INSTALLATION

A. If an installation is unsatisfactory to the COR, the contractor shall correct the installation at no additional cost or time to the Government.

B. Work shall be installed as shown and according to the manufacturer's diagrams and recommendations.

C. Handle and install units in accordance with manufacturer's written instructions.

D. Support units rigidly so they always remain stationary. Cross-bracing or other means of stiffening shall be provided as necessary. Method of support shall be such that distortion and malfunction of units cannot occur.

E. Install fiberglass blanket insulation with a minimum R value of 8 above hydronic radiant panels.

3.2 STARTUP AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

C. The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the COR and CxA. Provide a minimum notice of 10 working days prior to startup and testing.

3.3 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

B. Components provided under this section of the specification will be tested as part of a larger system.

3.4 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer's technical representative for 8 hours to instruct each VA personnel responsible in operation and maintenance of the system.

B. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

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SECTION 23 82 16
AIR COILS

PART 1 - GENERAL

1.1 DESCRIPTION

A. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. Heating and cooling coils for air handling units and duct applications.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

D. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

E. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

F. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

G. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

H. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEMS for HVAC.

I. Section 23 31 00, HVAC DUCTS AND CASINGS.

J. Section 23 36 00, AIR TERMINAL UNITS

K. Section 23 72 00, AIR-TO-AIR ENERGY RECOVERY EQUIPMENT.

L. Section 23 73 00, INDOOR CENTRAL-STATION AIR-HANDLING UNITS.

M. Section 23 82 00, CONVECTION HEATING AND COOLING UNITS.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards will govern. The latest edition as of the specification issue date shall govern.

B. Air Conditioning and Refrigeration Institute (AHRI):
Directory of Certified Applied Air Conditioning Products

AHRI 4l0 ..... Forced-Circulation Air-Cooling and Air-Heating Coils

C. American Society for Testing and Materials (ASTM):
B75/75M ..... Standard Specifications for Seamless Copper Tube

D. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE):
15 ..... Safety Standard for Refrigeration Systems

34 ..... Designation and Classification of Refrigerants (ANSI)

E. National Electric Manufacturers Association (NEMA):
250 ..... Enclosures for Electrical Equipment (1,000 Volts Maximum)

F. National Fire Protection Association (NFPA):
70 .....National Electric Code

G. Underwriters Laboratories, Inc. (UL):
1996 .....Electric Duct Heaters

H. Department of Veterans Affairs (VA):
PG-18-10.....HVAC Design Manual

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 23 XX XX, SECTION TITLE”, with applicable paragraph identification.

C. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
1. Submit type, size, arrangements, and performance details. Present application ratings in the form of tables, charts, or curves.

D. Provide installation, operating and maintenance instructions.

E. Certification Compliance: Evidence of listing in current AHRI Directory of Certified Applied Air Conditioning Products.

F. Coils may be submitted with Section 23 36 00, AIR TERMINAL UNITS, Section 23 73 00, INDOOR CENTRAL-STATION AIR-HANDLING UNITS, or Section 23 82 00, CONVECTION HEATING AND COOLING UNITS.

G. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts, and troubleshooting guide:
1. Include complete list indicating all components of the systems.
2. Include complete diagrams of the internal wiring for each item of equipment.
3. Diagrams shall have their terminals identified to facilitate installation, operation, and maintenance.

H. Completed System Readiness Checklist provided by the CxA and completed by the contractor, signed by a qualified technician, and dated on the date of completion, in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

I. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

1.5 QUALITY ASSURANCE

A. Refer to paragraph QUALITY ASSURANCE of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. Unless specifically exempted by these specifications, heating and cooling coils shall be tested, rated, and certified in accordance with AHRI 4I0 and shall bear the AHRI certification label.

C. Bio-Based Materials: For products designated by the USDA’s Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

D. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

1.6 AS-BUILT DOCUMENTATION

A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

PART 2 - PRODUCTS

2.1 HEATING AND COOLING COILS

A. Conform to ASTM B75/75M and AHRI 410.

B. Tubes: Minimum 16 mm (0.625 inch) tube diameter; Seamless copper tubing.

C. Fins: 0.1397 mm (0.0055 inch) aluminum or 0.1143 mm (0.0045 inch) copper mechanically bonded or soldered or helically wound around tubing.

D. Headers: Copper, welded steel or cast-iron. Provide seamless copper tubing or resistance welded steel tube for volatile refrigerant coils.

E. "U" Bends, Where Used: Machine die-formed, silver brazed to tube ends.

F. Coil Casing: 1.6 mm (l6 gauge) galvanized steel with tube supports at 1219 mm (48 inch) maximum spacing. Construct casing to eliminate air bypass and moisture carry-over. Provide duct connection flanges.

G. Pressures kPa (PSIG):

Pressure	Water Coil	Steam Coil	Refrigerant Coil
Test	2070 (300)	1725 (250)	2070 (300)
Working	1380 (200)	520 (75)	1724 (250)

H. Protection: Unless protected by the coil casing, provide cardboard, plywood, or plastic material at the factory to protect tube and finned surfaces during shipping and construction activities.

I. Vents and Drain: Coils that are not vented or drainable by the piping system shall have capped vent/drain connections extended through coil casing.

2.2 REHEAT COILS, DUCT MOUNTED

A. The coils shall be continuous circuit booster type for hot water as shown in contract documents. Use the same coil material as listed in paragraph HEATING AND COOLING COILS.

2.3 WATER COILS, INCLUDING GLYCOL-WATER

A. Use the same coil material as listed in paragraph HEATING AND COOLING COILS.

B. Drainable Type (Self-Draining, Self-Venting); Manufacturer Standard:
   1. Cooling, all types.
   2. Heating or preheat.
   3. Runaround energy recovery. AHRI certification of capacity adjustment is waived. See Section 23 72 00, AIR-TO-AIR ENERGY RECOVERY EQUIPMENT.

PART 3 - EXECUTION

3.1 INSTALLATION

A. If an installation is unsatisfactory to the COR, the contractor shall correct the installation at no additional cost or time to the Government.

B. Follow coil manufacturer's instructions for handling, cleaning, installation, and piping connections.

C. Comb fins, if damaged. Eliminate air bypass or leakage at coil sections.

3.2 STARTUP AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

C. The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the COR and CxA. Provide a minimum of 10 working days prior to startup and testing.

3.3 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

B. Components provided under this section of the specification will be tested as part of a larger system.

3.4 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative for 4 hours to instruct VA personnel responsible in operation and maintenance of the system.

B. Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

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SECTION 26 05 11
REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section applies to all sections of Division 26.

B. Furnish and install electrical systems, materials, equipment, and accessories in accordance with the specifications and drawings. Capacities and ratings of motors, transformers, conductors and cable, switchboards, switchgear, panelboards, motor control centers, generators, automatic transfer switches, and other items and arrangements for the specified items are shown on the drawings.

C. Electrical service entrance equipment and arrangements for temporary and permanent connections to the electric utility company's system shall conform to the electric utility company's requirements. Coordinate fuses, circuit breakers and relays with the electric utility company's system, and obtain electric utility company approval for sizes and settings of these devices.

D. Conductor ampacities specified or shown on the drawings are based on copper conductors, with the conduit and raceways sized per NEC. Aluminum conductors are prohibited.

E. NOTE: FACILITY POWER IS 208V/3Ph. All Equipment installed under this project must be able to operate at 208V or 120V.

1.2 MINIMUM REQUIREMENTS

A. The latest International Building Code (IBC), Underwriters Laboratories, Inc. (UL), Institute of Electrical and Electronics Engineers (IEEE), and National Fire Protection Association (NFPA) codes and standards are the minimum requirements for materials and installation.

B. The drawings and specifications shall govern in those instances where requirements are greater than those stated in the above codes and standards.

1.3 TEST STANDARDS

A. All materials and equipment shall be listed, labeled, or certified by a Nationally Recognized Testing Laboratory (NRTL) to meet Underwriters Laboratories, Inc. (UL), standards where test standards have been established. Materials and equipment which are not covered by UL standards will be accepted, providing that materials and equipment are listed, labeled, certified or otherwise determined to meet the safety requirements of a NRTL. Materials and equipment which no NRTL accepts, certifies, lists, labels, or determines to be safe, will be considered if inspected or tested in accordance with national industrial standards, such as ANSI, NEMA, and NETA. Evidence of compliance shall include certified test reports and definitive shop drawings.

B. Definitions:
   1. Listed: Materials and equipment included in a list published by an organization that is acceptable to the Authority Having Jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production or listed materials and equipment or periodic evaluation of services, and whose listing states that the materials and equipment either meets appropriate designated standards or has been tested and found suitable for a specified purpose.
   2. Labeled: Materials and equipment to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the Authority Having Jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled materials and equipment, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.
   3. Certified: Materials and equipment which:

a. Have been tested and found by a NRTL to meet nationally recognized standards or to be safe for use in a specified manner.
b. Are periodically inspected by a NRTL.
c. Bear a label, tag, or other record of certification.

4. Nationally Recognized Testing Laboratory: Testing laboratory which is recognized and approved by the Secretary of Labor in accordance with OSHA regulations.

1.4 QUALIFICATIONS (PRODUCTS AND SERVICES)

A. Manufacturer’s Qualifications: The manufacturer shall regularly and currently produce, as one of the manufacturer's principal products, the materials and equipment specified for this project, and shall have manufactured the materials and equipment for at least three years.

B. Product Qualification:
1. Manufacturer's materials and equipment shall have been in satisfactory operation, on three installations of similar size and type as this project, for at least three years.
2. The Government reserves the right to require the Contractor to submit a list of installations where the materials and equipment have been in operation before approval.

C. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within four hours of receipt of notification that service is needed. Submit name and address of service organizations.

1.5 APPLICABLE PUBLICATIONS

A. Applicable publications listed in all Sections of Division 26 shall be the latest issue, unless otherwise noted.

B. Products specified in all sections of Division 26 shall comply with the applicable publications listed in each section.

1.6 MANUFACTURED PRODUCTS

A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, and for which replacement parts shall be available. Materials and equipment furnished shall be new, and shall have superior quality and freshness.

B. When more than one unit of the same class or type of materials and equipment is required, such units shall be the product of a single manufacturer.

C. Equipment Assemblies and Components:
1. Components of an assembled unit need not be products of the same manufacturer.
2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
3. Components shall be compatible with each other and with the total assembly for the intended service.
4. Constituent parts which are similar shall be the product of a single manufacturer.

D. Factory wiring and terminals shall be identified on the equipment being furnished and on all wiring diagrams.

E. When Factory Tests are specified, Factory Tests shall be performed in the factory by the equipment manufacturer, and witnessed by the contractor. In addition, the following requirements shall be complied with:
1. The Government shall have the option of witnessing factory tests. The Contractor shall notify the Government through the COR a minimum of thirty (30) days prior to the manufacturer’s performing of the factory tests.
2. When factory tests are successful, contractor shall furnish four (4) copies of the equipment manufacturer’s certified test reports to the COR fourteen (14) days prior to shipment of the equipment, and not more than ninety (90) days after completion of the factory tests.

3. When factory tests are not successful, factory tests shall be repeated in the factory by the equipment manufacturer, and witnessed by the Contractor. The Contractor shall be liable for all additional expenses for the Government to witness factory re-testing.

1.7 VARIATIONS FROM CONTRACT REQUIREMENTS

A. Where the Government or the Contractor requests variations from the contract requirements, the connecting work and related components shall include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.

1.8 MATERIALS AND EQUIPMENT PROTECTION

A. Materials and equipment shall be protected during shipment and storage against physical damage, vermin, dirt, corrosive substances, fumes, moisture, cold, freeze and rain.
   1. Store materials and equipment indoors in clean dry space with uniform temperature to prevent condensation.
   2. During installation, equipment shall be protected against entry of foreign matter, and be vacuum-cleaned both inside and outside before testing and operating. Compressed air shall not be used to clean equipment. Remove loose packing and flammable materials from inside equipment.
   3. Damaged equipment shall be repaired or replaced, as determined by the COR.
   4. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.
   5. Damaged paint on equipment shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

1.9 WORK PERFORMANCE

A. All electrical work shall comply with requirements of the latest NFPA 70 (NEC), NFPA 70B, NFPA 70E, NFPA 99, NFPA 110, NFPA 780, OSHA Part 1910 subpart J – General Environmental Controls, OSHA Part 1910 subpart K – Medical and First Aid, and OSHA Part 1910 subpart S – Electrical, in addition to other references required by contract.

B. Job site safety and worker safety is the responsibility of the Contractor.

C. Electrical work shall be accomplished with all affected circuits or equipment de-energized. However, energized electrical work may be performed only for the non-destructive and non-invasive diagnostic testing(s), or when scheduled outage poses an imminent hazard to patient care, safety, or physical security. In such case, all aspects of energized electrical work, such as the availability of appropriate/correct personal protective equipment (PPE) and the use of PPE, shall comply with the latest NFPA 70E, as well as the following requirements:
   1. Only Qualified Person(s) shall perform energized electrical work. Supervisor of Qualified Person(s) shall witness the work of its entirety to ensure compliance with safety requirements and approved work plan.
   2. At least two weeks before initiating any energized electrical work, the Contractor and the Qualified Person(s) who is designated to perform the work shall visually inspect, verify and confirm that the work area and electrical equipment can safely accommodate the work involved.
   3. At least two weeks before initiating any energized electrical work, the Contractor shall develop and submit a job specific work plan, and energized electrical work request to the COR, and Medical Center's Chief Engineer or his/her designee. At the minimum, the work plan must include relevant information such as proposed work schedule, area of work, description of work, name(s) of Supervisor and Qualified Person(s) performing the work, equipment to be used, procedures to be used on and near the live electrical equipment, barriers to be installed, safety equipment to be used, and exit pathways.
   4. Energized electrical work shall begin only after the Contractor has obtained written approval of the work plan, and the energized electrical work request from the COR, and Medical Center's Chief Engineer or his/her designee. The Contractor shall make these

approved documents present and available at the time and place of energized electrical work.

5. Energized electrical work shall begin only after the Contractor has invited and received acknowledgment from the COR, and Medical Center's Chief Engineer or his/her designee to witness the work.

D. For work that affects existing electrical systems, arrange, phase and perform work to assure minimal interference with normal functioning of the facility. Refer to Article OPERATIONS AND STORAGE AREAS under Section 01 00 00, GENERAL REQUIREMENTS.

E. New work shall be installed and connected to existing work neatly, safely and professionally. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required by Section 01 00 00, GENERAL REQUIREMENTS.

F. Coordinate location of equipment and conduit with other trades to minimize interference.

1.10 EQUIPMENT INSTALLATION AND REQUIREMENTS

A. Equipment location shall be as close as practical to locations shown on the drawings.

B. Working spaces or working clearances shall comply with NEC's requirements, at a minimum.

C. Inaccessible Equipment:

1. Where the Government determines that the Contractor has installed equipment not readily accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Government.
2. "Readily accessible" is defined as being capable of being reached quickly for operation, maintenance, or inspections without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.

D. Electrical service entrance equipment and arrangements for temporary and permanent connections to the electric utility company's system shall conform to the electric utility company's requirements. Coordinate fuses, circuit breakers and relays with the electric utility company's system, and obtain electric utility company approval for sizes and settings of these devices.

1.11 EQUIPMENT IDENTIFICATION

A. In addition to the requirements of the NEC, install an identification sign which clearly indicates information required for use and maintenance of items such as switchboards and switchgear, panelboards, cabinets, motor controllers, fused and non-fused safety switches, generators, automatic transfer switches, separately enclosed circuit breakers, individual breakers and controllers in switchboards, switchgear and motor control assemblies, control devices and other significant equipment.

B. Identification signs for Normal Power System equipment shall be laminated black phenolic resin with a white core with engraved lettering. Identification signs for Essential Electrical System (EES) equipment, as defined in the NEC, shall be laminated red phenolic resin with a white core with engraved lettering. Lettering shall be a minimum of 12 mm (1/2 inch) high. Identification signs shall indicate equipment designation, rated bus amperage, voltage, number of phases, number of wires, and type of EES power branch as applicable. Secure nameplates with screws.

C. Install adhesive arc flash warning labels on all equipment as required by the latest NFPA 70E. Label shall show specific and correct information for specific equipment based on its arc flash calculations. Label shall show the followings:

1. Nominal system voltage.
2. Equipment/bus name, date prepared, and manufacturer name and address.
3. Arc flash boundary.
4. Available arc flash incident energy and the corresponding working distance.
5. Minimum arc rating of clothing.

6. Site-specific level of PPE.

1.12 SUBMITTALS

A. Submit to the COR in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. The Government's approval shall be obtained for all materials and equipment before delivery to the job site. Delivery, storage or installation of materials and equipment which has not had prior approval will not be permitted.

C. All submittals shall include six copies of adequate descriptive literature, catalog cuts, shop drawings, test reports, certifications, samples, and other data necessary for the Government to ascertain that the proposed materials and equipment comply with drawing and specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify specific materials and equipment being submitted.

D. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.
   1. Mark the submittals, "SUBMITTED UNDER SECTION_____".
   2. Submittals shall be marked to show specification reference including the section and paragraph numbers.
   3. Submit each section separately.

E. The submittals shall include the following:
   1. Information that confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, manuals, pictures, nameplate data, and test reports as required.
   2. Submittals are required for all equipment anchors and supports. Submittals shall include weights, dimensions, center of gravity, standard connections, manufacturer's recommendations and behavior problems (e.g., vibration, thermal expansion, etc.) associated with equipment or piping so that the proposed installation can be properly reviewed. Include sufficient fabrication information so that appropriate mounting and securing provisions may be designed and attached to the equipment.
   3. Elementary and interconnection wiring diagrams for communication and signal systems, control systems, and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.
   4. Parts list which shall include information for replacement parts and ordering instructions, as recommended by the equipment manufacturer.

F. Maintenance and Operation Manuals:
   1. Submit as required for systems and equipment specified in the technical sections. Furnish in hardcover binders or an approved equivalent.
   2. Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, material, equipment, building, name of Contractor, and contract name and number. Include in the manual the names, addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the material or equipment.
   3. Provide a table of contents and assemble the manual to conform to the table of contents, with tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in.
   4. The manuals shall include:
      a. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.
      b. A control sequence describing start-up, operation, and shutdown.
      c. Description of the function of each principal item of equipment.
      d. Installation instructions.
      e. Safety precautions for operation and maintenance.

f. Diagrams and illustrations.
g. Periodic maintenance and testing procedures and frequencies, including replacement parts numbers.
h. Performance data.
i. Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare and replacement parts, and name of servicing organization.
j. List of factory approved or qualified permanent servicing organizations for equipment repair and periodic testing and maintenance, including addresses and factory certification qualifications.

G. Approvals will be based on complete submission of shop drawings, manuals, test reports, certifications, and samples as applicable.

H. After approval and prior to installation, furnish the COR with one sample of each of the following:
1. A minimum 300 mm (12 inches) length of each type and size of wire and cable along with the tag from the coils or reels from which the sample was taken. The length of the sample shall be sufficient to show all markings provided by the manufacturer.
2. Each type of conduit coupling, bushing, and termination fitting.
3. Conduit hangers, clamps, and supports.
4. Duct sealing compound.
5. Each type of receptacle, toggle switch, lighting control sensor, outlet box, manual motor starter, device wall plate, engraved nameplate, wire and cable splicing and terminating material, and branch circuit single pole molded case circuit breaker.

1.13 SINGULAR NUMBER

A. Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the switch"), this reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

1.14 ACCEPTANCE CHECKS AND TESTS

A. The Contractor shall furnish the instruments, materials, and labor for tests.

B. Where systems are comprised of components specified in more than one section of Division 26, the Contractor shall coordinate the installation, testing, and adjustment of all components between various manufacturer’s representatives and technicians so that a complete, functional, and operational system is delivered to the Government.

C. When test results indicate any defects, the Contractor shall repair or replace the defective materials or equipment, and repeat the tests for the equipment. Repair, replacement, and re-testing shall be accomplished at no additional cost to the Government.

1.15 WARRANTY

A. All work performed and all equipment and material furnished under this Division shall be free from defects and shall remain so for a period of one year from the date of acceptance of the entire installation by the Contracting Officer for the Government.

1.16 INSTRUCTION

A. Instruction to designated Government personnel shall be provided for the particular equipment or system as required in each associated technical specification section.

B. Furnish the services of competent and factory-trained instructors to give full instruction in the adjustment, operation, and maintenance of the specified equipment and system, including pertinent safety requirements. Instructors shall be thoroughly familiar with all aspects of the installation, and shall be factory-trained in operating theory as well as practical operation and maintenance procedures.

C. A training schedule shall be developed and submitted by the Contractor and approved by the COR at least 30 days prior to the planned training.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

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SECTION 26 05 19
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, connection, and testing of the electrical conductors and cables for use in electrical systems rated 600 V and below, indicated as cable(s), conductor(s), wire, or wiring in this section.

1.2 RELATED WORK

A. Section 07 84 00, FIRESTOPPING: Sealing around penetrations to maintain the integrity of fire-resistant rated construction.

B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

D. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits for conductors and cables.

E. Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION: Installation of conductors and cables in manholes and ducts.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:
   1. Shop Drawings:
      a. Submit sufficient information to demonstrate compliance with drawings and specifications.
      b. Submit the following data for approval:
         1) Electrical ratings and insulation type for each conductor and cable.
         2) Splicing materials and pulling lubricant.
   2. Certifications: Two weeks prior to final inspection, submit the following.
      a. Certification by the manufacturer that the conductors and cables conform to the requirements of the drawings and specifications.
      b. Certification by the Contractor that the conductors and cables have been properly installed, adjusted, and tested.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are reference in the text by designation only. The latest edition as of the specification issue date shall govern.

B. American Society of Testing Material (ASTM):

D2301 ..... Standard Specification for Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape

D2304 ..... Test Method for Thermal Endurance of Rigid Electrical Insulating Materials

D3005 ..... Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape

C. National Electrical Manufacturers Association (NEMA):
WC 70 ..... Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy

D. National Fire Protection Association (NFPA):
70 ..... National Electrical Code (NEC)

E. Underwriters Laboratories, Inc. (UL):
44 ..... Thermoset-Insulated Wires and Cables
83 ..... Thermoplastic-Insulated Wires and Cables
467 ..... Grounding and Bonding Equipment
486A-486B ..... Wire Connectors
486C ..... Splicing Wire Connectors
486D ..... Sealed Wire Connector Systems
486E ..... Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
493 ..... Thermoplastic-Insulated Underground Feeder and Branch Circuit Cables
514B ..... Conduit, Tubing, and Cable Fittings

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Conductors and cables shall be in accordance with ASTM, NEMA, NFPA, UL, as specified herein, and as shown on the drawings.

B. Conductors shall be copper.

C. Single Conductor:
1. No. 12 AWG: Minimum size, except where smaller sizes are specified herein or shown on the drawings.
2. No. 8 AWG and larger: Stranded.
3. No. 10 AWG and smaller: Solid; except shall be stranded for final connection to motors, transformers, and vibrating equipment.
4. Insulation: THHN-THWN and XHHW-2. XHHW-2 shall be used for isolated power systems.

D. Conductor Color Code:
1. No. 10 AWG and smaller: Solid color insulation or solid color coating.
2. No. 8 AWG and larger: Color-coded using one of the following methods:
   a. Solid color insulation or solid color coating.
   b. Stripes, bands, or hash marks of color specified.
   c. Color using 19 mm (0.75 inches) wide tape.
3. For modifications and additions to existing wiring systems, color coding shall conform to the existing wiring system.
4. Conductors shall be color-coded as follows:

208/120 V	Phase	480/277 V
Black	A	Brown
Red	B	Orange

Blue	C	Yellow
White	Neutral	Gray *
* or white with colored (other than green) tracer.		

5. Lighting circuit “switch legs”, and 3-way and 4-way switch “traveling wires,” shall have color coding that is unique and distinct (e.g., pink and purple) from the color coding indicated above. The unique color codes shall be solid and in accordance with the NEC. Coordinate color coding in the field with the COR.
6. Color code for isolated power system wiring shall be in accordance with the NEC.

2.2 SPLICES

A. Splices shall be in accordance with NEC and UL.

B. Above Ground Splices for No. 10 AWG and Smaller:
1. Solderless, screw-on, reusable pressure cable type, with integral insulation, approved for copper and aluminum conductors.
2. The integral insulator shall have a skirt to completely cover the stripped conductors.
3. The number, size, and combination of conductors used with the connector, as listed on the manufacturer's packaging, shall be strictly followed.

C. Above Ground Splices for No. 8 AWG to No. 4/0 AWG:
1. Compression, hex screw, or bolt clamp-type of high conductivity and corrosion-resistant material, listed for use with copper and aluminum conductors.
2. Insulate with materials approved for the particular use, location, voltage, and temperature. Insulation level shall be not less than the insulation level of the conductors being joined.
3. Splice and insulation shall be product of the same manufacturer.
4. All bolts, nuts, and washers used with splices shall be cadmium-plated steel.

D. Above Ground Splices for 250 kcmil and Larger:
1. Long barrel “butt-splice” or “sleeve” type compression connectors, with minimum of two compression indents per wire, listed for use with copper and aluminum conductors.
2. Insulate with materials approved for the particular use, location, voltage, and temperature. Insulation level shall be not less than the insulation level of the conductors being joined.
3. Splice and insulation shall be product of the same manufacturer.

E. Underground Splices for No. 10 AWG and Smaller:
1. Solderless, screw-on, reusable pressure cable type, with integral insulation. Listed for wet locations, and approved for copper and aluminum conductors.
2. The integral insulator shall have a skirt to completely cover the stripped conductors.
3. The number, size, and combination of conductors used with the connector, as listed on the manufacturer's packaging, shall be strictly followed.

F. Underground Splices for No. 8 AWG and Larger:
1. Mechanical type, of high conductivity and corrosion-resistant material. Listed for wet locations, and approved for copper and aluminum conductors.
2. Insulate with materials approved for the particular use, location, voltage, and temperature. Insulation level shall be not less than the insulation level of the conductors being joined.
3. Splice and insulation shall be product of the same manufacturer.

G. Plastic electrical insulating tape: Per ASTM D2304, flame-retardant, cold and weather resistant.

2.3 CONNECTORS AND TERMINATIONS

A. Mechanical type of high conductivity and corrosion-resistant material, listed for use with copper and aluminum conductors.

B. Long barrel compression type of high conductivity and corrosion-resistant material, with minimum of two compression indents per wire, listed for use with copper and aluminum conductors.

C. All bolts, nuts, and washers used to connect connections and terminations to bus bars or other termination points shall be cadmium-plated steel.

2.4 CONTROL WIRING

A. Unless otherwise specified elsewhere in these specifications, control wiring shall be as specified herein, except that the minimum size shall be not less than No. 14 AWG, or as required by the control wiring equipment manufacturer.

B. Control wiring shall be sized such that the voltage drop under in-rush conditions does not adversely affect operation of the controls.

2.5 WIRE LUBRICATING COMPOUND

A. Lubricating compound shall be suitable for the wire insulation and conduit, and shall not harden or become adhesive.

B. Shall not be used on conductors for isolated power systems.

PART 3 - EXECUTION

3.1 GENERAL

A. Installation shall be in accordance with the NEC, as shown on the drawings, and manufacturer's instructions.

B. Install conductors in raceway systems.

C. Splice conductors only in outlet boxes, junction boxes, pullboxes, manholes, or handholes.

D. Conductors of different systems (e.g., 120 V and 277 V) shall not be installed in the same raceway.

E. For conductors installed in vertical raceways, provide conductor support (also known as cable support), to counter gravity pull on conductor weight. Conductor support shall be split-wedge conductor support type. Prior to installing the conductor support plug, remove all pulling compound from conductors where they pass through the conductor support body. After installing the conductor support plug, tap the conductor support plug firmly in the conductor support body.

F. In panelboards, cabinets, wireways, switches, enclosures, and equipment assemblies, neatly form, train, and tie the conductors with non-metallic "zip" ties.

G. For connections to motors, transformers, and vibrating equipment, stranded conductors shall be used only from the last fixed point of connection to the motors, transformers, or vibrating equipment.

H. Use expanding foam or non-hardening duct-seal to seal conduits entering a building, after installation of conductors.

I. Conductor Pulling:
   1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling. Use lubricants approved for the cable.
   2. Use nonmetallic pull ropes.

3. Attach pull ropes by means of either woven basket grips or pulling eyes attached directly to the conductors.
4. All conductors in a single conduit shall be pulled simultaneously.
5. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

J. Number of conductors for branch circuits shall not exceed more than three branch circuits in any one conduit.

K. When stripping stranded conductors, use a tool that does not damage the conductor or remove conductor strands.

3.2 INSTALLATION IN MANHOLES

A. Train the conductors around the manhole walls, but do not bend to a radius less than six times the overall conductor diameter.

B. Fireproofing:
1. Install fireproofing on low-voltage conductors where the low-voltage conductors are installed in the same manholes with medium-voltage conductors.
2. Use fireproofing tape, and apply the tape in a single layer, half-lapped, or as recommended by the manufacturer. Install the tape with the coated side towards the cable and extend it not less than 25 mm (1 inch) into each duct.
3. Secure the fireproofing tape in place by a random wrap of glass cloth tape.

3.3 SPLICE AND TERMINATION INSTALLATION

A. Splices and terminations shall be mechanically and electrically secure, and tightened to manufacturer's published torque values using a torque screwdriver or wrench.

B. Where the Government determines that unsatisfactory splices or terminations have been installed, replace the splices or terminations at no additional cost to the Government.

3.4 CONDUCTOR IDENTIFICATION

A. When using colored tape to identify phase, neutral, and ground conductors larger than No. 8 AWG, apply tape in half-overlapping turns for a minimum of 75 mm (3 inches) from terminal points, and in junction boxes, pullboxes, and manholes. Apply the last two laps of tape with no tension to prevent possible unwinding. Where markings are covered by tape, apply tags to conductors, stating size and insulation type.

3.5 FEEDER CONDUCTOR IDENTIFICATION

A. In each interior pullbox and each underground manhole and handhole, install brass tags on all feeder conductors to clearly designate their circuit identification and voltage. The tags shall be the embossed type, 40 mm (1-1/2 inches) in diameter and 40 mils thick. Attach tags with plastic ties.

3.6 EXISTING CONDUCTORS

A. Unless specifically indicated on the plans, existing conductors shall not be reused.

3.7 CONTROL WIRING INSTALLATION

A. Unless otherwise specified in other sections, install control wiring and connect to equipment to perform the required functions as specified or as shown on the drawings.

B. Install a separate power supply circuit for each system, except where otherwise shown on the drawings.

3.8 CONTROL WIRING IDENTIFICATION

A. Install a permanent wire marker on each wire at each termination.

B. Identifying numbers and letters on the wire markers shall correspond to those on the wiring diagrams used for installing the systems.

C. Wire markers shall retain their markings after cleaning.

D. In each manhole and handhole, install embossed brass tags to identify the system served and function.

3.9 ACCEPTANCE CHECKS AND TESTS

A. Perform in accordance with the manufacturer's recommendations. In addition, include the following:
   1. Visual Inspection and Tests: Inspect physical condition.
   2. Electrical tests:
      a. After installation but before connection to utilization devices, such as fixtures, motors, or appliances, test conductors phase-to-phase and phase-to-ground resistance with an insulation resistance tester. Existing conductors to be reused shall also be tested.
      b. Applied voltage shall be 500 V DC for 300 V rated cable, and 1000 V DC for 600 V rated cable. Apply test for one minute or until reading is constant for 15 seconds, whichever is longer. Minimum insulation resistance values shall not be less than 25 megohms for 300 V rated cable and 100 megohms for 600 V rated cable.
      c. Perform phase rotation test on all three-phase circuits.

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SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, connection, and testing of grounding and bonding equipment, indicated as grounding equipment in this section.

B. “Grounding electrode system” refers to grounding electrode conductors and all electrodes required or allowed by NEC, as well as made, supplementary, and lightning protection system grounding electrodes.

C. The terms “connect” and “bond” are used interchangeably in this section and have the same meaning.

1.2 RELATED WORK

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

B. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Low-voltage conductors.

C. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduit and boxes.

D. Section 26 24 16, PANELBOARDS: Low-voltage panelboards.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:
   1. Shop Drawings:
      a. Submit sufficient information to demonstrate compliance with drawings and specifications.
      b. Submit plans showing the location of system grounding electrodes and connections, and the routing of aboveground and underground grounding electrode conductors.
   2. Test Reports:
      a. Two weeks prior to the final inspection, submit ground resistance field test reports to the COR.
   3. Certifications:
      a. Certification by the Contractor that the grounding equipment has been properly installed and tested.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only. The latest edition as of the specification issue date shall govern.

B. American Society for Testing and Materials (ASTM):
   B1 ..... Standard Specification for Hard-Drawn Copper Wire

   B3 ..... Standard Specification for Soft or Annealed Copper Wire

B8 ..... Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

C. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
81 ..... IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System Part 1: Normal Measurements

D. National Fire Protection Association (NFPA):
70 ..... National Electrical Code (NEC)

70E ..... National Electrical Safety Code

99 ..... Health Care Facilities

E. Underwriters Laboratories, Inc. (UL):
44 ..... Thermoset-Insulated Wires and Cables

83 ..... Thermoplastic-Insulated Wires and Cables

467 ..... Grounding and Bonding Equipment

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING CONDUCTORS

A. Equipment grounding conductors shall be insulated stranded copper, except that sizes No. 10 AWG and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes No. 4 AWG and larger shall be identified per NEC.

B. Bonding conductors shall be bare stranded copper, except that sizes No. 10 AWG and smaller shall be bare solid copper. Bonding conductors shall be stranded for final connection to motors, transformers, and vibrating equipment.

C. Conductor sizes shall not be less than shown on the drawings, or not less than required by the NEC, whichever is greater.

D. Insulation: THHN-THWN and XHHW-2. XHHW-2 shall be used for isolated power systems.

2.2 GROUND RODS

A. Steel or copper clad steel, 19 mm (0.75 inch) diameter by 3 M (10 feet) long.

B. Quantity of rods shall be as shown on the drawings, and as required to obtain the specified ground resistance.

2.3 CONCRETE ENCASED ELECTRODE

A. Concrete encased electrode shall be No. 4 AWG bare copper wire, installed per NEC.

2.4 GROUND CONNECTIONS

A. Below Grade and Inaccessible Locations: Exothermic-welded type connectors.

B. Above Grade:
1. Bonding Jumpers: Listed for use with aluminum and copper conductors. For wire sizes No. 8 AWG and larger, use compression-type connectors. For wire sizes smaller than No. 8 AWG, use mechanical type lugs. Connectors or lugs shall use cadmium-plated steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.
2. Connection to Building Steel: Exothermic-welded type connectors.
3. Connection to Grounding Bus Bars: Listed for use with aluminum and copper conductors. Use mechanical type lugs, with cadmium-plated steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.

4. Connection to Equipment Rack and Cabinet Ground Bars: Listed for use with aluminum and copper conductors. Use mechanical type lugs, with cadmium-plated steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.

2.5 EQUIPMENT RACK AND CABINET GROUND BARS

A. Provide solid copper ground bars designed for mounting on the framework of open or cabinet-enclosed equipment racks. Ground bars shall have minimum dimensions of 6.3 mm (0.25 inch) thick x 19 mm (0.75 inch) wide, with length as required or as shown on the drawings. Provide insulators and mounting brackets.

2.6 GROUND TERMINAL BLOCKS

A. At any equipment mounting location (e.g., backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted, provide mechanical type lugs, with cadmium-plated steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.

2.7 GROUNDING BUS BAR

A. Pre-drilled rectangular copper bar with stand-off insulators, minimum 6.3 mm (0.25 inch) thick x 100 mm (4 inches) high in cross-section, length as shown on the drawings, with hole size, quantity, and spacing per detail shown on the drawings. Provide insulators and mounting brackets.

PART 3 - EXECUTION

3.1 GENERAL

A. Installation shall be in accordance with the NEC, as shown on the drawings, and manufacturer's instructions.

B. System Grounding:
   1. Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformer.
   2. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.

C. Equipment Grounding: Metallic piping, building structural steel, electrical enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits, shall be bonded and grounded.

D. For patient care area electrical power system grounding, conform to the latest NFPA 70 and 99.

3.2 INACCESSIBLE GROUNDING CONNECTIONS

A. Make grounding connections, which are normally buried or otherwise inaccessible, by exothermic weld.

3.3 MEDIUM-VOLTAGE EQUIPMENT AND CIRCUITS

A. Switchgear: Provide a bare grounding electrode conductor from the switchgear ground bus to the grounding electrode system.

B. Duct Banks and Manholes: Provide an insulated equipment grounding conductor in each duct containing medium-voltage conductors, sized per NEC except that minimum size shall be No. 2 AWG. Bond the equipment grounding conductors to the switchgear ground bus, to all manhole grounding provisions and hardware, to the cable shield grounding provisions of medium-voltage cable splices and terminations, and to equipment enclosures.

C. Pad-Mounted Transformers:

1. Provide a driven ground rod and bond with a grounding electrode conductor to the transformer grounding pad.
2. Ground the secondary neutral.

D. Lightning Arresters: Connect lightning arresters to the equipment ground bus or ground rods as applicable.

3.4 SECONDARY VOLTAGE EQUIPMENT AND CIRCUITS

A. Main Bonding Jumper: Bond the secondary service neutral to the ground bus in the service equipment.

B. Metallic Piping, Building Structural Steel, and Supplemental Electrode(s):
1. Provide a grounding electrode conductor sized per NEC between the service equipment ground bus and all metallic water pipe systems, building structural steel, and supplemental or made electrodes. Provide jumpers across insulating joints in the metallic piping.
2. Provide a supplemental ground electrode as shown on the drawings and bond to the grounding electrode system.

C. Switchgear, Switchboards, Unit Substations, Panelboards, Motor Control Centers, Engine-Generators, Automatic Transfer Switches, and other electrical equipment:
1. Connect the equipment grounding conductors to the ground bus.
2. Connect metallic conduits by grounding bushings and equipment grounding conductor to the equipment ground bus.

3.5 RACEWAY

A. Conduit Systems:
1. Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor.
2. Non-metallic conduit systems, except non-metallic feeder conduits that carry a grounded conductor from exterior transformers to interior or building-mounted service entrance equipment, shall contain an equipment grounding conductor.
3. Metallic conduit that only contains a grounding conductor, and is provided for its mechanical protection, shall be bonded to that conductor at the entrance and exit from the conduit.
4. Metallic conduits which terminate without mechanical connection to an electrical equipment housing by means of locknut and bushings or adapters, shall be provided with grounding bushings. Connect bushings with a equipment grounding conductor to the equipment ground bus.

B. Feeders and Branch Circuits: Install equipment grounding conductors with all feeders, and all branch circuits.

C. Boxes, Cabinets, Enclosures, and Panelboards:
1. Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes (except for special grounding systems for intensive care units and other critical units shown).
2. Provide lugs in each box and enclosure for equipment grounding conductor termination.

D. Wireway Systems:
1. Bond the metallic structures of wireway to provide electrical continuity throughout the wireway system, by connecting a No. 6 AWG bonding jumper at all intermediate metallic enclosures and across all section junctions.
2. Install insulated No. 6 AWG bonding jumpers between the wireway system, bonded as required above, and the closest building ground at each end and approximately every 16 M (50 feet).
3. Use insulated No. 6 AWG bonding jumpers to ground or bond metallic wireway at each end for all intermediate metallic enclosures and across all section junctions.

4. Use insulated No. 6 AWG bonding jumpers to ground cable tray to column-mounted building ground plates (pads) at each end and approximately every 15 M (49 feet).

E. Receptacles shall not be grounded through their mounting screws. Ground receptacles with a jumper from the receptacle green ground terminal to the device box ground screw and a jumper to the branch circuit equipment grounding conductor.

F. Ground lighting fixtures to the equipment grounding conductor of the wiring system. Fixtures connected with flexible conduit shall have a green ground wire included with the power wires from the fixture through the flexible conduit to the first outlet box.

G. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.

H. Raised Floors: Provide bonding for all raised floor components as shown on the drawings.

I. Panelboard Bonding in Patient Care Areas: The equipment grounding terminal buses of the normal and essential branch circuit panel boards serving the same individual patient vicinity shall be bonded together with an insulated continuous copper conductor not less than No. 10 AWG, installed in rigid metal conduit.

3.6 CORROSION INHIBITORS

A. When making grounding and bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.

3.7 CONDUCTIVE PIPING

A. Bond all conductive piping systems, interior and exterior, to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.

B. In operating rooms and at intensive care and coronary care type beds, bond the medical gas piping and medical vacuum piping at the outlets directly to the patient ground bus.

3.8 LIGHTNING PROTECTION SYSTEM

A. Bond the lightning protection system to the electrical grounding electrode system.

3.9 MAIN ELECTRICAL ROOM GROUNDING

A. Provide ground bus bar and mounting hardware at each main electrical room where incoming feeders are terminated, as shown on the drawings. Connect to pigtail extensions of the building grounding ring, as shown on the drawings.

3.10 GROUND RESISTANCE

A. Grounding system resistance to ground shall not exceed 5 ohms. Make any modifications or additions to the grounding electrode system necessary for compliance without additional cost to the Government. Final tests shall ensure that this requirement is met.

B. Grounding system resistance shall comply with the electric utility company ground resistance requirements.

3.11 GROUND ROD INSTALLATION

A. For outdoor installations, drive each rod vertically in the earth, until top of rod is 610 mm (24 inches) below final grade.

B. For indoor installations, leave 100 mm (4 inches) of each rod exposed.

C. Where buried or permanently concealed ground connections are required, make the connections by the exothermic process, to form solid metal joints. Make accessible ground connections with mechanical pressure-type ground connectors.

D. Where rock or impenetrable soil prevents the driving of vertical ground rods, install angled ground rods or grounding electrodes in horizontal trenches to achieve the specified ground resistance.

3.12 ACCEPTANCE CHECKS AND TESTS

A. Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE 81. Ground resistance measurements shall be made before the electrical distribution system is energized or connected to the electric utility company ground system, and shall be made in normally dry conditions not fewer than 48 hours after the last rainfall.

B. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

C. Below-grade connections shall be visually inspected by the COR prior to backfilling. The Contractor shall notify the COR 24 hours before the connections are ready for inspection.

---END---

SECTION 26 05 33
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, and connection of conduit, fittings, and boxes, to form complete, coordinated, grounded raceway systems. Raceways are required for all wiring unless shown or specified otherwise.

B. Definitions: The term conduit, as used in this specification, shall mean any or all of the raceway types specified.

1.2 RELATED WORK

A. Section 06 10 00, ROUGH CARPENTRY: Mounting board for telephone closets.

B. Section 07 60 00, FLASHING AND SHEET METAL: Fabrications for the deflection of water away from the building envelope at penetrations.

C. Section 07 84 00, FIRESTOPPING: Sealing around penetrations to maintain the integrity of fire rated construction.

D. Section 07 92 00, JOINT SEALANTS: Sealing around conduit penetrations through the building envelope to prevent moisture migration into the building.

E. Section 09 91 00, PAINTING: Identification and painting of conduit and other devices.

F. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Conduits bracing.

G. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.

H. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

I. Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION: Underground conduits.

J. Section 31 20 11, EARTHWORK (SHORT FORM): Bedding of conduits.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:
   1. Shop Drawings:
      a. Size and location of main feeders.
      b. Size and location of panels and pull-boxes.
      c. Layout of required conduit penetrations through structural elements.
      d. Submit the following data for approval:
         1) Raceway types and sizes.
         2) Conduit bodies, connectors and fittings.
         3) Junction and pull boxes, types and sizes.
   2. Certifications: Two weeks prior to final inspection, submit the following:
      a. Certification by the manufacturer that raceways, conduits, conduit bodies, connectors, fittings, junction and pull boxes, and all related equipment conform to the requirements of the drawings and specifications.

b. Certification by the Contractor that raceways, conduits, conduit bodies, connectors, fittings, junction and pull boxes, and all related equipment have been properly installed.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only. The latest edition as of the specification issue date shall govern.

B. American Iron and Steel Institute (AISI):
S100 ..... North American Specification for the Design of Cold-Formed Steel Structural Members

C. National Electrical Manufacturers Association (NEMA):
C80.1 ..... Electrical Rigid Steel Conduit
C80.3 ..... Steel Electrical Metal Tubing
C80.6 ..... Electrical Intermediate Metal Conduit
FB1 ..... Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable
FB2.10 ..... Selection and Installation Guidelines for Fittings for use with Non-Flexible Conduit or Tubing (Rigid Metal Conduit, Intermediate Metallic Conduit, and Electrical Metallic Tubing)
FB2.20 ..... Selection and Installation Guidelines for Fittings for use with Flexible Electrical Conduit and Cable
TC-2 ..... Electrical Polyvinyl Chloride (PVC) Tubing and Conduit
TC-3 ..... PVC Fittings for Use with Rigid PVC Conduit and Tubing

D. National Fire Protection Association (NFPA):
70 ..... National Electrical Code (NEC)

E. Underwriters Laboratories, Inc. (UL):
1 ..... Flexible Metal Conduit
5 ..... Surface Metal Raceway and Fittings
6 ..... Electrical Rigid Metal Conduit - Steel
50 ..... Enclosures for Electrical Equipment
360 ..... Liquid-Tight Flexible Steel Conduit
467 ..... Grounding and Bonding Equipment
514A ..... Metallic Outlet Boxes
514B ..... Conduit, Tubing, and Cable Fittings
514C ..... Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers
651 ..... Schedule 40 and 80 Rigid PVC Conduit and Fittings
651A ..... Type EB and A Rigid PVC Conduit and HDPE Conduit
797 ..... Electrical Metallic Tubing
1242 ..... Electrical Intermediate Metal Conduit - Steel

PART 2 - PRODUCTS

2.1 MATERIAL

A. Conduit Size: In accordance with the NEC, but not less than 13 mm (0.5-inch) unless otherwise shown. Where permitted by the NEC, 13 mm (0.5-inch) flexible conduit may be used for tap connections to recessed lighting fixtures.

B. Conduit:
   1. Size: In accordance with the NEC, but not less than 13 mm (0.5-inch).
   2. Rigid Steel Conduit (RMC): Shall conform to UL 6 and NEMA C80.1.
   3. Rigid Intermediate Steel Conduit (IMC): Shall conform to UL 1242 and NEMA C80.6.
   4. Electrical Metallic Tubing (EMT): Shall conform to UL 797 and NEMA C80.3. Maximum size not to exceed 105 mm (4 inches) and shall be permitted only with cable rated 600 V or less.
   5. Flexible Metal Conduit: Shall conform to UL 1.
   6. Liquid-tight Flexible Metal Conduit: Shall conform to UL 360.
   7. Direct Burial Plastic Conduit: Shall conform to UL 651 and UL 651A, heavy wall PVC or high density polyethylene (PE).
   8. Surface Metal Raceway: Shall conform to UL 5.

C. Conduit Fittings:
   1. Rigid Steel and Intermediate Metallic Conduit Fittings:
      a. Fittings shall meet the requirements of UL 514B and NEMA FB1.
      b. Standard threaded couplings, locknuts, bushings, conduit bodies, and elbows: Only steel or malleable iron materials are acceptable. Integral retractable type IMC couplings are also acceptable.
      c. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.
      d. Bushings: Metallic insulating type, consisting of an insulating insert, molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.
      e. Erickson (Union-Type) and Set Screw Type Couplings: Approved for use in concrete are permitted for use to complete a conduit run where conduit is installed in concrete. Use set screws of case-hardened steel with hex head and cup point to firmly seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.
      f. Sealing Fittings: Threaded cast iron type. Use continuous drain-type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank cover plates having the same finishes as that of other electrical plates in the room.
   2. Electrical Metallic Tubing Fittings:
      a. Fittings and conduit bodies shall meet the requirements of UL 514B, NEMA C80.3, and NEMA FB1.
      b. Only steel or malleable iron materials are acceptable.
      c. Compression Couplings and Connectors: Concrete-tight and rain-tight, with connectors having insulated throats.
      d. Indent-type connectors or couplings are prohibited.
      e. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.
   3. Flexible Metal Conduit Fittings:
      a. Conform to UL 514B. Only steel or malleable iron materials are acceptable.
      b. Clamp-type, with insulated throat.
   4. Liquid-tight Flexible Metal Conduit Fittings:
      a. Fittings shall meet the requirements of UL 514B and NEMA FB1.
      b. Only steel or malleable iron materials are acceptable.

c. Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.

5. Direct Burial Plastic Conduit Fittings: Fittings shall meet the requirements of UL 514C and NEMA TC3.
6. Surface Metal Raceway Fittings: As recommended by the raceway manufacturer. Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, conduit entry fittings, accessories, and other fittings as required for complete system.
7. Expansion and Deflection Couplings:
   a. Conform to UL 467 and UL 514B.
   b. Accommodate a 19 mm (0.75-inch) deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.
   c. Include internal flexible metal braid, sized to guarantee conduit ground continuity and a low-impedance path for fault currents, in accordance with UL 467 and the NEC tables for equipment grounding conductors.
   d. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat-resistant molded rubber material with stainless steel jacket clamps.

D. Conduit Supports:
1. Parts and Hardware: Zinc-coat or provide equivalent corrosion protection.
2. Individual Conduit Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.
3. Multiple Conduit (Trapeze) Hangers: Not less than 38 mm x 38 mm (1.5 x 1.5 inches), 12-gauge steel, cold-formed, lipped channels; with not less than 9 mm (0.375-inch) diameter steel hanger rods.
4. Solid Masonry and Concrete Anchors: Self-drilling expansion shields, or machine bolt expansion.

E. Outlet, Junction, and Pull Boxes:
1. Comply with UL-50 and UL-514A.
2. Rustproof cast metal where required by the NEC or shown on drawings.
3. Sheet Metal Boxes: Galvanized steel, except where shown on drawings.

F. Metal Wireways: Equip with hinged covers, except as shown on drawings. Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for a complete system.

PART 3 - EXECUTION

3.1 PENETRATIONS

A. Cutting or Holes:
1. Cut holes in advance where they should be placed in the structural elements, such as ribs or beams. Obtain the approval of the COR prior to drilling through structural elements.
2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammers, impact electric, hand, or manual hammer-type drills are not allowed, except when permitted by the COR where working space is limited.

B. Firestop: Where conduits, wireways, and other electrical raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING.

C. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal the gap around conduit to render it watertight, as specified in Section 07 92 00, JOINT SEALANTS.

3.2 INSTALLATION, GENERAL

A. In accordance with NEC, NEMA, UL, as shown on drawings, and as specified herein.

B. Raceway systems used for Essential Electrical Systems (EES) shall be entirely independent of other raceway systems.

C. Install conduit as follows:
   1. In complete mechanically and electrically continuous runs before pulling in cables or wires.
   2. Unless otherwise indicated on the drawings or specified herein, installation of all conduits shall be concealed within finished walls, floors, and ceilings.
   3. Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new conduits.
   4. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.
   5. Cut conduits square, ream, remove burrs, and draw up tight.
   6. Independently support conduit at 2.4 M (8 feet) on centers with specified materials and as shown on drawings.
   7. Do not use suspended ceilings, suspended ceiling supporting members, lighting fixtures, other conduits, cable tray, boxes, piping, or ducts to support conduits and conduit runs.
   8. Support within 300 mm (12 inches) of changes of direction, and within 300 mm (12 inches) of each enclosure to which connected.
   9. Close ends of empty conduits with plugs or caps at the rough-in stage until wires are pulled in, to prevent entry of debris.
   10. Conduit installations under fume and vent hoods are prohibited.
   11. Secure conduits to cabinets, junction boxes, pull-boxes, and outlet boxes with bonding type locknuts. For rigid steel and IMC conduit installations, provide a locknut on the inside of the enclosure, made up wrench tight. Do not make conduit connections to junction box covers.
   12. Flashing of penetrations of the roof membrane is specified in Section 07 60 00, FLASHING AND SHEET METAL.
   13. Conduit bodies shall only be used for changes in direction, and shall not contain splices.

D. Conduit Bends:
   1. Make bends with standard conduit bending machines.
   2. Conduit hickey may be used for slight offsets and for straightening stubbed out conduits.
   3. Bending of conduits with a pipe tee or vise is prohibited.

E. Layout and Homeruns:
   1. Install conduit with wiring, including homeruns, as shown on drawings.
   2. Deviations: Make only where necessary to avoid interferences and only after drawings showing the proposed deviations have been submitted and approved by the COR.

3.3 CONCEALED WORK INSTALLATION

A. In Concrete:
   1. Conduit: Rigid steel, IMC, or EMT. Do not install EMT in concrete slabs that are in contact with soil, gravel, or vapor barriers.
   2. Align and run conduit in direct lines.
   3. Install conduit through concrete beams only:
      a. Where shown on the structural drawings.
      b. As approved by the COR prior to construction, and after submittal of drawing showing location, size, and position of each penetration.
   4. Installation of conduit in concrete that is less than 75 mm (3 inches) thick is prohibited.
      a. Conduit outside diameter larger than one-third of the slab thickness is prohibited.
      b. Space between conduits in slabs: Approximately six conduit diameters apart, and one conduit diameter at conduit crossings.

c. Install conduits approximately in the center of the slab so that there will be a minimum of 19 mm (0.75-inch) of concrete around the conduits.

5. Make couplings and connections watertight. Use thread compounds that are UL approved conductive type to ensure low resistance ground continuity through the conduits. Tightening setscrews with pliers is prohibited.

B. Above Furred or Suspended Ceilings and in Walls:
1. Conduit for Conductors Above 600 V: Rigid steel. Mixing different types of conduits in the same system is prohibited.
2. Conduit for Conductors 600 V and Below: Rigid steel, IMC, or EMT. Mixing different types of conduits in the same system is prohibited.
3. Align and run conduit parallel or perpendicular to the building lines.
4. Connect recessed lighting fixtures to conduit runs with maximum 1.8 M (6 feet) of flexible metal conduit extending from a junction box to the fixture.
5. Tightening set screws with pliers is prohibited.
6. For conduits running through metal studs, limit field cut holes to no more than 70% of web depth. Spacing between holes shall be at least 457 mm (18 inches). Cuts or notches in flanges or return lips shall not be permitted.

3.4 EXPOSED WORK INSTALLATION

A. Unless otherwise indicated on drawings, exposed conduit is only permitted in mechanical and electrical rooms.

B. Conduit for Conductors Above 600 V: Rigid steel. Mixing different types of conduits in the system is prohibited.

C. Conduit for Conductors 600 V and Below: Rigid steel, IMC, or EMT. Mixing different types of conduits in the system is prohibited.

D. Align and run conduit parallel or perpendicular to the building lines.

E. Install horizontal runs close to the ceiling or beams and secure with conduit straps.

F. Support horizontal or vertical runs at not over 2.4 M (8 feet) intervals.

G. Surface Metal Raceways: Use only where shown on drawings.

H. Painting:
1. Paint exposed conduit as specified in Section 09 91 00, PAINTING.
2. Paint all conduits containing cables rated over 600 V safety orange. Refer to Section 09 91 00, PAINTING for preparation, paint type, and exact color. In addition, paint legends, using 50 mm (2 inch) high black numerals and letters, showing the cable voltage rating. Provide legends where conduits pass through walls and floors and at maximum 6 M (20 feet) intervals in between.

3.5 HAZARDOUS LOCATIONS

A. Use rigid steel conduit only.

B. Install UL approved sealing fittings that prevent passage of explosive vapors in hazardous areas equipped with explosion-proof lighting fixtures, switches, and receptacles, as required by the NEC.

3.6 WET OR DAMP LOCATIONS

A. Use rigid steel or IMC conduits unless as shown on drawings.

B. Provide sealing fittings to prevent passage of water vapor where conduits pass from warm to cold locations, i.e., refrigerated spaces, constant-temperature rooms, air-conditioned spaces, building exterior walls, roofs, or similar spaces.

C. Use rigid steel or IMC conduit within 1.5 M (5 feet) of the exterior and below concrete building slabs in contact with soil, gravel, or vapor barriers, unless as shown on drawings. Conduit shall

be half-lapped with 10 mil PVC tape before installation. After installation, completely recoat or retape any damaged areas of coating.

D. Conduits run on roof shall be supported with integral galvanized lipped steel channel, attached to UV-inhibited polycarbonate or polypropylene blocks every 2.4 M (8 feet) with 9 mm (3/8-inch) galvanized threaded rods, square washer and locknut. Conduits shall be attached to steel channel with conduit clamps.

3.7 MOTORS AND VIBRATING EQUIPMENT

A. Use flexible metal conduit for connections to motors and other electrical equipment subject to movement, vibration, misalignment, cramped quarters, or noise transmission.

B. Use liquid-tight flexible metal conduit for installation in exterior locations, moisture or humidity laden atmosphere, corrosive atmosphere, water or spray wash-down operations, inside airstream of HVAC units, and locations subject to seepage or dripping of oil, grease, or water.

C. Provide a green equipment grounding conductor with flexible and liquid-tight flexible metal conduit.

3.8 EXPANSION JOINTS

A. Conduits 75 mm (3 inch) and larger that are secured to the building structure on opposite sides of a building expansion joint require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.

B. Provide conduits smaller than 75 mm (3 inch) with junction boxes on both sides of the expansion joint. Connect flexible metal conduits to junction boxes with sufficient slack to produce a 125 mm (5 inch) vertical drop midway between the ends of the flexible metal conduit. Flexible metal conduit shall have a green insulated copper bonding jumper installed. In lieu of this flexible metal conduit, expansion and deflection couplings as specified above are acceptable.

C. Install expansion and deflection couplings where shown.

D. Seismic Areas: In seismic areas, provide conduits rigidly secured to the building structure on opposite sides of a building expansion joint with junction boxes on both sides of the joint. Connect conduits to junction boxes with 375 mm (15 inches) of slack flexible conduit. Flexible conduit shall have a copper bonding jumper installed.

3.9 CONDUIT SUPPORTS

A. Safe working load shall not exceed one-quarter of proof test load of fastening devices.

B. Use pipe straps or individual conduit hangers for supporting individual conduits.

C. Support multiple conduit runs with trapeze hangers. Use trapeze hangers that are designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and an additional 90 kg (200 lbs). Attach each conduit with U-bolts or other approved fasteners.

D. Support conduit independently of junction boxes, pull-boxes, fixtures, suspended ceiling T-bars, angle supports, and similar items.

E. Fasteners and Supports in Solid Masonry and Concrete:
   1. New Construction: Use steel or malleable iron concrete inserts set in place prior to placing the concrete.
   2. Existing Construction:
      a. Steel expansion anchors not less than 6 mm (0.25-inch) bolt size and not less than 28 mm (1.125 inch) in embedment.
      b. Power set fasteners not less than 6 mm (0.25-inch) diameter with depth of penetration not less than 75 mm (3 inch).
      c. Use vibration and shock-resistant anchors and fasteners for attaching to concrete ceilings.

F. Hollow Masonry: Toggle bolts.

G. Bolts supported only by plaster or gypsum wallboard are not acceptable.

H. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.

I. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.

J. Chain, wire, or perforated strap shall not be used to support or fasten conduit.

K. Spring steel type supports or fasteners are prohibited for all uses except horizontal and vertical supports/fasteners within walls.

L. Vertical Supports: Vertical conduit runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

3.10 BOX INSTALLATION

A. Boxes for Concealed Conduits:
   1. Flush-mounted.
   2. Provide raised covers for boxes to suit the wall or ceiling, construction, and finish.

B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling-in operations or where more than the equivalent of 4-90 degree bends are necessary.

C. Locate pullboxes so that covers are accessible and easily removed. Coordinate locations with piping and ductwork where installed above ceilings.

D. Remove only knockouts as required. Plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.

E. Outlet boxes mounted back-to-back in the same wall are prohibited. A minimum 600 mm (24 inch) center-to-center lateral spacing shall be maintained between boxes.

F. Flush-mounted wall or ceiling boxes shall be installed with raised covers so that the front face of raised cover is flush with the wall. Surface-mounted wall or ceiling boxes shall be installed with surface-style flat or raised covers.

G. Minimum size of outlet boxes for ground fault circuit interrupter (GFCI) receptacles is 100 mm (4 inches) square x 55 mm (2.125 inches) deep, with device covers for the wall material and thickness involved.

H. Stencil or install phenolic nameplates on covers of the boxes identified on riser diagrams; for example "ELECTRICAL PB No. 1."

I. On all branch circuit junction box covers, identify the circuits with black marker.

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SECTION 26 05 39
UNDERFLOOR RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, and connection of the underfloor raceways to form a complete, coordinated, grounded raceway system.

1.2 RELATED WORK

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

B. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Low-voltage conductors.

C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.

D. Section 26 27 26, WIRING DEVICES: Wiring devices installed as part of the underfloor raceway system.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:
   1. Shop Drawings:
      a. Submit sufficient information to demonstrate compliance with drawings and specifications.
      b. Provide plan drawings, section drawings, and details.
      c. Identify components and accessories such as expansion-joint assemblies, straight raceway lengths, inserts, junction boxes, and service fittings.
      d. Provide dimensions locating raceway components. Include spacing between preset inserts and between preset inserts and ends of raceway runs, walls, and columns.
      e. Show connections between raceways and adjacent structural and architectural elements including slab reinforcement, floor finish work, permanent partitions, and pre-tensioning or post-tensioning components.
      f. Indicate height of preset inserts, junction boxes, and raceways coordinated with depth of concrete slab.
      g. Indicate required floor slab thickness for encasement of raceways.
      h. Show details of connections of underfloor raceways to conduits.
   2. Manuals:
      a. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals, including technical data sheets and information for ordering replacement parts.
      b. Manuals shall include information on locating and installing preset and afterset inserts.
      c. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.
   3. As-built Drawings:

a. Deliver drawings to the COR showing the exact location of all underfloor ducts and junction boxes dimensioned from the centerline of building columns.
b. Show the location and circuiting of all power outlet fittings.
c. Show the location of all telecommunications fittings.

4. Certifications: Two weeks prior to final inspection, submit the following.
   a. Certification by the manufacturer that the underfloor raceways conform to the requirements of the drawings and specifications.
   b. Certification by the Contractor that the underfloor raceways have been properly installed and adjusted.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only. The latest edition as of the specification issue date shall govern.

B. National Fire Protection Association (NFPA):
   70 .....National Electrical Code (NEC)

C. Underwriters Laboratories, Inc. (UL):
   884 .....Underfloor Raceways and Fittings

PART 2 - PRODUCTS

2.1 RACEWAYS

A. Raceways shall comply with NFPA, UL, and as shown on the drawings.

B. Raceways:

1. The raceway shall have minimum outside dimensions of 6-1/2 inches x 1-1/2 inches.
2. Preset inserts shall be spaced 600 mm (24 inches) on centers and shall not be less than 58 mm (2-1/4 inches) in diameter.
3. Raceways shall not be less than No. 16 gauge steel, continuously welded, with corrosion resistant coating, inside and outside.
4. Raceway covers shall be minimum 6mm (1/4 inch) thick steel, with tile trim.
5. Shall have rounded corners.
6. Raceways shall have vertical 90 degree elbows as required.
7. Raceways shall have horizontal 90 degree and 45 degree elbows and tees as required.
8. Raceways shall have all fittings and accessories for a complete installation, such as adjustable supports, connectors, end closures, panel risers, covers, tile and carpet trims, etc.
9. Power and telecommunications raceways shall be separate.
10. Raceways shall provide a 50 mm (2 inch) minimum bending radius for telecommunication cables.

C. Junction Boxes:
   1. Shall be cast metal or formed steel, with corner conduit adapters.
   2. Each box shall have four screws for adjustment and leveling after installation.
   3. Boxes shall have adjustable covers.
   4. Coverplates shall be removable and the proper depth for and coordinated with the floor coverings and finishes.

D. Service fittings:
   1. Shall be the low compact type, satin-finished aluminum.
   2. Power outlets shall have receptacles as indicated and as specified in Section 26 27 26, WIRING DEVICES.

3. Telecommunications outlets shall have dimensions which are approximately the same as the power outlets. Data, telephone and other telecommunications jacks shall be as required by the applicable specifications.
4. Include mounting, hinged cover, and trim to support and provide access to connector, jack, or receptacle devices mounted flush with floor within insert.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the NEC, manufacturers recommendations, and as shown on the drawings.

B. Connect the raceways, boxes, and fittings so they are mechanically firm, electrically continuous, and watertight.

C. Align, level, and make the raceways parallel to or at right angles with the building walls.

D. Level raceways with floor slab, including height adjustments for floor finishes.

E. Raceways shall be free from burrs, sharp edges, dents and other defects.

F. Cap or plug unused openings with standard fittings.

G. Fasten the junction boxes firmly in place to prevent their movement during pouring of the slabs.

H. Raceway systems shall be supported at not more than 1500 mm (five feet) on centers.

I. Specific methods of installing the raceways shall be demonstrated to and approved by the COR prior to performing the installation.

J. Branch circuit wiring shall be the same as that specified for wet locations in Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.

K. Ground raceway system.

L. Seal the raceway system, and prevent water, concrete, or other materials from entering the raceway system during floor construction.

M. Protect underfloor raceway system from damage. Do not use the installed raceway system as working platforms or walkways. Do not allow equipment or heavy traffic over raceway during construction without first installing ramps over the raceway. Ramps shall be designed so that imposed loads are not transferred to the duct. Components of the system which are damaged during construction shall be replaced.

N. Provide expansion fittings with suitable bonding jumper where raceway crosses building expansion joints.

O. Install junction box tops flush and level with finished floor. Install blank closure plates or plugs to close unused junction box openings. Grout boxes in place to prevent movement during construction. Place top covers in inverted position during construction to prevent damage to surface of cover. Reinstall covers in proper position prior to final acceptance of work.

3.2 ACCEPTANCE CHECKS AND TESTS

A. Perform manufacturer’s required field checks in accordance with the manufacturer's recommendations. In addition, include the following:
   1. Visual Inspection and Tests:
      a. Inspect physical and electrical condition.
      b. Vacuum-clean raceway interior.
      c. Wipe clean raceway exterior.

3.3 FOLLOW-UP VERIFICATION

A. Upon completion of acceptance checks, the Contractor shall show by demonstration in service that the raceway is in good operating condition and properly performing the intended functions.

---END---

SECTION 26 05 41
UNDERGROUND ELECTRICAL CONSTRUCTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, and connection of underground ducts and raceways, and precast manholes and pullboxes to form a complete underground electrical raceway system.

B. The terms “duct” and “conduit” are used interchangeably in this section.

1.2 RELATED WORK

A. Section 07 92 00, JOINT SEALANTS: Sealing of conduit penetrations.

B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

D. Section 31 20 11, EARTHWORK (SHORT FORM): Trenching, backfill, and compaction.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

B. Coordinate layout and installation of ducts, manholes, and pullboxes with final arrangement of other utilities, site grading, and surface features.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:
   1. Shop Drawings:
      a. Submit sufficient information to demonstrate compliance with drawings and specifications.
      b. Submit information on manholes, pullboxes, ducts, and hardware. Submit manhole plan and elevation drawings, showing openings, pulling irons, cable supports, cover, ladder, sump, and other accessories.
      c. Proposed deviations from the drawings shall be clearly marked on the submittals. If it is necessary to locate manholes, pullboxes, or duct banks at locations other than shown on the drawings, show the proposed locations accurately on scaled site drawings, and submit to the COR for approval prior to construction.
   2. Certifications: Two weeks prior to the final inspection, submit the following.
      a. Certification by the manufacturer that the materials conform to the requirements of the drawings and specifications.
      b. Certification by the Contractor that the materials have been properly installed, connected, and tested.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only. The latest edition as of the specification issue date shall govern.

B. American Concrete Institute (ACI):

Building Code Requirements for Structural Concrete

318-19/318M-19 ..... Building Code Requirements for Structural Concrete & Commentary

MNL-66-20 ..... ACI Detailing Manual

C. American National Standards Institute (ANSI):
77-17 ..... Underground Enclosure Integrity

D. American Society for Testing and Materials (ASTM):
C478/C478M ..... Standard Specification for Precast Reinforced Concrete Manhole Sections

C858 ..... Underground Precast Concrete Utility Structures

C990/C990M-25 ..... Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants.

E. National Electrical Manufacturers Association (NEMA):
TC 2 ..... Electrical Polyvinyl Chloride (PVC) Conduit

TC 3 ..... Polyvinyl Chloride (PVC) Fittings for Use With Rigid PVC Conduit And Tubing

TC 6 & 8 ..... Polyvinyl Chloride (PVC) Plastic Utilities Duct For Underground Installations

TC 9 ..... Fittings For Polyvinyl Chloride (PVC) Plastic Utilities Duct For Underground Installation

F. National Fire Protection Association (NFPA):
70 ..... National Electrical Code (NEC)

70E ..... National Electrical Safety Code

G. Underwriters Laboratories, Inc. (UL):
6 ..... Electrical Rigid Metal Conduit-Steel

467 ..... Grounding and Bonding Equipment

651 ..... Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings

651A ..... Schedule 40 and 80 High Density Polyethylene (HDPE) Conduit

PART 2 - PRODUCTS

2.1 PULLBOXES

A. General: Size as indicated on the drawings. Provide pullboxes with weatherproof, non-skid covers with recessed hook eyes, secured with corrosion- and tamper-resistant hardware. Cover material shall be identical to pullbox material. Covers shall have molded lettering, ELECTRIC, as applicable. Pullboxes shall comply with the requirements of ANSI 77 Tier 15 loading. Provide pulling irons, 22 mm (0.875 inch) diameter galvanized steel bar with exposed triangular-shaped opening.

B. Polymer Concrete Pullboxes: Shall be molded of sand, aggregate, and polymer resin, and reinforced with steel, fiberglass, or both. Pullbox shall have open bottom.

C. Fiberglass Pullboxes: Shall be sheet-molded, fiberglass-reinforced, polyester resin enclosure joined to polymer concrete top ring or frame.

D. Concrete Pullboxes: Shall be monolithically-poured reinforced concrete.

2.2 DUCTS

A. Number and sizes shall be as shown on the drawings.

B. Ducts (concrete-encased):
   1. Plastic Duct:
      a. UL 651 and 651A Schedule 40 PVC conduit.
      b. Duct shall be suitable for use with 90˚ C (194˚ F) rated conductors.
   2. Conduit Spacers: Prefabricated plastic.

C. Ducts (direct-burial):
   1. Plastic duct:
      a. UL 651, 651A, and 651B, Schedule 80 PVC or HDPE conduit.
      b. Duct shall be suitable for use with 75˚ C (167˚ F) rated conductors.
   2. Rigid metal conduit: UL 6 and NEMA RN1 galvanized rigid metal, half-lap wrapped with 10 mil PVC tape.

2.3 GROUNDING

A. Ground Rods and Ground Wire: Per Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

2.4 WARNING TAPE

A. 4-mil polyethylene 75 mm (3 inches) wide detectable tape, red with black letters, imprinted with “CAUTION - BURIED ELECTRIC CABLE BELOW” or similar.

2.5 PULL ROPE FOR SPARE DUCTS

A. Plastic with 890 N (200 lb) minimum tensile strength.

PART 3 - EXECUTION

3.1 MANHOLE AND PULLBOX INSTALLATION

A. Assembly and installation shall be per the requirements of the manufacturer.
   1. Install manholes and pullboxes level and plumb.
   2. Units shall be installed on a 300 mm (12 inches) thick level bed of 90% compacted granular fill, well-graded from the 25 mm (1 inch) sieve to the No. 4 sieve. Granular fill shall be compacted with a minimum of four passes with a plate compactor.

B. Access: Ensure the top of frames and covers are flush with finished grade.

C. Grounding in Manholes:
   1. Ground Rods in Manholes: Drive a ground rod into the earth, through the floor sleeve, after the manhole is set in place. Fill the sleeve with sealant to make a watertight seal. Rods shall protrude approximately 100 mm (4 inches) above the manhole floor.
   2. Install a No. 3/0 AWG bare copper ring grounding conductor around the inside perimeter of the manhole and anchor to the walls with metallic cable clips.
   3. Connect the ring grounding conductor to the ground rod by an exothermic welding process.
   4. Bond the ring grounding conductor to the duct bank equipment grounding conductors, the exposed non-current carrying metal parts of racks, sump covers, and like items in the manholes with a minimum No. 6 AWG bare copper jumper using an exothermic welding process.

3.2 TRENCHING

A. Refer to Section 31 20 11 EARTH MOVING (SHORT FORM) for trenching, backfilling, and compaction.

B. Before performing trenching work at existing facilities, a Ground Penetrating Radar Survey shall be carefully performed by a certified technician to reveal all existing underground ducts, conduits, cables, and other utility systems.

C. Work with extreme care near existing ducts, conduits, and other utilities to avoid damaging them.

D. Cut the trenches neatly and uniformly.

E. For Concrete-Encased Ducts:
   1. After excavation of the trench, stakes shall be driven in the bottom of the trench at 1.2 M (4 feet) intervals to establish the grade and route of the duct bank.
   2. Pitch the trenches uniformly toward manholes or both ways from high points between manholes for the required duct line drainage. Avoid pitching the ducts toward buildings wherever possible.
   3. The walls of the trench may be used to form the side walls of the duct bank, provided that the soil is self-supporting and that the concrete envelope can be poured without soil inclusions. Forms are required where the soil is not self-supporting.
   4. After the concrete-encased duct has sufficiently cured, the trench shall be backfilled to grade with earth, and appropriate warning tape installed.

F. Individual conduits to be installed under existing paved areas and roads that cannot be disturbed shall be jacked into place using rigid metal conduit, or bored using plastic utilities duct or PVC conduit, as approved by the COR.

3.3 DUCT INSTALLATION

A. General Requirements:
   1. Ducts shall be in accordance with the NEC, as shown on the drawings, and as specified.
   2. Join and terminate ducts with fittings recommended by the manufacturer.
   3. Slope ducts to drain towards manholes and pullboxes, and away from building and equipment entrances. Pitch not less than 100 mm (4 inches) in 30 M (100 feet).
   4. Below building foundation slab: Underground conduit stub-ups and sweeps to medium and low voltage electrical power distribution equipment, or all electrically operated equipment located inside of buildings shall be galvanized rigid metal conduit half-lap wrapped with PVC tape, shall extend a minimum of 1.5 M (5 feet) outside the building foundation, and shall run below building foundation slab at a minimum 610 mm (24 inches) below bottom of slab from top of conduits.
   5. Outdoor concrete slab: Underground conduit stub-ups and sweeps to medium and low voltage electrical power distribution equipment, or all electrically operated equipment mounted on outdoor concrete slabs shall be galvanized rigid metal conduit half-lap wrapped with PVC tape, and shall extend a minimum of 1.5 M (5 feet) away from the edge of slab.
   6. Install insulated grounding bushings on the conduit terminations.
   7. Radius for sweeps shall be sufficient to accomplish pulls without damage. Minimum radius shall be six times conduit diameter.
   8. All multiple conduit runs shall have conduit spacers. Spacers shall securely support and maintain uniform spacing of the duct assembly a minimum of 75 mm (3 inches) above the bottom of the trench during the concrete pour. Spacer spacing shall not exceed 1.5 M (5 feet). Secure spacers to ducts and earth to prevent floating during concrete pour. Provide nonferrous tie wires to prevent displacement of the ducts during concrete pour. Tie wires shall not act as substitute for spacers.
   9. Duct lines shall be installed no less than 300 mm (12 inches) from other utility systems, such as water, sewer, chilled water.
   10. Clearances between individual ducts:
      a. For similar services, not less than 75 mm (3 inches).
      b. For power and signal services, not less than 150 mm (6 inches).
   11. Duct lines shall terminate at window openings in manhole walls as shown on the drawings. All ducts shall be fitted with end bells.
   12. Couple the ducts with proper couplings. Stagger couplings in rows and layers to ensure maximum strength and rigidity of the duct bank.

13. Keep ducts clean of earth, sand, or gravel, and seal with tapered plugs upon completion of each portion of the work.
14. Spare Ducts: Where spare ducts are shown, they shall have a nylon pull rope installed. They shall be capped at each end and labeled as to location of the other end.
15. Duct Identification: Place continuous strip of warning tape approximately 300 mm (12 inches) above ducts before backfilling trenches. Warning tape shall be preprinted with proper identification.
16. Duct Sealing: Seal ducts, including spare ducts, at building entrances and at outdoor terminations for equipment, with a suitable non-hardening compound to prevent the entrance of foreign objects and material, moisture, and gases.
17. Use plastic ties to secure cables to insulators on cable arms. Use minimum two ties per cable per insulator.

B. Concrete-Encased Ducts:
1. Install concrete-encased ducts for medium-voltage systems, low-voltage systems, and signal systems, unless otherwise shown on the drawings.
2. Duct banks shall be single or multiple duct assemblies encased in concrete. Ducts shall be uniform in size and material throughout the installation.
3. Tops of concrete-encased ducts shall be:
   a. Not less than 600 mm (24 inches) and not less than shown on the drawings, below finished grade.
   b. Not less than 750 mm (30 inches) and not less than shown on the drawings, below roads and other paved surfaces.
   c. Additional burial depth shall be required in order to accomplish NEC-required minimum bend radius of ducts.
   d. Conduits crossing under grade slab construction joints shall be installed a minimum of 1.2 M (4 feet) below slab.
4. Extend the concrete envelope encasing the ducts not less than 75 mm (3 inches) beyond the outside walls of the outer ducts.
5. Within 3 M (10 feet} of building and manhole wall penetrations, install reinforcing steel bars at the top and bottom of each concrete envelope to provide protection against vertical shearing.
6. Install reinforcing steel bars at the top and bottom of each concrete envelope of all ducts underneath roadways and parking areas.
7. Where new ducts and concrete envelopes are to be joined to existing manholes, pullboxes, ducts, and concrete envelopes, make the joints with the proper fittings and fabricate the concrete envelopes to ensure smooth durable transitions.
8. Duct joints in concrete may be placed side by side horizontally, but shall be staggered at least 150 mm (6 inches) vertically.
9. Pour each run of concrete envelope between manholes or other terminations in one continuous pour. If more than one pour is necessary, terminate each pour in a vertical plane and install 19 mm (0.75 inch) reinforcing rod dowels extending 450 mm (18 inches) into concrete on both sides of joint near corners of envelope.
10. Pour concrete so that open spaces are uniformly filled. Do not agitate with power equipment unless approved by COR.

C. Direct-Burial Ducts: Direct-burial ducts are only allowed for low-voltage power and lighting branch circuits for site power and lighting. Install direct-burial ducts only where shown on the drawings Connections to Manholes: Ducts connecting to manholes shall be flared to have an enlarged cross-section to provide additional shear strength. Dimensions of the flared cross-section shall be larger than the corresponding manhole opening dimensions by no less than 300 mm (12 inches) in each direction. Perimeter of the duct bank opening in the manhole shall be flared toward the inside or keyed to provide a positive interlock between the duct and the wall of the manhole. Use vibrators when this portion of the encasement is poured to ensure a seal between the envelope and the wall of the structure.

D. Connections to Existing Manholes: For duct connections to existing manholes, break the structure wall out to the dimensions required and preserve the steel in the structure wall. Cut steel and extend into the duct bank envelope. Chip the perimeter surface of the duct bank opening to form a key or flared surface, providing a positive connection with the duct bank envelope.

E. Connections to Existing Ducts: Where connections to existing ducts are indicated, excavate around the ducts as necessary. Cut off the ducts and remove loose concrete from inside before installing new ducts. Provide a reinforced-concrete collar, poured monolithically with the new ducts, to take the shear at the joint of the duct banks.

F. Partially-Completed Ducts: During construction, wherever a construction joint is necessary in a duct bank, prevent debris such as mud and dirt from entering ducts by providing suitable plugs. Fit concrete envelope of a partially completed ducts with reinforcing steel extending a minimum of 600 mm (2 feet) back into the envelope and a minimum of 600 mm (2 feet) beyond the end of the envelope. Provide one No. 4 bar in each corner, 75 mm (3 inches) from the edge of the envelope. Secure corner bars with two No. 3 ties, spaced approximately 300 mm (12 inches) apart. Restrain reinforcing assembly from moving during pouring of concrete.

3.4 ACCEPTANCE CHECKS AND TESTS

A. Duct Testing and Cleaning:
   1. Upon completion of the duct installation, a standard flexible mandrel shall be pulled through each duct to loosen particles of earth, sand, or foreign material left in the duct, and to test for out-of-round conditions.
   2. The mandrel shall be not less than 300 mm (12 inches) long, and shall have a diameter not less than 13 mm (0.5 inch) less than the inside diameter of the duct. A brush with stiff bristles shall then be pulled through each duct to remove the loosened particles. The diameter of the brush shall be the same as, or slightly larger than, the diameter of the duct.
   3. If testing reveals obstructions or out-of-round conditions, the Contractor shall replace affected section(s) of duct and retest to the satisfaction of the COR.
   4. Mandrel pulls shall be witnessed by the COR.

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SECTION 26 05 73
OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the overcurrent protective device coordination study, related calculations and analysis, indicated as the study in this section.

B. A short-circuit and selective coordination study, and arc flash calculations and analysis shall be prepared for the electrical overcurrent devices to be installed under this project.

C. The study shall present a well-coordinated time-current analysis of each overcurrent protective device from the individual device up to the utility source and the on-site generator sources.

1.2 RELATED WORK

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one section of Division 26.

B. Section 26 24 16, PANELBOARDS: Low-voltage panelboards.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

B. The study shall be prepared by the equipment manufacturer, and performed by the equipment manufacturer's licensed electrical engineer.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:
   1. Product data on the software program to be used for the study. Software shall be in mainstream use in the industry, shall provide device settings and ratings, and shall show selective coordination by time-current drawings.
   2. Complete study as described in paragraph 1.6. Submittal of the study shall be well-coordinated with submittals of the shop drawings for equipment in related specification sections.
   3. Certifications: Two weeks prior to final inspection, submit the following.
      a. Certification by the Contractor that the overcurrent protective devices have been set in accordance with the approved study.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only. The latest edition as of the specification issue date shall govern.

B. Institute of Electrical and Electronics Engineers (IEEE):

241 ..... Recommended Practice Electrical Systems in Commercial Buildings

242 ..... Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems

399 ..... Recommended Practice for Industrial and Commercial Power Systems Analysis

1584 ..... Performing Arc-Flash Hazards Calculations

C. National Fire Protection Association (NFPA):

70 .....National Electrical Code (NEC)

70E .....Standard for Electrical Safety in the Workplace

99 .....Health Care Facilities Code

1.6 STUDY REQUIREMENTS

A. The study shall be in accordance with IEEE and NFPA standards.

B. The study shall include one line diagram, short-circuit and ground fault analysis, protective coordination plots for all overcurrent protective devices, and arc flash calculations and analysis.

C. One Line Diagram:
   1. Show all electrical equipment and wiring to be protected by the overcurrent devices.
   2. Show the following specific information:
      a. Calculated fault impedance, X/R ratios, and short-circuit values at each feeder and branch circuit bus.
      b. Relay, circuit breaker, and fuse ratings.
      c. Generator kW/kVA and transformer kVA and voltage ratings, percent impedance, X/R ratios, and wiring connections.
      d. Voltage at each bus.
      e. Identification of each bus, matching the identification on the drawings.
      f. Conduit, conductor, and busway material, size, length, and X/R ratios.

D. Short-Circuit Study:
   1. The study shall be performed using computer software designed for this purpose. Pertinent data and the rationale employed in developing the calculations shall be described in the introductory remarks of the study.
   2. Calculate the fault impedance to determine the available short-circuit and ground fault currents at each bus. Incorporate applicable motor and/or generator contribution in determining the momentary and interrupting ratings of the overcurrent protective devices.
   3. Present the results of the short-circuit study in a table. Include the following:
      a. Device identification.
      b. Operating voltage.
      c. Overcurrent protective device type and rating.
      d. Calculated short-circuit current.

E. Coordination Study:
   1. Prepare the coordination curves to determine the required settings of overcurrent protective devices to demonstrate selective coordination. Graphically illustrate on log-log paper that adequate time separation exists between devices, including the utility company upstream device if applicable. Plot the specific time-current characteristics of each overcurrent protective device in such a manner that all devices are clearly depicted.
   2. The following specific information shall also be shown on the coordination curves:
      a. Device identification.
      b. Potential transformer and current transformer ratios.
      c. Three-phase and single-phase ANSI damage points or curves for each cable, transformer, or generator.
      d. Applicable circuit breaker or protective relay characteristic curves.
      e. No-damage, melting, and clearing curves for fuses.
      f. Transformer in-rush points.
   3. Develop a table to summarize the settings selected for the overcurrent protective devices. Include the following in the table:
      a. Device identification.
      b. Protective relay or circuit breaker potential and current transformer ratios, sensor rating, and available and suggested pickup and delay settings for each available trip characteristic.
      c. Fuse rating and type.

F. Arc Flash Calculations and Analysis:
   1. Arc flash warning labels shall comply with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
   2. Arc flash calculations shall be based on actual over-current protective device clearing time. Maximum clearing time shall be in accordance with IEEE 1584.
   3. Arc flash analysis shall be based on the lowest clearing time setting of the over-current protective device to minimize the incident energy level without compromising selective coordination.
   4. Arc flash boundary and available arc flash incident energy at the corresponding working distance shall be calculated for all electrical power distribution equipment specified in the project, and as shown on the drawings.
   5. Required arc-rated clothing and other PPE shall be selected and specified in accordance with NFPA 70E.

1.7 ANALYSIS

A. Analyze the short-circuit calculations, and highlight any equipment determined to be underrated as specified. Propose solutions to effectively protect the underrated equipment.

1.8 ADJUSTMENTS, SETTINGS, AND MODIFICATIONS

A. Final field settings and minor modifications of the overcurrent protective devices shall be made to conform with the study, without additional cost to the Government.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

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SECTION 26 08 00

COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. The requirements of this Section apply to all sections of Division 26.

B. This project will have selected building systems commissioned. The complete list of equipment and systems to be commissioned is specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS. The commissioning process, which the Contractor is responsible to execute, is defined in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS. A Commissioning Agent (CxA) appointed by the VA will manage the commissioning process.

1.2 RELATED WORK

A. Section 01 00 00 GENERAL REQUIREMENTS.

B. Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

C. Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

1.3 SUMMARY

A. This Section includes requirements for commissioning the Facility electrical systems, related subsystems and related equipment. This Section supplements the general requirements specified in Section 01 91 00 General Commissioning Requirements.

B. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for more details regarding processes and procedures as well as roles and responsibilities for all Commissioning Team members.

1.4 DEFINITIONS

A. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for definitions.

1.5 COMMISSIONED SYSTEMS

A. Commissioning of a system or systems specified in Division 26 is part of the construction process. Documentation and testing of these systems, as well as training of the VA's Operation and Maintenance personnel in accordance with the requirements of Section 01 91 00 and of Division 26, is required in cooperation with the VA and the Commissioning Agent.

B. The Facility electrical systems commissioning will include the systems listed in Section 01 91 00 General Commissioning Requirements:

1.6 SUBMITTALS

A. The commissioning process requires review of selected Submittals that pertain to the systems to be commissioned. The Commissioning Agent will provide a list of submittals that will be reviewed by the Commissioning Agent. This list will be reviewed and approved by the VA prior to forwarding to the Contractor. Refer to Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, and SAMPLES for further details.

B. The commissioning process requires Submittal review simultaneously with engineering review. Specific submittal requirements related to the commissioning process are specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 CONSTRUCTION INSPECTIONS

A. Commissioning of Electrical systems will require inspection of individual elements of the electrical systems construction throughout the construction period. The Contractor shall coordinate with the Commissioning Agent in accordance with Section 01 91 00 and the Commissioning plan to schedule electrical systems inspections as required to support the Commissioning Process.

3.2 PRE-FUNCTIONAL CHECKLISTS

A. The Contractor shall complete Pre-Functional Checklists to verify systems, subsystems, and equipment installation is complete and systems are ready for Systems Functional Performance Testing. The Commissioning Agent will prepare Pre-Functional Checklists to be used to document equipment installation. The Contractor shall complete the checklists. Completed checklists shall be submitted to the VA and to the Commissioning Agent for review. The Commissioning Agent may spot check a sample of completed checklists. If the Commissioning Agent determines that the information provided on the checklist is not accurate, the Commissioning Agent will return the marked-up checklist to the Contractor for correction and resubmission. If the Commissioning Agent determines that a significant number of completed checklists for similar equipment are not accurate, the Commissioning Agent will select a broader sample of checklists for review. If the Commissioning Agent determines that a significant number of the broader sample of checklists is also inaccurate, all the checklists for the type of equipment will be returned to the Contractor for correction and resubmission. Refer to SECTION 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for submittal requirements for Pre-Functional Checklists, Equipment Startup Reports, and other commissioning documents.

3.3 CONTRACTORS TESTS

A. Contractor tests as required by other sections of Division 26 shall be scheduled and documented in accordance with Section 01 00 00 GENERAL REQUIREMENTS. All testing shall be incorporated into the project schedule. Contractor shall provide no less than 7 calendar days' notice of testing. The Commissioning Agent will witness selected Contractor tests at the sole discretion of the Commissioning Agent. Contractor tests shall be completed prior to scheduling Systems Functional Performance Testing.

3.4 SYSTEMS FUNCTIONAL PERFORMANCE TESTING

A. The Commissioning Process includes Systems Functional Performance Testing that is intended to test systems functional performance under steady state conditions, to test system reaction to changes in operating conditions, and system performance under emergency conditions. The Commissioning Agent will prepare detailed Systems Functional Performance Test procedures for review and approval by the Resident Engineer. The Contractor shall review and comment on the tests prior to approval. The Contractor shall provide the required labor, materials, and test equipment identified in the test procedure to perform the tests. The Commissioning Agent will witness and document the testing. The Contractor shall sign the test reports to verify tests were performed. See Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS, for additional details.

3.5 TRAINING OF VA PERSONNEL

A. Training of the VA operation and maintenance personnel is required in cooperation with the Resident Engineer and Commissioning Agent. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems. Contractor shall submit training agendas and trainer resumes in accordance with the requirements of Section 01 91 00.

The instruction shall be scheduled in coordination with the VA Resident Engineer after submission and approval of formal training plans. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS and Division 26 Sections for additional Contractor training requirements.

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SECTION 26 09 23
LIGHTING CONTROLS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation and connection of the lighting controls.

1.2 RELATED WORK

A. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC: Interface of lighting controls with HVAC control systems.

B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General requirements that are common to more than one section of Division 26.

C. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.

D. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.

E. Section 26 24 16, PANELBOARDS: Panelboard enclosure and interior bussing used for lighting control panels.

F. Section 26 27 26, WIRING DEVICES: Wiring devices used for control of the lighting systems.

G. Section 26 51 00, INTERIOR LIGHTING: Luminaire ballast and drivers used in control of lighting systems.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:
   1. Shop Drawings:
      a. Submit the following information for each type of lighting controls.
      b. Material and construction details.
      c. Physical dimensions and description.
      d. Wiring schematic and connection diagram.
      e. Installation details.
   2. Manuals:
      a. Submit, simultaneously with the shop drawings, complete maintenance and operating manuals, including technical data sheets, wiring diagrams, and information for ordering replacement parts.
      b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.
   3. Certifications: Two weeks prior to final inspection, submit the following.
      a. Certification by the Contractor that the lighting control systems have been properly installed and tested.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only. The latest edition as of the specification issue date shall govern.

B. National Electrical Manufacturer's Association (NEMA):
- C136.10 ..... American National Standard for Roadway and Area Lighting Equipment—Locking-Type Photocontrol Devices and Mating Receptacles—Physical and Electrical Interchangeability and Testing
- ICS-1) ..... Standard for Industrial Control and Systems General Requirements
- ICS-2 ..... Standard for Industrial Control and Systems Controllers, Contractors, and Overload Relays Rated 600 Volts
- ICS-6 ..... Standard for Industrial Controls and Systems Enclosures

C. National Fire Protection Association (NFPA):
- 70 ..... National Electrical Code (NEC)

D. Underwriters Laboratories, Inc. (UL):
- 20 ..... Standard for General-Use Snap Switches
- 98 ..... Enclosed and Dead-Front Switches
- 773 ..... Standard for Plug-In Locking Type Photocontrols for Use with Area Lighting
- 773A ..... Nonindustrial Photoelectric Switches for Lighting Control
- 916 ..... Standard for Energy Management Equipment
- 917 ..... Clock Operated Switches
- 924 ..... Emergency Lighting and Power Equipment

PART 2 - PRODUCTS

2.1 ELECTRONIC TIME SWITCHES

A. Electronic, solid-state programmable units with alphanumeric display; complying with UL 916 and or 917.
1. Contact Configuration: DPDT.
2. Contact Rating: 30-A inductive or resistive 120-277 volt.
3. Astronomical Clock: Capable of switching a load on at sunset and off at sunrise, and automatically changing the settings each day in accordance with seasonal changes of sunset and sunrise. Additionally, it shall be programmable to a fixed on/off weekly schedule.
4. Power Backup: Battery or capacitor for schedules and time clock.

2.2 ELECTROMECHANICAL-DIAL TIME SWITCHES

A. Electromechanical-dial time switches; complying with UL 917.
1. Contact Configuration: DPDT.
2. Contact Rating: 30-A inductive or resistive, 120-277 volt.
3. Wound-spring reserve carryover mechanism to keep time during power failures.

2.3 TIMER SWITCHES

A. Digital switches with backlit LCD display, 120/277 volt rated, fitting as a replacement for standard wall switches.

1. Compatibility: Compatible with all ballasts.
2. Warning: Audible warning to sound during the last minute of “on” operation.
3. Time-out: Adjustable from 5 minutes to 12 hours.
4. Faceplate: Refer to wall plate material and color requirements for toggle switches, as specified in Section 26 27 26, WIRING DEVICES.

2.4 INDOOR OCCUPANCY SENSORS

A. Wall- or ceiling-mounting, solid-state units with a power supply and relay unit, suitable for the environmental conditions in which installed.
   1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a 1 to 15 minute adjustable time delay for turning lights off.
   2. Sensor Output: Contacts rated to operate the connected relay. Sensor shall be powered from the relay unit.
   3. Relay Unit: Dry contacts rated for 20A ballast load at 120 volt and 277 volt, for 13A tungsten at 120 volt, and for 1 hp at 120 volt.
   4. Mounting:
      a. Sensor: Suitable for mounting in any position on a standard outlet box.
      b. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
   5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
   6. Bypass Switch: Override the on function in case of sensor failure.
   7. Manual/automatic selector switch.
   8. Automatic Light-Level Sensor: Adjustable from 21.5 to 2152 lx (2 to 200 fc); keep lighting off when selected lighting level is present.
   9. Faceplate for Wall-Switch Replacement Type: Refer to wall plate material and color requirements for toggle switches, as specified in Section 26 27 26, WIRING DEVICES.

B. Dual-technology Type: Ceiling mounting; combination PIR and ultrasonic detection methods, field-selectable.
   1. Sensitivity Adjustment: Separate for each sensing technology.
   2. Detector Sensitivity: Detect occurrences of 150 mm (6-inch) minimum movement of any portion of a human body that presents a target of not less than 232 sq. cm (36 sq. in), and detect a person of average size and weight moving not less than 305 mm (12 inches) in either a horizontal or a vertical manner at an approximate speed of 305 mm/s (12 inches/s).

C. Detection Coverage: Shall be sufficient to provide coverage as required by sensor locations shown on drawing.

2.5 INDOOR VACANCY SENSOR SWITCH

A. Wall mounting, solid-state units with integral sensor and switch.
   1. Operation: Manually turn lights on with switch and sensor detects vacancy to turn lights off.
   2. Switch Rating: 120/277 volt, 1200 watts at 277 volt, 800 watts at 120 volt unit.
   3. Mounting:
      a. Sensor: Suitable for mounting in a standard switch box.
      b. Time-Delay and Sensitivity Adjustments: Integral with switch and accessible for reprogramming without removing switch.
   4. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
   5. Switch: Manual operation to turn lights on and override lights off.
   6. Faceplate: Refer to wall plate material and color requirements for toggle switches, as specified in Section 26 27 26, WIRING DEVICES.

2.6 LIGHTING CONTROL SYSTEM – RELAY PANEL TYPE (STAND ALONE)

A. System Description:

1. The lighting control system shall be with lighting relay panels. Lighting control devices connect to the relay panels and communicate via the panel controller. System includes all interfaces and wiring, relay panels, control modules, input modules, panel processors, relays, photocells, switches, dimmers, time clock, and occupancy sensors.
2. System shall include the capability of BACnet IP communication with other systems as described. System communication protocol shall be compatible with the building automation system specified in Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.
3. Panel Controller shall provide programmable operation of lights connected via system relays and controlled with system devices. System software shall provide control of relays and control devices, time and sequence scheduling, timed out and blink light operation and monitoring and reporting of system events and components. Initial programming shall be as shown on plans and schedules.

B. Panel Controller: Comply with UL 508; programmable, solid-state, astronomic 365-day control unit with non-volatile memory, mounted in preassembled relay panel with low-voltage-controlled, latching-type, single-pole lighting circuit relays. Controller shall be capable of receiving inputs from control devices and other sources. Where indicated, a limited number of digital or analog, low-voltage control-circuit outputs shall be supported by control unit and circuit boards associated with relays.

C. Cabinet: Steel with hinged, locking door. Barriers separate low-voltage and line-voltage components.

D. Directory: Identifies each relay as to load controlled.

E. System Power Supply: Transformer and full-wave rectifier with filtered dc output for panel, controllers and control devices. Feed from an equipment emergency circuit at a minimum.

F. Single-Pole Relays: Mechanically held unless otherwise indicated; split-coil, momentary-pulsed type, rated 20 A, 125 volt AC for tungsten filaments and 20 A, 277 volt AC for electronic ballasts, 50,000 cycles at rated capacity.

G. Control Devices: All occupancy sensors (Ultrasonic, IR and Dual Technology type), photocells, switches and timers shall be provided with system and designed to operate on system network. Supplemental power packs shall be provided as required for multiple control devices. This equipment shall be identified in shop drawing submission.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the NEC, manufacturer's instructions, as shown on the drawings, and as specified.

B. Aim outdoor photoelectric sensor according to manufacturer's recommendations. Set adjustable window slide for 1 footcandle turn-on.

C. Aiming for wall-mounted and ceiling-mounted motion sensor switches shall be per manufacturer’s recommendations.

D. Set occupancy sensor "on" duration to 15 minutes.

E. Locate photoelectric sensors as indicated and in accordance with the manufacturer's recommendations. Adjust sensor for the available light level at the typical work plane for that area.

F. Label time switches and contactors with a unique designation.

G. Program lighting control panels per schedule on drawings.

3.2 ACCEPTANCE CHECKS AND TESTS

A. Perform in accordance with the manufacturer's recommendations.

B. Upon completion of installation, conduct an operating test to show that equipment operates in accordance with requirements of this section.

C. Test for full range of dimming ballast and dimming controls capability. Observe for visually detectable flicker over full dimming range.

D. Test occupancy sensors for proper operation. Observe for light control over entire area being covered.

E. Upon completion of the installation, the system shall be commissioned by the manufacturer’s factory-authorized technician who will verify all adjustments and sensor placements.

3.3 FOLLOW-UP VERIFICATION

A. Upon completion of acceptance checks and tests, the Contractor shall show by demonstration in service that the lighting control devices are in good operating condition and properly performing the intended function in the presence of COR.

3.4 INSTRUCTION

A. Furnish the services of a factory-trained technician for one 8-hour training period for instructing personnel in the maintenance and operation of the lighting control system on the dates requested by the COR.

B. Contractor shall submit written instructions on training and maintenance as reviewed in training session.

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SECTION 26 24 16
PANELBOARDS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, and connection of panelboards.

1.2 RELATED WORK

A. Section 09 91 00, PAINTING: Painting of panelboards.

B. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Requirements for seismic restraint of non-structural components.

C. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

D. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Low-voltage conductors.

E. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

F. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits.

G. Section 26 05 73, OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY: Short circuit and coordination study, and requirements for a coordinated electrical system.

H. Section 26 09 23, LIGHTING CONTROLS: Lighting controls integral to panelboards.

I. Section 26 43 13, SURGE PROTECTIVE DEVICES: Surge protective devices integral to panelboards.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:
   1. Shop Drawings:
      a. Submit sufficient information to demonstrate compliance with drawings and specifications.
      b. Include electrical ratings, dimensions, mounting details, materials, required clearances, terminations, weight, circuit breakers, wiring and connection diagrams, accessories, and nameplate data.
      c. Certification from the manufacturer that a representative panelboard has been seismically tested to International Building Code requirements. Certification shall be based upon simulated seismic forces on a shake table or by analytical methods, but not by experience data or other methods.
   2. Manuals:
      a. Submit, simultaneously with the shop drawings, complete maintenance and operating manuals including technical data sheets, wiring diagrams, and information for ordering circuit breakers and replacement parts.
         1) Include schematic diagrams, with all terminals identified, matching terminal identification in the panelboards.
         2) Include information for testing, repair, troubleshooting, assembly, and disassembly.

b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.

3. Certifications: Two weeks prior to final inspection, submit the following.
   a. Certification by the manufacturer that the panelboards conform to the requirements of the drawings and specifications.
   b. Certification by the Contractor that the panelboards have been properly installed, adjusted, and tested.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only. The latest edition as of the specification issue date shall govern.

B. International Code Council (ICC):
IBC ..... International Building Code

C. National Electrical Manufacturers Association (NEMA):
PB 1..... Panelboards

250 ..... Enclosures for Electrical Equipment (1,000V Maximum)

D. National Fire Protection Association (NFPA):
70 ..... National Electrical Code (NEC)

70E ..... Standard for Electrical Safety in the Workplace

E. Underwriters Laboratories, Inc. (UL):
50 ..... Enclosures for Electrical Equipment

67 ..... Panelboards

489 ..... Molded Case Circuit Breakers and Circuit Breaker Enclosures

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Panelboards shall be in accordance with NEC, NEMA, UL, as specified, and as shown on the drawings.

B. Panelboards shall have main circuit breaker and shall have bus size, voltage, phases, number of circuit breaker mounting spaces, top or bottom feed, flush or surface mounting, branch circuit breakers, and accessories as shown on the drawings.

C. Panelboards shall be completely factory-assembled with molded case circuit breakers and integral accessories as shown on the drawings or specified herein.

D. Non-reduced size copper bus bars, rigidly supported on molded insulators, and fabricated for bolt-on type circuit breakers.

E. Bus bar connections to the branch circuit breakers shall be the “distributed phase” or “phase sequence” type.

F. Mechanical lugs furnished with panelboards shall be cast, stamped, or machined metal alloys listed for use with the conductors to which they will be connected.

G. Neutral bus shall be 200% rated, mounted on insulated supports.

H. Grounding bus bar shall be equipped with screws or lugs for the connection of equipment grounding conductors.

I. Bus bars shall be braced for the available short-circuit current as shown on the drawings, but not be less than 10,000 A symmetrical for 120/208 V and 120/240 V panelboards, and 14,000 A symmetrical for 277/480 V panelboards.

J. In two-section panelboards, the main bus in each section shall be full size. The first section shall be furnished with subfeed lugs on the line side of main lugs only, or through-feed lugs for main breaker type panelboards, and have field-installed cable connections to the second section as shown on the drawings. Panelboard sections with tapped bus or crossover bus are not acceptable.

K. Series-rated panelboards are not permitted.

2.2 ENCLOSURES AND TRIMS

A. Enclosures:
1. Provide galvanized steel enclosures, with NEMA rating as shown on the drawings or as required for the environmental conditions in which installed.
2. Enclosures shall not have ventilating openings.
3. Enclosures may be of one-piece formed steel or of formed sheet steel with end and side panels welded, riveted, or bolted as required.
4. Provide manufacturer's standard option for prepunched knockouts on top and bottom endwalls.
5. Include removable inner dead front cover, independent of the panelboard cover.
6. All panel boards shall be Main Circuit Breaker (MCB) Type.

B. Trims:
1. Hinged "door-in-door" type.
2. Interior hinged door with hand-operated latch or latches, as required to provide access only to circuit breaker operating handles, not to energized parts.
3. Outer hinged door shall be securely mounted to the panelboard enclosure with factory bolts, screws, clips, or other fasteners, requiring a key or tool for entry. Hand-operated latches are not acceptable.
4. Inner and outer doors shall open left to right.
5. Trims shall be flush or surface type as shown on the drawings.

2.3 MOLDED CASE CIRCUIT BREAKERS

A. Circuit breakers shall be per UL, NEC, as shown on the drawings, and as specified.

B. Circuit breakers shall be bolt-on type.

C. Circuit breakers shall have minimum interrupting rating as required to withstand the available fault current, but not less than:
1. 120/208 V Panelboard: 10,000 A symmetrical.
2. 120/240 V Panelboard: 10,000 A symmetrical.
3. 277/480 V Panelboard: 14,000 A symmetrical.

D. Circuit breakers shall have automatic, trip free, non-adjustable, inverse time, and instantaneous magnetic trips for less than 400 A frame. Circuit breakers with 400 A frames and above shall have magnetic trip, adjustable from 5x to 10x. Breaker trip setting shall be set in the field, based on the approved protective device study as specified in Section 26 05 73, ELECTRICAL SYSTEM PROTECTIVE DEVICE STUDY.

E. Circuit breaker features shall be as follows:
1. A rugged, integral housing of molded insulating material.
2. Silver alloy contacts.
3. Arc quenchers and phase barriers for each pole.
4. Quick-make, quick-break, operating mechanisms.
5. A trip element for each pole, thermal magnetic type with long time delay and instantaneous characteristics, a common trip bar for all poles and a single operator.
6. Electrically and mechanically trip free.

7. An operating handle which indicates closed, tripped, and open positions.
8. An overload on one pole of a multi-pole breaker shall automatically cause all the poles of the breaker to open.
9. Ground fault current interrupting breakers, shunt trip breakers, lighting control breakers (including accessories to switch line currents), or other accessory devices or functions shall be provided where shown on the drawings.
10. For circuit breakers being added to existing panelboards, coordinate the breaker type with existing panelboards. Modify the panel directory accordingly.

2.4 SURGE PROTECTIVE DEVICES

A. Where shown on the drawings, furnish panelboards with integral surge protective devices. Refer to Section 26 43 13, SURGE PROTECTIVE DEVICES.

PART 3 - PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the manufacturer’s instructions, the NEC, as shown on the drawings, and as specified.

B. Locate panelboards so that the present and future conduits can be conveniently connected.

C. In seismic areas, panelboards shall be adequately anchored and braced per details on structural contract drawings to withstand the seismic forces at the location where installed.

D. Install a printed schedule of circuits in each panelboard after approval by the COR. Schedules shall reflect final load descriptions, room numbers, and room names connected to each circuit breaker. Schedules shall be printed on the panelboard directory cards and be installed in the appropriate panelboards

E. Mount panelboards such that the maximum height of the top circuit breaker above the finished floor shall not exceed 1980 mm (78 inches).

F. Provide blank cover for each unused circuit breaker mounting space.

G. Rust and scale shall be removed from the inside of existing enclosures where new interior components are to be installed. Paint inside of enclosures with rust-preventive paint before the new interior components are installed. Provide new trim. Trim shall fit tight to the enclosure.

H. Panelboard enclosures shall not be used for conductors feeding through, spliced, or tapping off to other enclosures or devices.

3.2 ACCEPTANCE CHECKS AND TESTS

A. Perform in accordance with the manufacturer's recommendations. In addition, include the following:
   1. Visual Inspection and Tests:
      a. Compare equipment nameplate data with specifications and approved shop drawings.
      b. Inspect physical, electrical, and mechanical condition.
      c. Verify appropriate anchorage and required area clearances.
      d. Verify that circuit breaker sizes and types correspond to approved shop drawings.
      e. To verify tightness of accessible bolted electrical connections, use the calibrated torque-wrench method or perform thermographic survey after energization.
      f. Vacuum-clean enclosure interior. Clean enclosure exterior.

3.3 FOLLOW-UP VERIFICATION

A. Upon completion of acceptance checks, settings, and tests, the Contractor shall demonstrate that the panelboards are in good operating condition and properly performing the intended function.

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SECTION 26 25 11
BUSWAYS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, connection, and testing of busways for use in electrical systems rated 600 V and below.

1.2 RELATED WORK

A. Section 07 84 00, FIRESTOPPING: Sealing around busway penetrations to maintain the integrity of fire-resistant rated construction.

B. Section 07 92 00, JOINT SEALANTS: Sealing around busway penetrations through the building envelope to prevent moisture migration into the building.

C. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Requirement for seismic restraint for nonstructural components.

D. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

E. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.

F. Section 26 24 16, PANELBOARDS: Circuit breakers for use in plug-in busway.

G. Section 26 29 21, ENCLOSED SWITCHES AND CIRCUIT BREAKERS: Switches and fuses for use in plug-in busway.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:
   1. Shop Drawings:
      a. Submit sufficient information to demonstrate compliance with drawings and specifications.
      b. Submit the following data for approval:
         1) Electrical ratings, dimensions, mounting details and position, mounting method, vertical supports, materials, fire stops, and weatherproofing.
         2) Detailed coordinated connections to equipment terminations such as switchgear, switchboards, and transformers.
         3) Coordination Drawings: Submit floor plans and sections, drawn to scale. Include bus assembly layouts and relationships between components and adjacent structural, mechanical, and electrical elements. Indicate vertical and horizontal enclosed busway runs, offsets, transitions, and clearances for access above and to the side of enclosed busways. Indicate vertical elevation of busway above the floor or bottom of structure. Indicate support locations, type of support, and weight on each support.
      c. Certification from the manufacturer that representative busway has been seismically tested to International Building Code requirements. Certification shall be based upon simulated seismic forces on a shake table or by analytical methods, but not by experience data or other methods.

2. Manuals:
   a. Submit complete maintenance and operating manuals including technical data sheets, and information for ordering replacement parts.
      1) Include information for testing, repair, troubleshooting, assembly, and disassembly.
   b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.
3. Certifications: Two weeks prior to final inspection, submit the following.
   a. Certification by the manufacturer that the busway conforms to the requirements of the drawings and specifications.
   b. Certification by the Contractor that the busway has been properly installed, adjusted, and tested.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplement and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only. The latest edition as of the specification issue date shall govern.

B. International Code Council (ICC):
   IBC ..... International Building Code

C. National Electrical Manufacturers Association (NEMA):
   BU 1.1 ..... General Instructions for Handling, Installation, Operation and Maintenance of Busway Rated 600 Volts or Less

   BU 1.2 ..... Application Information for Busway Rated 600 Volts or Less

D. National Fire Protection Association (NFPA):
   70 ..... National Electrical Code (NEC)

E. Underwriters Laboratories Inc. (UL):
   857 ..... Busways

PART 2 - PRODUCTS

2.1 MATERIAL

A. Busway shall be in accordance with NEMA and UL.

B. Busway shall be rated as shown on the drawings.

C. Busway shall have the following features:
   1. For indoor locations;, totally enclosed and moisture resistant.
   2. For outdoor locations; feeder type only, totally enclosed and listed for outdoor use. Plug-in busway is not allowed for outdoor installation.
   3. Short circuit current rating shall not be less than 42,000 A, or as required to withstand the available fault current shown on the drawings, whichever is higher.
   4. 3-phase, 4-wire, with full 200% neutral, except where 3-phase, 3-wire is shown on the drawings.
   5. Internal 50%-rated ground bus bar. Busway housing is not allowed to serve as the equipment grounding conductor.
   6. All bus bars, phase, neutral, and ground, for each busway shall be within a single housing.
   7. Bus Bars:
      a. Shall be full round edge rectangular copper of sufficient cross-section to provide full current rating without exceeding a temperature rise of 55° C above a 40° C ambient.

b. Interconnection joints shall be tin or silver plated, with steel bolts, nuts, and Belleville washers.
c. Shall be completely insulated with flame-retardant, track-resistant, self-extinguishing insulation.

8. Housings:
a. Shall be steel or aluminum, with continuous mounting rails.
b. Shall be thoroughly cleaned and painted at the factory with primer and the manufacturer's standard finish.
c. Shall have rustproof metal hardware.
d. Provide external flanges and weatherproofing at busway entrances to buildings.
e. For busways that pass through fire-resistant rated construction, incorporate listed fire stops within the busway housings and external flanges.
f. Install expansion fittings in the busway runs in compliance with the manufacturer's standard recommendations.
g. The temperature rise at any point on the housing shall not exceed 30° C above an ambient temperature of 40° C.

9. Busway shall not be reduced in size at any point.
10. Provide manufacturer’s fittings and accessories, including but not limited to elbows, tees, tap boxes, transformer taps, end boxes, expansion fittings, offsets, adapters, hangers, and mounting hardware.

D. Dimensions and Configuration:
1. Configure within the space designated for busway installation.
2. Coordinate busway routing with equipment installation by other trades to avoid conflicts.
3. Make final field measurements and check them with the busway coordination drawings prior to authorization of fabrication of the busways.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the NEC, as shown on the drawings, and manufacturer’s instructions.

B. Support busways as required by the NEC and as required by manufacturer’s shop drawings.

C. In seismic areas, busway shall be adequately anchored and braced per details on structural contract drawings to withstand the seismic forces at the location where installed.

D. Coordinate all of the busway terminations to equipment to ensure proper phasing.

E. Tighten bolted connections with a torque wrench to values as required by the manufacturer.

F. Install expansion fittings at locations where busways cross building expansion joints. Install at other locations so distance between expansion fittings does not exceed manufacturer's recommended distance between fittings.

G. Install fire-stop assemblies per Section 07 84 00, FIRESTOPPING where busways penetrate fire-resistant construction.

H. Install weatherproofing fittings and flanges where busways penetrate exterior elements such as walls or roofs. Seal around openings to make weathertight according to Section 07 92 00, JOINT SEALANTS.

3.2 ACCEPTANCE CHECKS AND TESTS

A. Perform manufacturer’s required field tests in accordance with the manufacturer's recommendations. In addition, include the following:
1. Visual Inspection and Tests:
a. Compare equipment nameplate data with specifications and approved shop drawings.

b. Inspect physical, electrical, and mechanical condition.
c. Verify appropriate anchorage, required area clearances, and correct alignment.
d. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey after energization.
e. Verify appropriate equipment grounding.
f. Examine outdoor busways for removal of weep-hole plugs, if applicable, and the correct installation of joint shield.

2. Electrical Tests:
   a. After installation, test busway phase-to-phase and phase-to-ground resistance with an insulation resistance tester. Resulting values shall not be less than one megohm.

3.3 FOLLOW-UP VERIFICATION

A. After the busways have been energized for a minimum of 30 days, repeat the torque wrench tightening of all bolt connections.

---END---

SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, connection, and testing of wiring devices.

1.2 RELATED WORK

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one section of Division 26.

B. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Cables and wiring.

C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.

D. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduit and boxes.

E. Section 26 51 00, INTERIOR LIGHTING: Fluorescent ballasts and LED drivers for use with manual dimming controls.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:
   1. Shop Drawings:
      a. Submit sufficient information to demonstrate compliance with drawings and specifications.
      b. Include electrical ratings, dimensions, mounting details, construction materials, grade, and termination information.
   2. Manuals:
      a. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals, including technical data sheets and information for ordering replacement parts.
      b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.
   3. Certifications: Two weeks prior to final inspection, submit the following.
      a. Certification by the manufacturer that the wiring devices conform to the requirements of the drawings and specifications.
      b. Certification by the Contractor that the wiring devices have been properly installed and adjusted.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only. The latest edition as of the specification issue date shall govern.

B. National Electrical Manufacturers Association (NEMA):
   WD 1 .....General Color Requirements for Wiring Devices

WD 6 .....Wiring Devices – Dimensional Specifications

C. National Fire Protection Association (NFPA):
70 .....National Electrical Code (NEC)

99 .....Health Care Facilities

D. Underwriter's Laboratories, Inc. (UL):
5 .....Surface Metal Raceways and Fittings

20 .....General-Use Snap Switches

231 .....Power Outlets

467 .....Grounding and Bonding Equipment

498 .....Attachment Plugs and Receptacles

943 .....Ground-Fault Circuit-Interrupters

1449 .....Surge Protective Devices

1472 .....Solid State Dimming Controls

PART 2 - PRODUCTS

2.1 RECEPTACLES

A. General: All receptacles shall comply with NEMA, NFPA, UL, and as shown on the drawings.
1. Mounting straps shall be nickel plated brass, brass, nickel plated steel or galvanize steel with break-off plaster ears, and shall include a self-grounding feature. Terminal screws shall be brass, brass plated or a copper alloy metal.
2. Receptacles shall have provisions for back wiring with separate metal clamp type terminals (four minimum) and side wiring from four captively held binding screws.

B. Duplex Receptacles - Hospital-grade: shall be listed for hospital grade, single phase, 20 ampere, 120 volts, 2-pole, 3-wire, NEMA 5-20R, with break-off feature for two-circuit operation.
1. Bodies shall be white in color.
2. Switched duplex receptacles shall be wired so that only the top receptacle is switched. The lower receptacle shall be unswitched.
3. Duplex Receptacles on Emergency Circuit:
   a. In rooms without emergency powered general lighting, the emergency receptacles shall be of the self-illuminated type.
4. Ground Fault Current Interrupter (GFCI) Duplex Receptacles: Shall be an integral unit, hospital-grade, suitable for mounting in a standard outlet box, with end-of-life indication and provisions to isolate the face due to improper wiring. GFCI receptacles shall be self-test receptacles in accordance with UL 943.
   a. Ground fault interrupter shall consist of a differential current transformer, self-test, solid state sensing circuitry and a circuit interrupter switch. Device shall have nominal sensitivity to ground leakage current of 4-6 milliamperes and shall function to interrupt the current supply for any value of ground leakage current above five milliamperes (+ or – 1 milliampere) on the load side of the device. Device shall have a minimum nominal tripping time of 0.025 second.
   b. Self-test function shall be automatically initiated within 5 seconds after power is activated to the receptacles. Self-test function shall be periodically and automatically performed every 3 hours or less.
   c. End-of-life indicator light shall be a persistent flashing or blinking light to indicate that the GFCI receptacle is no longer in service.
5. Tamper-Resistant Duplex Receptacles:
   a. Bodies shall be gray in color.

1) Shall permit current to flow only while a standard plug is in the proper position in the receptacle.
2) Screws exposed while the wall plates are in place shall be the tamperproof type.

C. Receptacles - 20, 30, and 50 ampere, 250 Volts: Shall be complete with appropriate cord grip plug.

D. Weatherproof Receptacles: Shall consist of a duplex receptacle, mounted in box with a gasketed, weatherproof, cast metal cover plate and cap over each receptacle opening. The cap shall be permanently attached to the cover plate by a spring-hinged flap. The weatherproof integrity shall not be affected when heavy duty specification or hospital grade attachment plug caps are inserted. Cover plates on outlet boxes mounted flush in the wall shall be gasketed to the wall in a watertight manner.

E. Surge Protective Receptacles shall have integral surge suppression in line to ground, line to neutral, and neutral to ground modes.
1. Surge Protective Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400 Volts, and minimum single transient pulse energy dissipation of 210 Joules.
2. Active Surge Protective Indication: LED, visible in face of device to indicate device is active or no longer in service.

F. Cable Reel Receptacles:
1. Reel shall have a heavy-duty spring motor, with self-contained rewind power and non-sparking ratchet assembly, a 4-way roller and adjustable cable stop, and a safety chain. Reel shall lock when desired cable has been payed out, and unlock and retract when cable is pulled to release lock.
2. Reel shall be provided with minimum 40 foot [12m] cable rated for 30 amperes with required phase conductors, neutral, and equipment grounding conductor. Provide device with NEMA configuration as shown.

2.2 TOGGLE SWITCHES

A. Toggle switches shall be totally enclosed tumbler type with nylon bodies. Handles shall be white in color unless otherwise specified or shown on the drawings.
1. Switches installed in hazardous areas shall be explosion-proof type in accordance with the NEC and as shown on the drawings.
2. Shall be single unit toggle, butt contact, quiet AC type, heavy-duty general-purpose use with an integral self grounding mounting strap with break-off plasters ears and provisions for back wiring with separate metal wiring clamps and side wiring with captively held binding screws.
3. Switches shall be rated 20 amperes at 120-277 Volts AC.

2.3 MANUAL DIMMING CONTROL

A. Electronic full-wave manual slide dimmer with on/off switch and audible frequency and EMI/RFI suppression filters.

B. Manual dimming controls shall be fully compatible with LED dimming driver and be approved by the driver manufacturer, shall operate over full specified dimming range, and shall not degrade the performance or rated life of the electronic dimming ballast and lamp.

C. Provide single-pole, three-way or four-way, as shown on the drawings.

D. Manual dimming control and faceplates shall be white in color unless otherwise specified.

2.4 WALL PLATES

A. Wall plates for switches and receptacles shall be type smooth nylon. Oversize plates are not acceptable.

B. Color shall be white unless otherwise specified.

C. For receptacles or switches mounted adjacent to each other, wall plates shall be common for each group of receptacles or switches.

D. In areas requiring tamperproof wiring devices, wall plates shall be type 302 stainless steel, and shall have tamperproof screws and beveled edges.

E. Duplex Receptacles on Emergency Circuit: Wall plates shall be red nylon with the word "EMERGENCY" engraved in 6 mm (1/4 inch) white letters.

2.5 SURFACE MULTIPLE-OUTLET ASSEMBLIES

A. Shall have the following features:
   1. Enclosures:
      a. Thickness of steel shall be not less than 1 mm (0.040 inch) for base and cover. Nominal dimensions shall be 40 mm x 70 mm (1-1/2 inches by 2-3/4 inches) with inside cross sectional area not less than 2250 square mm (3-1/2 square inches). The enclosures shall be thoroughly cleaned, phosphatized, and painted at the factory with primer and the manufacturer's standard baked enamel finish.
   2. Receptacles shall be duplex, hospital grade. See paragraph 'RECEPTACLES' in this Section. Device cover plates shall be the manufacturer's standard corrosion resistant finish and shall not exceed the dimensions of the enclosure.
   3. Unless otherwise shown on drawings, receptacle spacing shall be 600 mm (24 inches) on centers.
   4. Conductors shall be as specified in Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLE.
   5. Installation fittings shall be the manufacturer’s standard bends, offsets, device brackets, inside couplings, wire clips, elbows, and other components as required for a complete system.
   6. Bond the assemblies to the branch circuit conduit system.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the NEC and as shown as on the drawings.

B. Install wiring devices after wall construction and painting is complete.

C. The ground terminal of each wiring device shall be bonded to the outlet box with an approved green bonding jumper, and also connected to the branch circuit equipment grounding conductor.

D. Outlet boxes for toggle switches and manual dimming controls shall be mounted on the strike side of doors.

E. Provide barriers in multi-gang outlet boxes to comply with the NEC.

F. Coordinate the electrical work with the work of other trades to ensure that wiring device flush outlets are positioned with box openings aligned with the face of the surrounding finish material. Pay special attention to installations in cabinet work, and in connection with laboratory equipment.

G. Exact field locations of floors, walls, partitions, doors, windows, and equipment may vary from locations shown on the drawings. Prior to locating sleeves, boxes and chases for roughing-in of conduit and equipment, the Contractor shall coordinate exact field location of the above items with other trades.

H. Install wall switches 1.2 M (48 inches) above floor, with the toggle OFF position down.

I. Install wall dimmers 1.2 M (48 inches) above floor.

J. Install receptacles 450 mm (18 inches) above floor, and 152 mm (6 inches) above counter backsplash or workbenches. Install specific-use receptacles at heights shown on the drawings.

K. Install horizontally mounted receptacles with the ground pin to the right.

L. When required or recommended by the manufacturer, use a torque screwdriver. Tighten unused terminal screws.

M. Label device plates with a permanent adhesive label listing panel and circuit feeding the wiring device.

3.2 ACCEPTANCE CHECKS AND TESTS

A. Perform manufacturer's required field checks in accordance with the manufacturer's recommendations, and the latest NFPA 99. In addition, include the following:
   1. Visual Inspection and Tests:
      a. Inspect physical and electrical conditions.
      b. Vacuum-clean surface metal raceway interior. Clean metal raceway exterior.
      c. Test wiring devices for damaged conductors, high circuit resistance, poor connections, inadequate fault current path, defective devices, or similar problems using a portable receptacle tester. Correct circuit conditions, remove malfunctioning units and replace with new, and retest as specified above.
      d. Test GFCI receptacles.
   2. Receptacle testing in the Patient Care Spaces, such as retention force of the grounding blade of each receptacle, shall comply with the latest NFPA 99.

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SECTION 26 29 11
MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, connection, and testing of motor controllers, including all low- and medium-voltage motor controllers and manual motor controllers, indicated as motor controllers in this section, and low-voltage variable speed motor controllers.

B. Motor controllers, whether furnished with the equipment specified in other sections or otherwise (with the exception of elevator motor controllers specified in Division 14 and fire pump controllers specified in Division 21), shall meet this specification and all related specifications.

1.2 RELATED WORK

A. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Requirements for seismic restraint for nonstructural components.

B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

C. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Low-voltage conductors.

D. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

E. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:
   1. Shop Drawings:
      a. Submit sufficient information to demonstrate compliance with drawings and specifications.
      b. Include electrical ratings, dimensions, weights, mounting details, materials, overcurrent protection devices, overload relays, sizes of enclosures, wiring diagrams, starting characteristics, interlocking, and accessories.
      c. Certification from the manufacturer that representative motor controllers have been seismically tested to International Building Code requirements. Certification shall be based upon simulated seismic forces on a shake table or by analytical methods, but not by experience data or other methods.
   2. Manuals:
      a. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals, including technical data sheets, wiring diagrams, and information for ordering replacement parts.
         1) Wiring diagrams shall have their terminals identified to facilitate installation, maintenance, and operation.
         2) Wiring diagrams shall indicate internal wiring for each item of equipment and interconnections between the items of equipment.
         3) Elementary schematic diagrams shall be provided for clarity of operation.
         4) Include the catalog numbers for the correct sizes of overload relays for the motor controllers.

b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.

3. Certifications: Two weeks prior to final inspection, submit the following.
   a. Certification by the manufacturer that the motor controllers conform to the requirements of the drawings and specifications.
   b. Certification by the Contractor that the motor controllers have been properly installed, adjusted, and tested.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only. The latest edition as of the specification issue date shall govern.

B. Institute of Electrical and Electronic Engineers (IEEE):
   519 ..... Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems
   C37.90.1 ..... Standard Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus

C. International Code Council (ICC):
   IBC ..... International Building Code

D. National Electrical Manufacturers Association (NEMA):
   ICS 1 ..... Industrial Control and Systems: General Requirements
   ICS 1.1 ..... Safety Guidelines for the Application, Installation and Maintenance of Solid State Control
   ICS 2 ..... Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 Volts
   ICS 4 ..... Industrial Control and Systems: Terminal Blocks
   ICS 6 ..... Industrial Control and Systems: Enclosures
   ICS 7 ..... Industrial Control and Systems: Adjustable-Speed Drives
   ICS 7.1 ..... Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable-Speed Drive Systems

E. National Fire Protection Association (NFPA):
   70 ..... National Electrical Code (NEC)

F. Underwriters Laboratories Inc. (UL):
   508A ..... Industrial Control Panels
   1449 ..... Surge Protective Devices
   61800-5-1 ..... Adjustable Speed Electrical Power Drive Systems

PART 2 - PRODUCTS

2.1 MOTOR CONTROLLERS

A. Motor controllers shall comply with IEEE, NEMA, NFPA, UL, and as shown on the drawings.

B. Motor controllers shall be separately enclosed, unless part of another assembly. For installation in motor control centers, provide plug-in, draw-out type motor controllers up through NEMA size 4. NEMA size 5 and above require bolted connections.

C. Enclosures:

1. Enclosures shall be NEMA-type rated 1, 3R, or 12 as indicated on the drawings or as required per the installed environment.
2. Enclosure doors shall be interlocked to prevent opening unless the disconnecting means is open. A "defeater" mechanism shall allow for inspection by qualified personnel with the disconnect means closed. Provide padlocking provisions.
3. All metal surfaces shall be thoroughly cleaned, phosphatized, and factory primed prior to applying light gray baked enamel finish.

D. Motor control circuits:
1. Shall operate at not more than 120 Volts.
2. Shall be grounded, except where the equipment manufacturer recommends that the control circuits be isolated.
3. For each motor operating over 120 Volts, incorporate a separate, heavy duty, control transformer within each motor controller enclosure.
4. Incorporate primary and secondary overcurrent protection for the control power transformers.

E. Hand-Off-Automatic (H-O-A) switch is required unless specifically stated on the drawings as not required for a particular controller. H-O-A switch shall be operable without opening enclosure door. H-O-A switch is not required for manual motor controllers.

F. Incorporate into each control circuit a 120 Volt, electronic time-delay relay (ON delay), minimum adjustable range from 0.3 to 10 minutes, with transient protection. Time-delay relay is not required where H-O-A switch is not required.

G. Unless noted otherwise, equip each motor controller with not less than two normally open (N.O.) and two normally closed (N.C.) auxiliary contacts.

H. Provide green (RUN) and red (STOP) pilot lights.

I. Motor controllers incorporated within equipment assemblies shall also be designed for the specific requirements of the assemblies.

J. Additional requirements for specific motor controllers, as indicated in other specification sections, shall also apply.

2.2 LOW-VOLTAGE VARIABLE SPEED MOTOR CONTROLLERS (VSMC)

A. VSMC shall be in accordance with applicable portions of 2.1 above.

B. VSMC shall be electronic, with adjustable frequency and voltage, three phase output, capable of driving standard NEMA B three-phase induction motors at full rated speed. The control technique shall be pulse width modulation (PWM), where the VSMC utilizes a full wave bridge design incorporating diode rectifier circuitry. Silicon controlled rectifiers or other control techniques are not acceptable.

C. VSMC shall be suitable for variable torque loads, and shall be capable of providing sufficient torque to allow the motor to break away from rest upon first application of power.

D. VSMC shall be capable of operating within voltage parameters of plus 10 to minus 15 percent of line voltage, and be suitably rated for the full load amps of the maximum watts (HP) within its class.

E. Minimum efficiency shall be 95 percent at 100 percent speed and 85 percent at 50 percent speed.

F. The displacement power factor of the VSMC shall not be less than 95 percent under any speed or load condition.

G. VSMC current and voltage harmonic distortion shall not exceed the values allowed by IEEE 519.

H. Operating and Design Conditions:
1. Elevation: 118 feet Above Mean Sea Level (AMSL)

2. Temperatures: Maximum +90°F Minimum -10°F
3. Relative Humidity: 95%
4. VSMC Location: Non-conditioned space

I. VSMC shall have the following features:
1. Isolated power for control circuits.
2. Manually resettable overload protection for each phase.
3. Adjustable current limiting circuitry to provide soft motor starting. Maximum starting current shall not exceed 200 percent of motor full load current.
4. Independent acceleration and deceleration time adjustment, manually adjustable from 2 to 2000 seconds. Set timers to the equipment manufacturer's recommended time in the above range.
5. Control input circuitry that will accept 4 to 20 mA current or 0-10 VDC voltage control signals from an external source.
6. Automatic frequency adjustment from 1 Hz to 300 Hz.
7. Circuitry to initiate an orderly shutdown when any of the conditions listed below occur. The VSMC shall not be damaged by any of these electrical disturbances and shall automatically restart when the conditions are corrected. The VSMC shall be able to restart into a rotating motor operating in either the forward or reverse direction and matching that frequency.
   a. Incorrect phase sequence.
   b. Single phasing.
   c. Overvoltage in excess of 10 percent.
   d. Undervoltage in excess of 15 percent.
   e. Running overcurrent above 110 percent (VSMC shall not automatically reset for this condition.)
   f. Instantaneous overcurrent above 150 percent (VSMC shall not automatically reset for this condition).
   g. Short duration power outages of 12 cycles or less (i.e., distribution line switching, generator testing, and automatic transfer switch operations.)
8. Automatic Reset/Restart: Attempt three restarts after VSMC fault or on return of power after an interruption and before shutting down for manual reset or fault correction, with adjustable delay time between restart attempts.
9. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped, unless "Bidirectional Autospeed Search" feature is available and engaged.
10. Bidirectional Autospeed Search: Capable of starting VSMC into rotating loads spinning in either direction and returning motor to set speed in proper direction, without causing damage to VSMC, motor, or load.

J. VSMC shall include an input circuit breaker which will disconnect all input power, interlocked with the door so that the door cannot be opened with the circuit breaker in the closed position.

K. VSMC shall include a 5% line reactor and a RFI/EMI filter.

L. Surge Suppression: Provide three-phase protection against damage from supply voltage surges in accordance with UL 1449.

M. VSMC shall include front-accessible operator station, with sealed keypad and digital display, which allows complete programming, operating, monitoring, and diagnostic capabilities.
1. Typical control functions shall include but not be limited to:
   a. HAND-OFF-AUTOMATIC-RESET, with manual speed control in HAND mode.
   b. NORMAL-BYPASS.
2. Typical monitoring functions shall include but not be limited to:
   a. Output frequency (Hz).
   b. Motor speed and status (run, stop, fault).
   c. Output voltage and current.
3. Typical fault and alarm functions shall include but not be limited to:

a. Loss of input signal, under- and over-voltage, inverter overcurrent, motor overload, critical frequency rejection with selectable and adjustable deadbands, instantaneous line-to-line and line-to-ground overcurrent, loss-of-phase, reverse-phase, and short circuit.
b. System protection indicators indicating that the system has shutdown and will not automatically restart.

N. VSMC shall include two N.O. and two N.C. dry contacts rated 120 Volts, 10 amperes, 60 Hz.

O. Hardware, software, network interfaces, gateways, and programming to control and monitor the VSMC by control systems specified in other specification sections, including but not limited to Divisions 22 and 23.

P. Network communications ports: As required for connectivity to control systems specified in other specification sections, including but not limited to Divisions 22 and 23.

Q. Communications protocols: As required for communications with control systems specified in other specification sections, including but not limited to Divisions 22 and 23.

R. Bypass controller: Provide contactor-style bypass, arranged to bypass the inverter.
1. Inverter Output Contactor and Bypass Contactor: Load-break NEMA-rated contactor.
2. Motor overload relays.
3. HAND-OFF-AUTOMATIC bypass control.

S. Bypass operation: Transfers motor between inverter output and bypass circuit, manually, automatically, or both. VSMC shall be capable of stable operation (starting, stopping, and running), and control by fire alarm and detection systems, with motor completely disconnected from the inverter output. Transfer between inverter and bypass contactor and retransfer shall only be allowed with the motor at zero speed.

T. Inverter Isolating Switch: Provide non-load-break switch arranged to isolate inverter and permit safe troubleshooting and testing of the inverter, both energized and de-energized, while motor is operating in bypass mode. Include padlockable, door-mounted handle mechanism.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install motor controllers in accordance with the NEC, as shown on the drawings, and as recommended by the manufacturer.

B. In seismic areas, motor controllers shall be adequately anchored and braced per details on structural contract drawings to withstand the seismic forces at the location where installed.

C. Install manual motor controllers in flush enclosures in finished areas.

D. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and electronic overload relay pickup and trip ranges.

E. Program variable speed motor controllers per the manufacturer’s instructions and in coordination with other trades so that a complete and functional system is delivered.

F. Adjust trip settings of circuit breakers and motor circuit protectors with adjustable instantaneous trip elements. Initially adjust at six times the motor nameplate full-load ampere ratings and attempt to start motors several times, allowing for motor cooldown between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficiency motors if required). Where these maximum settings do not allow starting of a motor, notify COR before increasing settings.

G. Set the taps on reduced-voltage autotransformer controllers at 80 percent of line voltage.

3.2 ACCEPTANCE CHECKS AND TESTS

A. Perform manufacturer's required field tests in accordance with the manufacturer's recommendations. In addition, include the following:
   1. Visual Inspection and Tests:
      a. Compare equipment nameplate data with specifications and approved shop drawings.
      b. Inspect physical, electrical, and mechanical condition.
      c. Verify appropriate anchorage, required area clearances, and correct alignment.
      d. Verify that circuit breaker, motor circuit protector, and fuse sizes and types correspond to approved shop drawings.
      e. Verify overload relay ratings are correct.
      f. Vacuum-clean enclosure interior. Clean enclosure exterior.
      g. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data.
      h. Test all control and safety features of the motor controllers.
      i. For low-voltage variable speed motor controllers, final programming and connections shall be by a factory-trained technician. Set all programmable functions of the variable speed motor controllers to meet the requirements and conditions of use.

3.3 FOLLOW-UP VERIFICATION

A. Upon completion of acceptance checks, settings, and tests, the Contractor shall show by demonstration in service that the motor controllers are in good operating condition and properly performing the intended functions.

3.4 SPARE PARTS

A. Two weeks prior to the final inspection, provide one complete set of spare fuses for each motor controller.

3.5 INSTRUCTION

A. Furnish the services of a factory-trained technician for two 4-hour training periods for instructing personnel in the maintenance and operation of the motor controllers, on the dates requested by the COR.

---END---

SECTION 26 29 21
ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, and connection of fused and unfused disconnect switches (indicated as switches in this section), and separately-enclosed circuit breakers for use in electrical systems rated 600 V and below.

1.2 RELATED WORK

A. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Requirements for seismic restraint of non-structural components.

B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

C. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Low-voltage conductors.

D. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground faults.

E. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits.

F. Section 26 24 16, PANELBOARDS: Molded-case circuit breakers.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:
   1. Shop Drawings:
      a. Submit sufficient information to demonstrate compliance with drawings and specifications.
      b. Submit the following data for approval:
         1) Electrical ratings, dimensions, mounting details, materials, required clearances, terminations, weight, fuses, circuit breakers, wiring and connection diagrams, accessories, and device nameplate data.
      c. Certification from the manufacturer that representative enclosed switches and circuit breakers have been seismically tested to International Building Code requirements. Certification shall be based upon simulated seismic forces on a shake table or by analytical methods, but not by experience data or other methods.
   2. Manuals:
      a. Submit complete maintenance and operating manuals including technical data sheets, wiring diagrams, and information for ordering fuses, circuit breakers, and replacement parts.
         1) Include schematic diagrams, with all terminals identified, matching terminal identification in the enclosed switches and circuit breakers.
         2) Include information for testing, repair, troubleshooting, assembly, and disassembly.
      b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.
   3. Certifications: Two weeks prior to final inspection, submit the following.

a. Certification by the manufacturer that the enclosed switches and circuit breakers conform to the requirements of the drawings and specifications.
b. Certification by the Contractor that the enclosed switches and circuit breakers have been properly installed, adjusted, and tested.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only. The latest edition as of the specification issue date shall govern.

B. International Code Council (ICC):
IBC .....International Building Code

C. National Electrical Manufacturers Association (NEMA):
FU I.....Low Voltage Cartridge Fuses

KS I.....Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum)

D. National Fire Protection Association (NFPA):
70 .....National Electrical Code (NEC)

E. Underwriters Laboratories, Inc. (UL):
98 .....Enclosed and Dead-Front Switches

248 1 .....Low Voltage Fuses

489 .....Molded Case Circuit Breakers and Circuit Breaker Enclosures

PART 2 - PRODUCTS

2.1 FUSED SWITCHES RATED 600 AMPERES AND LESS

A. Switches shall be in accordance with NEMA, NEC, UL, as specified, and as shown on the drawings.

B. Shall be NEMA classified General Duty (GD) for 240 V switches, and NEMA classified Heavy Duty (HD) for 480 V switches.

C. Shall be horsepower (HP) rated.

D. Shall have the following features:
1. Switch mechanism shall be the quick-make, quick-break type.
2. Copper blades, visible in the open position.
3. An arc chute for each pole.
4. External operating handle shall indicate open and closed positions, and have lock-open padlocking provisions.
5. Mechanical interlock shall permit opening of the door only when the switch is in the open position, defeatable to permit inspection.
6. Fuse holders for the sizes and types of fuses specified.
7. Solid neutral for each switch being installed in a circuit which includes a neutral conductor.
8. Ground lugs for each ground conductor.
9. Enclosures:
   a. Shall be the NEMA types shown on the drawings.
   b. Where the types of switch enclosures are not shown, they shall be the NEMA types most suitable for the ambient environmental conditions.
   c. Shall be finished with manufacturer’s standard gray baked enamel paint over pretreated steel.

2.2 UNFUSED SWITCHES RATED 600 AMPERES AND LESS

A. Shall be the same as fused switches, but without provisions for fuses.

2.3 FUSED SWITCHES RATED OVER 600 AMPERES TO 1200 AMPERES

A. Shall be the same as fused switches, and shall be NEMA classified Heavy Duty (HD).

2.4 MOTOR RATED TOGGLE SWITCHES

A. Type 1, general purpose for single-phase motors rated up to 1 horsepower.

B. Quick-make, quick-break toggle switch with external reset button and thermal overload protection matched to nameplate full-load current of actual protected motor.

2.5 CARTRIDGE FUSES

A. Shall be in accordance with NEMA FU 1.

B. Service Entrance: Class RK1, fast acting.

C. Feeders: RK1, fast acting.

D. Motor Branch Circuits: Class RK1, time delay.

E. Other Branch Circuits: Class RK1, time delay.

F. Control Circuits: Class CC, fast acting.

2.6 SEPARATELY-ENCLOSED CIRCUIT BREAKERS

A. Provide circuit breakers in accordance with the applicable requirements in Section 26 24 16, PANELBOARDS.

B. Enclosures shall be the NEMA types shown on the drawings. Where the types are not shown, they shall be the NEMA type most suitable for the ambient environmental conditions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the NEC, as shown on the drawings, and manufacturer’s instructions.

B. In seismic areas, enclosed switches and circuit breakers shall be adequately anchored and braced per details on structural contract drawings to withstand the seismic forces at the location where installed.

C. Fused switches shall be furnished complete with fuses. Arrange fuses such that rating information is readable without removing the fuses.

3.2 ACCEPTANCE CHECKS AND TESTS

A. Perform in accordance with the manufacturer's recommendations. In addition, include the following:
   1. Visual Inspection and Tests:
      a. Compare equipment nameplate data with specifications and approved shop drawings.
      b. Inspect physical, electrical, and mechanical condition.
      c. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method.
      d. Vacuum-clean enclosure interior. Clean enclosure exterior.

3.3 SPARE PARTS

A. Two weeks prior to the final inspection, furnish one complete set of spare fuses for each fused disconnect switch installed on the project. Deliver the spare fuses to the COR.

---END---

SECTION 26 33 53.10
STATIC UPS FOR TELECOMMUNICATIONS SPACES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, connection, and testing of the static uninterruptible power supply for telecommunications spaces, indicated in this section as UPS.

1.2 RELATED WORK

A. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS (TELECOMMUNICATIONS): Requirement for seismic restraint for nonstructural components.

B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

C. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Low-voltage conductors.

D. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible fault currents.

E. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits.

F. Section 26 05 73, OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY: Short circuit and coordination study, and requirements for a coordinated electrical system.

G. Section 26 24 13, DISTRIBUTION SWITCHBOARDS: For low-voltage switchboard required for maintenance bypass of multiple module UPS.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Section 27 05 11, COMMON WORK RESULTS FOR COMMUNICATIONS.

1.4 FACTORY TESTS

A. UPS shall be thoroughly tested at the factory to assure that there are no electrical or mechanical defects.

B. Factory Tests shall be in accordance with Paragraph, MANUFACTURED PRODUCTS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:
   1. 1. UPS shall be factory full-load tested to meet the requirements specified using a test battery (not the battery to be supplied with the system) with AC input power and with battery power for a minimum of 8 hours, with meter readings taken every 30 minutes. Should a malfunction occur, the problem shall be corrected and the test shall be repeated. The tests shall encompass all aspects of operation, such as module failure, static bypass operation, battery failure, input power failure and overload ratings.

1.5 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:
   1. Shop Drawings:
      a. Submit sufficient information to demonstrate compliance with drawings and specifications.
      b. Include electrical ratings, dimensions, mounting details, materials, required clearances, terminations, weight, plan, front, side, and rear elevations, accessories, and device nameplate data.

c. Provide detailed and project-specific system diagram, showing maintenance bypass, UPS module(s), battery cabinet(s) and batteries, major circuit protective devices, interconnecting power and control wiring, key-type mechanical interlocks, and connections to power sources and loads, as applicable. Indicate whether interconnections are factory-provided/factory-installed, factory-provided/field-installed, or field-provided/field installed.

d. Certification from the manufacturer that a representative UPS has been seismically tested to International Building Code requirements. Certification shall be based upon simulated seismic forces on a shake table or by analytical methods, but not by experience data or other methods.

2. Manuals:

a. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals including technical data sheets, wiring diagrams, and information for ordering replacement parts.

1) Wiring diagrams shall have their terminals identified to facilitate installation, maintenance, and operation.

2) Wiring diagrams shall indicate internal wiring for each item of equipment and the interconnection between the items of equipment.

3) Provide a clear and concise description of operation, which gives, in detail, the information required to properly operate the UPS, including but not limited to bypass switchboard, UPS, key-type mechanical interlocks, remote devices, emergency power off buttons, fire alarm interface, and other components as applicable.

b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.

1) Include complete "As Installed" diagrams that indicate all pieces of equipment and their interconnecting wiring.

2) Include complete diagrams of the internal wiring for each piece of equipment, including "As Installed" revisions of the diagrams.

3) The wiring diagrams shall identify the terminals to facilitate installation, maintenance, operation, and testing.

3. Test Reports:

a. Submit certified factory design and production test reports for approval.

b. Two weeks prior to the final inspection, submit certified field test reports and data sheets to the COR.

4. Certifications: Two weeks prior to final inspection, submit the following.

a. Certification by the manufacturer that the UPS conforms to the requirements of the drawings and specifications.

b. Certification by the Contractor that the UPS has been properly installed, adjusted, and tested.

1.6 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata), form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.

B. Institute of Engineering and Electronic Engineers (IEEE):

C57.110-08.....Recommended Practice for Establishing Transformer Capability When Supplying Nonsinusoidal Load Currents

C62.41.1-02.....Surge Environment in Low-Voltage (1000 V and Less) AC Power Circuits

C62.41.2-02.....Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits

450-20 ..... Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications

485-20 ..... Sizing Lead-Acid Batteries for Stationary Applications

C. International Code Council (ICC):
IBC-18 ..... International Building Code

D. National Electrical Manufacturers Association (NEMA):
PE 1-12 ..... Uninterruptible Power Systems - Specification and Performance Verification

E. National Fire Protection Association (NFPA):
70-23 ..... National Electrical Code (NEC)

PART 2 - PRODUCTS

2.1 RACK-MOUNTED UPS SYSTEMS FOR TELECOMMUNICATIONS ENCLOSURES (TE)

A. Rack-Mounted UPS for Telecommunications Enclosures (TEs): Line interactive UPS system shall consist of a rectifier/charger unit and a 1-phase inverter module unit with their associated transformers, switching equipment, and accessories as required for operation.

B. General Requirements.
1. Form Factor: 2RU 19” rack-mountable, provided with 4-post mounting rails.
2. Capacity: 2,880VA.
3. Voltage: 120V (nominal).
4. UPS Type: Line Interactive.
5. AC Input: Single-phase, L5-30P, 2-wire plus ground.
6. AC Output: L5-30R, 2-wire plus ground.
7. Output Harmonic Distortion: <5%.
8. Battery Type: Lead-Acid, field replaceable.
9. Battery Runtime: 10 minutes at full load.
10. Monitoring: Onboard display interface providing information:
    a. Unit status (on utility, on UPS, charging, replace battery)
    b. Output load.
    c. Battery condition.
11. Ethernet Network Monitoring: Provided with RJ-45 form factor network interface, capable of communicating TCP/IP and SNMP v3.

2.2 RACK-MOUNTED UPS SYSTEMS

A. Rack-Mounted UPS: Double conversion UPS system shall consist of a rectifier/charger unit and a 3-phase inverter module unit with their associated transformers, synchronizing equipment, and accessories as required for operation.

B. General Requirements.
1. Form Factor: 6RU 19” rack-mountable, provided with 4-post mounting rails.
2. Airflow: Front to Rear.
3. Capacity: 5-6kW.
4. Voltage: 120/208V (nominal).
5. UPS Type: Double Conversion.
6. AC Input: Three-phase, L21-20P, 4-wire plus ground.
7. AC Output: L21-20R, 4-wire plus ground.
8. Output Harmonic Distortion: <5%.
9. Integral Maintenance Bypass Switch.
10. Integral Static Bypass Switch.
11. Battery Type: Lead-Acid, field replaceable, hot-swappable.
12. Battery Runtime: 10 minutes at full load.

13. Monitoring:
    a. Onboard display interface providing information:
        1) Unit status (on utility, on UPS, charging, replace battery)
        2) Output load (total and by phase).
        3) Battery condition.
    b. Ethernet remote interface:
        1) SNMP v3 output
        2) Unit status (on utility, on UPS, charging, replace battery)
        3) Output load.
        4) Battery condition.

2.3 MODULAR FRAME UPS SYSTEMS

A. Modular Frame UPS: Double conversion UPS system shall consist of a frame system that can support multiple rack-mountable, hot-swappable UPS and battery modules, along with associated transformers, input, output, and bypass circuit breakers, synchronizing equipment, and accessories as required for operation.

B. System Capacity: Unless stated otherwise, the parameters listed are under full rated output load at a unity power factor, with batteries fully charged and floating on the DC bus and with nominal input voltage. Overall up to 100 kVA with internal N+1 UPS modules at up to 40 °C.

C. System Type: Double Conversion.

D. /Integral Maintenance Bypass.

E. UPS Modules: Individual hot-swappable UPS modules each rated 10 kVA. Quantity of modules provided meet internal N+1 redundancy at operating (not ultimate) load level.

F. Battery Capacity: Discharge time to end voltage: 10 minutes, at 25 °C (77 °F). Battery shall be capable of delivering 125 percent of full rated output load at initial start-up.

G. System Bus Bracing: Braced for amperes symmetrical interrupting capacity as shown on drawings.

H. AC Input:
    1. Voltage 208 volts line-to-line.
    2. Number of phases: 3-phase, 4-wire, plus ground.
    3. Voltage Range: Plus 1%, minus 1%, without affecting battery float voltage or output voltage.
    4. Frequency: 60 Hz, plus or minus 5%.
    5. Total harmonic current distortion (THD) reflected into the primary line: 5 percent maximum.

I. AC Output
    1. Voltage 208 volts line-to-line, 120 volts line-to-neutral.
    2. Number of phases: 3-phase, 4-wire, plus ground.
    3. Voltage regulation:
        a. Balanced load: Plus or minus 1.0 percent.
        b. 100 percent load imbalance, phase-to-phase: Plus or minus 3 percent.
    4. Frequency: 60 Hz.
    5. Frequency regulation: Plus or minus 0.05%.
    6. Harmonic content (RMS voltage): 5% maximum total harmonic distortion with 100% nonlinear load.
    7. Load power factor operating range: 1.0 to 0.98.
    8. Phase displacement:
        a. Balanced load: Plus or minus 1 degree of bypass input.
    9. Overload capability (at full voltage) (excluding battery):
        a. 125 percent load for 10 minutes.

b. 150 percent load for 1 minute.

J. Voltage Transient Response:
1. 100% load step: Plus or minus 5%.

K. Rectifier/Charger Unit: Rectifier/charger unit shall be solid state and shall provide direct current to the DC bus.
1. Input Circuit Breaker: Rectifier/charger unit shall be provided with an input circuit breaker. The circuit breaker shall be sized to accept simultaneously the full-rated load and the battery recharge current.
2. Sizing: Rectifier/charger unit shall be sized for the following two simultaneous operating conditions:
a. Supplying the full rated load current to the inverter.
b. Recharging a fully-discharged battery to 95 percent of rated ampere-hour capacity within ten times the discharge time after normal AC power is restored, with the input protective device closed.

L. Inverter Unit: Inverter unit shall be a solid-state device capable of accepting power from the DC bus and providing AC power within specified limits.
1. Output Overload: The inverter shall be able to sustain an overload as specified across its output terminals.
2. Synchronism: The inverter shall normally operate in phase-lock and synchronism with the bypass source.
3. Modular Construction: Each control logic printed circuit board shall be electrically and physically packaged on an individual plug-in module with separate indication and adjustments.
4. Output Circuit Breaker: The output circuit breaker shall be capable of shunt tripping and shall have interrupting capacity as specified. Circuit breaker shall have provision for locking in the "off" position.

5. Output Transformer: The inverter output transformer shall be similar to the input transformer and shall be capable of handling up to K-13 nonlinear loads as described in IEEE C57.110.
6. Modular Inverter Isolation: Each inverter in the UPS shall have fault sensing and static isolation as well as an output protective device, to remove a faulted module from the system without affecting the critical load bus beyond the stated limits. The protection system shall have control logic capable of isolating only the faulted module, and shall not shut down the entire UPS upon a fault in one module. Open protective devices shall be indicated by an alarm and indicator light.

M. External Protection: UPS module shall have built-in self-protection against undervoltage, overvoltage, overcurrent and surges introduced on the AC input source and/or the bypass source. The UPS system shall sustain input surges without damage in accordance with IEEE C62.41.1 and IEEE C62.41.2. The UPS shall also have built-in self-protection against overvoltage and voltage surges introduced at the output terminals by paralleled sources, load switching, or circuit breaker operation in the critical load distribution system.

N. Internal Protection: UPS module shall be self-protected against overcurrent, sudden changes in output load and short circuits at the output terminals. UPS module shall be provided with output reverse power detection which shall cause that module to be disconnected from the critical load bus when output reverse power is present. UPS module shall have built-in protection against permanent damage to itself and the connected load for predictable types of failure within itself and the connected load. At the end of battery discharge limit, the module shall shut down without damage to internal components.

O. Static Bypass Transfer Switch:
1. A static bypass transfer switch shall be provided as an integral part of the UPS and shall consist of a static switch and a bypass protective device or bypass switch. The control logic shall contain an automatic transfer circuit that senses the status of the inverter logic

signals and alarm conditions and provides an uninterrupted transfer of the load to the bypass AC power source, without exceeding the transient limits specified herein, when a malfunction occurs in the UPS or when an external overload condition occurs.

2. Static Bypass Transfer Switch Disconnect: A disconnect shall be incorporated to isolate the static bypass transfer switch assembly so it can be removed for servicing. The disconnect shall be equipped with auxiliary contacts and provision for padlocking in either the "on" or "off" position.

P. Maintenance Bypass:

1. A maintenance bypass switch shall be provided as an integral part of the UPS and located within the UPS module. The maintenance bypass switch shall provide the capability to continuously support the load from the bypass AC power source while the UPS is isolated for maintenance. The maintenance bypass switch shall be housed in an isolated compartment inside the UPS cabinet. Switch shall contain a maintenance bypass protective device and a module isolation protective device.
2. The maintenance bypass switch shall provide the capability of transferring the load from the UPS static bypass transfer switch to maintenance bypass and then back to the UPS static bypass transfer switch with no interruption to the load.

Q. Module Control Panel:

1. The UPS module shall be provided with a LED control/indicator panel. Meters, controls, alarms, system diagnostics, mimic screen showing one-line diagram of the system, and indicators for operation of the UPS shall be on this panel.
   a. Module Meters:
      1) Meters shall have within 1 percent accuracy.
      2) The following functions shall be monitored and displayed:
         i. Input voltage, phase-to-phase (all three phases).
         ii. Input current, all three phases.
         iii. Input frequency.
         iv. Battery voltage.
         v. Battery current (charge/discharge).
         vi. Output voltage, phase-to-phase and phase-to-neutral (all three phases).
         vii. Output current, all three phases.
         viii. Output frequency.
         ix. Output kilowatts.
         x. Elapsed time meter to indicate hours of operation, 6 digits.
         xi. Bypass voltage, phase-to-phase and phase-to-neutral (all three phases).
         xii. Output kilovars.
         xiii. Output kilowatt hours, with 15-minute interval.
   b. Module Controls:
      1) Module shall have the following controls:
         i. Alarm test/reset function.
         ii. Module input protective device trip function.
         iii. Module output protective device trip function.
         iv. Battery protective device trip function.
         v. Emergency Power Off (EPO) pushbutton, with guard.
         vi. Control power off switch.
         vii. Static bypass transfer switch enable/disable selector switch.
   c. Module Alarm Indicators:
      1) Module shall have indicators for the following alarm items. Any one of these conditions shall turn on an audible alarm and the appropriate summary indicator. Each new alarm shall register without affecting any previous alarm.

i. Input AC power source failure.
ii. Input protective device open.
iii. Output protective device open.
iv. Overload.
v. Overload shutdown.
vi. DC overvoltage.
vii. DC ground fault.
viii. Low battery.
ix. Battery discharged.
x. Battery protective device open.
xi. Cooling fan failure.
xii. Equipment overtemperature.
xiii. Control power failure.
xiv. Charger off.
xv. Inverter off.
xvi. Emergency off.
xvii. UPS on battery.
xviii. Load on static bypass.
xix. Static bypass transfer switch disabled.
xx. Inverter output overvoltage, undervoltage, overfrequency, and underfrequency.
xxi. Bypass source overvoltage, undervoltage, overfrequency, and underfrequency.
xxii. Bypass source to inverter out of synchronization.
xxiii. transformer overtemperature.
xxiv. Inverter transformer overtemperature.

R. Remote Monitoring:
1. The UPS shall be provided with an Ethernet network interface card that allows continuous remote monitoring of equipment status via SNMP v3.
2. Remote monitoring will provide access to the same information as the module meters and alarm indicators.
3. Indicators: Minimum display shall include the following indicators:
   a. Load on UPS.
   b. Load on battery.
   c. Load on bypass.
   d. Low battery.
4. The remote system shall not affect nor reset alarm conditions on the local module control panel.

S. Battery System:
1. General: A storage battery system with sufficient ampere-hour rating to maintain UPS output at full capacity for the specified duration shall be provided for each UPS system.
2. Battery Modules: Individual 12V (nominal) hot-swappable battery modules. Quantity of modules provided to meet internal N+1 redundancy at operating (not ultimate) load level.
3. Battery Type: Only VRLA batteries may be operated in the VA environment. No specific chemistry requirements are applicable.
4. Battery Construction: The battery shall be of the valve-regulated, sealed, non-gassing, recombinant type.
5. Battery Cabinet: The batteries shall be furnished in a battery cabinet matching the UPS. The battery cabinet shall be provided with smoke and high temperature alarms.
6. Battery Disconnect: Each battery cabinet shall have a fused disconnect switch or circuit breaker, lockable in the “off” position, provided in a NEMA 1 enclosure.
7. Battery Connections: Battery-to-battery connections shall be stranded cable with proper cable supports or integral backplane busway.

T. Battery Monitoring System (BMS):

1. General: Integral battery monitoring is specified for modular frame UPS systems using modular batteries.
2. Monitored Parameters.
   a. Individual cell/jar/block float voltage.
   b. Individual cell/jar/block discharge voltage (continuous during discharge event).
   c. Total string voltage.
   d. Individual cell ohmic value.
   e. Discharge current (continuous).
   f. Charge current (continuous).
   g. Cell temperature (continuous).
   h. Ambient temperature (continuous).
3. The BMS shall be able to detect and report deteriorating individual battery element conditions prior to these conditions impacting other batteries in the string.
4. The BMS shall provide history trends for individual cells for the following parameters:
   a. Current flow.
   b. Temperature.
   c. Cell/jar/block voltage.
   d. Cell/jar/block ohmic value.
5. Remote Monitoring: The BMS shall be able to communicate over the UPS Ethernet connection to report on monitored and trended parameters. A software interface compatible with current VA information technology hardware shall be provided.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The UPS shall be set in place, wired, and connected in accordance with the approved shop drawings and manufacturer's instructions.

B. In seismic areas, UPS shall be adequately anchored and braced per details on structural contract drawings to withstand the seismic forces at the location where installed.

C. The UPS shall be connected to the network via Ethernet cable. Output data from the UPS (status, load, alarm conditions, etc.) shall be sent on this connection via SNMP v3 and verified to be accessible from facility building automation system and emergency control center.

3.2 ACCEPTANCE CHECKS AND TESTS

A. An authorized representative of the UPS manufacturer shall technically supervise and participate during all of the field adjustments and tests. Major adjustments and field tests shall be witnessed by the COR. The manufacturer’s representative shall certify in writing that the equipment has been installed, adjusted, and tested in accordance with the manufacturer’s recommendations.

B. Perform manufacturer’s required field tests in accordance with the manufacturer's recommendations. In addition, include the following:
   1. Visual Inspection and Tests (as appropriate):
      a. Compare equipment nameplate data with specifications and approved shop drawings.
      b. Inspect physical, electrical, and mechanical condition.
      c. Verify appropriate anchorage, required area clearances, and correct alignment.
      d. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey after energization.
      e. Verify grounding connections.
      f. Vacuum-clean enclosure interior. Clean enclosure exterior.
      g. Verify the correct operation of all alarms and indicating devices.

h. Attach a phase rotation meter to the UPS input, output, and bypass buses, and observe proper phase sequences.
i. Check and test controls for proper operation.
j. Check doors for proper alignment and operation.
k. Check and test each protective device for proper mechanical and electrical operation.
l. Verify protective device overcurrent trip settings against approved coordination study.
m. Confirm correct operation and sequencing of key-type mechanical interlock systems.

2. Load Test: The UPS shall be load tested for a continuous 24 hour period by means of resistive load banks, sized for full rated output load and provided by the UPS manufacturer. The UPS shall be continuously tested at 1/2 load for 8 hours, 3/4 load for 8 hours and full load for 8 hours. If a failure occurs during the burn-in period, the tests shall be repeated. Instrument readings shall be recorded every half hour for the following:
   a. Input voltage and current (all three phases, for each module).
   b. Input and output frequency.
   c. Battery voltage for each module.
   d. Output voltage and current (all three phases, for each module).
   e. Output kilowatts for each module.
   f. Output voltage and current (all three phases).
   g. Output kilowatts.

3. Full Load Burn In Test: The UPS shall undergo an additional full load burn-in period of 24 continuous hours by means of resistive load banks, sized for full rated output load and provided by the UPS manufacturer. If a failure occurs during the burn-in period, the tests shall be repeated. Instrument readings shall be recorded every half hour as above. The following tests shall be performed:
   a. With the UPS carrying full rated output load and supplied from the normal source, switch 100 percent of load bank capacity on and off a minimum of five times within the burn-in period.
   b. With the UPS carrying maximum continuous design load and supplied from the emergency source, repeat the switching operations described above.
4. Full Load Battery Burn In Test: The UPS shall undergo a full load battery test by means of resistive load banks, sized for full rated output load and provided by the UPS manufacturer. If a failure occurs during the battery discharge time, the tests shall be repeated. Instrument readings shall be recorded every half hour as above.
   a. With the UPS carrying full rated output load and operating on battery power, switch 100 percent of load bank capacity on and off a minimum of five times within the battery discharge time.
5. Battery Discharge and Recharge Test: With the battery fully charged, the UPS shall undergo a complete battery discharge test to full depletion followed by a full recharge. Instrument readings shall be recorded every minute during discharge for the following:
   a. Battery voltage and current for each module.
   b. Output voltage and current (all three phases) for each module.
   c. Output kilowatts for each module.
   d. Output voltage and current (all three phases).
   e. Output kilowatts (system).
   f. Output frequency.

3.3 FOLLOW-UP VERIFICATION

A. After completion of acceptance checks and tests, the Contractor shall show by demonstration in service that the UPS is in good operating condition and properly performing the intended function.

3.4 ONE LINE DIAGRAM AND SEQUENCE OF OPERATION

A. Furnish a written sequence of operation for the UPS and connected line side/load side electrical distribution equipment. The sequence of operation shall be laminated or mounted under acrylic glass, and installed in a frame mounted near the UPS.

B. Deliver an additional four copies of the as-built one line diagram and sequence of operation to the COR.

3.5 INSTRUCTION

A. Furnish the services of a factory-trained technician for one 4-hour training period for instructing personnel in the maintenance and operation of the UPS, on the dates requested by the COR.

---END---

SECTION 26 43 13
SURGE PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, and connection of Type 2 Surge Protective Devices, as defined in NFPA 70, and indicated as SPD in this section.

1.2 RELATED WORK

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

B. Section 26 24 16, PANELBOARDS: For factory-installed or external SPD.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:
   1. Shop Drawings:
      a. Submit sufficient information to demonstrate compliance with drawings and specifications.
      b. Include electrical ratings and device nameplate data.
   2. Manuals:
      a. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals including technical data sheets, wiring diagrams, and information for ordering replacement parts.
      b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.
   3. Certifications: Two weeks prior to final inspection, submit the following.
      a. Certification by the manufacturer that the SPD conforms to the requirements of the drawings and specifications.
      b. Certification by the Contractor that the SPD has been properly installed.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplement and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only. The latest edition as of the specification issue date shall govern.

B. Institute of Engineering and Electronic Engineers (IEEE):
   IEEE C62.41.2.....Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits

   IEEE C62.45.....Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits

C. National Fire Protection Association (NFPA):
   70 .....National Electrical Code (NEC)

D. Underwriters Laboratories, Inc. (UL):
   UL 1283.....Electromagnetic Interference Filters

   UL 1449.....Surge Protective Devices

PART 2 - PRODUCTS

2.1 SWITCHGEAR/SWITCHBOARD SPD

A. General Requirements:
1. Comply with IEEE and UL.
2. Modular design with field-replaceable modules, or non-modular design.
3. Fuses, rated at 200 kA interrupting capacity.
4. Bolted compression lugs for internal wiring.
5. Integral disconnect switch.
6. Redundant suppression circuits.
7. LED indicator lights for power and protection status.
8. Audible alarm, with silencing switch, to indicate when protection has failed.
9. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device.
10. Four-digit transient-event counter.

B. Surge Current per Phase: Minimum 240kA per phase.

2.2 PANELBOARD SPD

A. General Requirements:
1. Comply with UL 1449 and IEEE C62.41.2.
2. Modular design with field-replaceable modules, or non-modular design.
3. Fuses, rated at 200 kA interrupting capacity.
4. Bolted compression lugs for internal wiring.
5. Integral disconnect switch.
6. Redundant suppression circuits.
7. LED indicator lights for power and protection status.
8. Audible alarm, with silencing switch, to indicate when protection has failed.
9. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device.
10. Four-digit transient-event counter.

B. Surge Current per Phase: Minimum 120kA per phase.

2.3 ENCLOSURES

A. Enclosures: NEMA 1.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the NEC, as shown on the drawings, and manufacturer’s instructions.

B. Factory-installed SPD: Switchgear, switchboard, or panelboard manufacturer shall install SPD at the factory.

C. Field-installed SPD: Contractor shall install SPD with conductors or buses between SPD and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.
1. Provide a circuit breaker as a dedicated disconnecting means for TVSS as shown on drawings.

D. Do not perform insulation resistance tests on switchgear, switchboards, panelboards, or feeders with the SPD connected. Disconnect SPD before conducting insulation resistance tests, and reconnect SPD immediately after insulation resistance tests are complete.

3.2 ACCEPTANCE CHECKS AND TESTS

A. Perform in accordance with the manufacturer's recommendations. In addition, include the following:
   1. Visual Inspection and Tests:
      a. Compare equipment nameplate data with specifications and approved shop drawings.
      b. Inspect physical, electrical, and mechanical condition.
      c. Verify that disconnecting means and feeder size and maximum length to SPD corresponds to approved shop drawings.
      d. Verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method.
      e. Vacuum-clean enclosure interior. Clean enclosure exterior.
      f. Verify the correct operation of all sensing devices, alarms, and indicating devices.

3.3 FOLLOW-UP VERIFICATION

A. After completion of acceptance checks and tests, the Contractor shall show by demonstration in service that SPD are in good operating condition and properly performing the intended function.

3.4 INSTRUCTION

A. Provide the services of a factory-trained technician for one 2-hour training period for instructing personnel in the maintenance and operation of the SPD, on the date requested by the COR.

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SECTION 26 51 00
INTERIOR LIGHTING

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies the furnishing, installation, and connection of the interior lighting systems. The terms “lighting fixture,” “fixture,” and “luminaire” are used interchangeably.

1.2 RELATED WORK

A. Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT: Disposal of lamps.

B. Section 02 41 00, DEMOLITION: Removal and disposal of lamps and ballasts.

C. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Requirement for seismic restraint for nonstructural components.

D. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

E. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Low-voltage conductors.

F. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.

G. Section 26 27 26, WIRING DEVICES: Wiring devices used for control of the lighting systems.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:
   1. Shop Drawings:
      a. Submit the following information for each type of lighting fixture designated on the LIGHTING FIXTURE SCHEDULE, arranged in order of lighting fixture designation.
      b. Material and construction details, include information on housing and optics system.
      c. Physical dimensions and description.
      d. Wiring schematic and connection diagram.
      e. Installation details.
      f. Energy efficiency data.
      g. Photometric data based on laboratory tests complying with IES Lighting Measurements testing and calculation guides.
      h. Lamp data including lumen output (initial and mean), color rendition index (CRI), rated life (hours), and color temperature (degrees Kelvin).
      i. Ballast data including ballast type, starting method, ambient temperature, ballast factor, sound rating, system watts, and total harmonic distortion (THD).
      j. For LED lighting fixtures, submit US DOE LED Lighting Facts label, and IES L70 rated life.
   2. Manuals:
      a. Submit, simultaneously with the shop drawings, complete maintenance and operating manuals, including technical data sheets, wiring diagrams, and information for ordering replacement parts.

b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.

3. Certifications: Two weeks prior to final inspection, submit the following.
   a. Certification by the Contractor that the interior lighting systems have been properly installed and tested.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only. The latest edition as of the specification issue date shall govern.

B. American Society for Testing and Materials (ASTM):
   C635/C635M ..... Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings

C. Environmental Protection Agency (EPA):
   40 CFR 261 ..... Identification and Listing of Hazardous Waste

D. Federal Communications Commission (FCC):
   CFR Title 47, Part 15 ..... Radio Frequency Devices

   CFR Title 47, Part 18 ..... Industrial, Scientific, and Medical Equipment

E. Illuminating Engineering Society of North America (IESNA):
   LM-79 ..... Electrical and Photometric Measurements of Solid-State Lighting Products

   LM-80 ..... Measuring Lumen Maintenance of LED Light Sources

   LM-82 ..... Characterization of LED Light Engines and LED Lamps for Electrical and Photometric Properties as a Function of Temperature

F. Institute of Electrical and Electronic Engineers (IEEE):
   C62.41 ..... Surge Voltages in Low Voltage AC Power Circuits

G. International Code Council (ICC):
   IBC ..... International Building Code

H. National Electrical Manufacturer's Association (NEMA):
   C78.376 ..... Chromaticity of Fluorescent Lamps

   C82.1 ..... Lamp Ballasts – Line Frequency Fluorescent Lamp Ballasts

   C82.2 ..... Method of Measurement of Fluorescent Lamp Ballasts

   C82.4 ..... Lamp Ballasts - Ballasts for High-Intensity Discharge and Low-Pressure Sodium (LPS) Lamps (Multiple-Supply Type)

   C82.11 ..... Lamp Ballasts - High Frequency Fluorescent Lamp Ballasts

   LL 9 ..... Dimming of T8 Fluorescent Lighting Systems

   SSL 1 ..... Electronic Drivers for LED Devices, Arrays, or Systems

I. National Fire Protection Association (NFPA):
   70 ..... National Electrical Code (NEC)

   101 ..... Life Safety Code

J. Underwriters Laboratories, Inc. (UL):
   496 ..... Lampholders

   542 ..... Fluorescent Lamp Starters

844 .....Luminaires for Use in Hazardous (Classified) Locations

924 .....Emergency Lighting and Power Equipment

935 .....Fluorescent-Lamp Ballasts

1029 .....High-Intensity-Discharge Lamp Ballasts

1029A.....Outline of Investigation for Ignitors and Related Auxiliaries for HID Lamp Ballasts

1574.....Standard for Safety Track Lighting Systems

1598 .....Standard for Safety Luminaires

2108.....Standard for Safety Low-Voltage Lighting Systems

8750.....Standard for Safety Light Emitting Diode (LED) Light Sources for Use in Lighting Products

PART 2 - PRODUCTS

2.1 LIGHTING FIXTURES

A. Shall be in accordance with NFPA, UL, as shown on drawings, and as specified.

B. Sheet Metal:
   1. Shall be formed to prevent warping and sagging. Housing, trim and lens frame shall be true, straight (unless intentionally curved), and parallel to each other as designed.
   2. Wireways and fittings shall be free of burrs and sharp edges, and shall accommodate internal and branch circuit wiring without damage to the wiring.
   3. When installed, any exposed fixture housing surface, trim frame, door frame, and lens frame shall be free of light leaks.
   4. Hinged door frames shall operate smoothly without binding. Latches shall function easily by finger action without the use of tools.

C. Ballasts and lamps shall be serviceable while the fixture is in its normally installed position. Ballasts shall not be mounted to removable reflectors or wireway covers unless so specified.

D. Lamp Sockets:
   1. Fluorescent: Single slot entry type, requiring a one-quarter turn of the lamp after insertion. Lampholder contacts shall be the biting edge type.
   2. Compact Fluorescent: 4-pin.
   3. High Intensity Discharge (HID): Porcelain.

E. Recessed fixtures mounted in an insulated ceiling shall be listed for use in insulated ceilings.

F. Mechanical Safety: Lighting fixture closures (lens doors, trim frame, hinged housings, etc.) shall be retained in a secure manner by captive screws, chains, aircraft cable, captive hinges, or fasteners such that they cannot be accidentally dislodged during normal operation or routine maintenance.

G. Metal Finishes:
   1. The manufacturer shall apply standard finish (unless otherwise specified) over a corrosion-resistant primer, after cleaning to free the metal surfaces of rust, grease, dirt and other deposits. Edges of pre-finished sheet metal exposed during forming, stamping or shearing processes shall be finished in a similar corrosion resistant manner to match the adjacent surface(s). Fixture finish shall be free of stains or evidence of rusting, blistering, or flaking, and shall be applied after fabrication.
   2. Interior light reflecting finishes shall be white with not less than 85 percent reflectances, except where otherwise shown on the drawing.
   3. Exterior finishes shall be as shown on the drawings.

H. Lighting fixtures shall have a specific means for grounding metallic wireways and housings to an equipment grounding conductor.

I. Light Transmitting Components for Fluorescent Fixtures:
   1. Shall be 100 percent virgin acrylic.
   2. Flat lens panels shall have not less than 3 mm (1/8 inch) of average thickness.
   3. Unless otherwise specified, lenses, reflectors, diffusers, and louvers shall be retained firmly in a metal frame by clips or clamping ring in such a manner as to allow expansion and contraction without distortion or cracking.

J. Lighting fixtures in hazardous areas shall be suitable for installation in Class and Division areas as defined in NFPA 70.

K. Compact fluorescent fixtures shall be manufactured specifically for compact fluorescent lamps with ballast integral to the fixture. Assemblies designed to retrofit incandescent fixtures are prohibited except when specifically indicated for renovation of existing fixtures.

2.2 BALLASTS

A. Linear Fluorescent Lamp Ballasts: Multi-voltage (120 – 277V), electronic instant-start type, designed for type and quantity of lamps indicated. Ballasts shall be designed for full light output unless dimmer or bi-level control is indicated. Ballasts shall include the following features:
   1. Lamp end-of-life detection and shutdown circuit (T5 lamps only).
   2. Automatic lamp starting after lamp replacement.
   3. Sound Rating: Class A.
   4. Total Harmonic Distortion (THD): 10 percent or less.
   5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
   6. Operating Frequency: 20 kHz or higher.
   7. Lamp Current Crest Factor: 1.7 or less.
   8. Ballast Factor: 0.87 or higher unless otherwise indicated.
   9. Power Factor: 0.98 or higher.
   10. EMR/RFI Interference: Comply with CFR Title 47 Part 18 for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.
   11. To facilitate multi-level lamp switching, lamps within fixture shall be wired with the outermost lamp at both sides of the fixture on the same ballast, the next inward pair on another ballast and so on to the innermost lamp (or pair of lamps). Within a given room, each switch shall uniformly control the same corresponding lamp (or lamp pairs) in all fixture units that are being controlled.
   12. Where three-lamp fixtures are indicated, unless switching arrangements dictate otherwise, utilize a common two-lamp ballast to operate the center lamp in pairs of adjacent units that are mounted in a continuous row. The ballast fixture and slave-lamp fixture shall be factory wired with leads or plug devices to facilitate this circuiting. Individually mounted fixtures and the odd fixture in a row shall utilize a single-lamp ballast for operation of the center lamp.
   13. Dimming ballasts shall be as per above, except dimmable from 100% to 10% of rated lamp lumens. Dimming ballasts shall be fully compatible with the dimming controls.

2.3 LED EXIT LIGHT FIXTURES

A. Exit light fixtures shall meet applicable requirements of NFPA and UL.

B. Housing and door shall be die-cast aluminum.

C. For general purpose exit light fixtures, door frame shall be hinged, with latch. For vandal-resistant exit light fixtures, door frame shall be secured with tamper-resistant screws.

D. Finish shall be satin or fine-grain brushed aluminum.

E. There shall be no radioactive material used in the fixtures.

F. Fixtures:
1. Inscription panels shall be cast or stamped aluminum a minimum of 2.25 mm (0.090 inch) thick, stenciled with 150 mm (6 inch) high letters, baked with red color stable plastic or fiberglass. Lamps shall be luminous Light Emitting Diodes (LED) mounted in center of letters on red color stable plastic or fiberglass.
2. Double-Faced Fixtures: Provide double-faced fixtures where required or as shown on drawings.
3. Directional Arrows: Provide directional arrows as part of the inscription panel where required or as shown on drawings. Directional arrows shall be the "chevron-type" of similar size and width as the letters and meet the requirements of NFPA 101.

G. Voltage: Multi-voltage (120 – 277V).

2.4 LED LIGHT FIXTURES

A. General:
1. LED light fixtures shall be in accordance with IES, NFPA, UL, as shown on the drawings, and as specified.
2. LED light fixtures shall be Reduction of Hazardous Substances (RoHS)-compliant.
3. LED drivers shall include the following features unless otherwise indicated:
   a. Minimum efficiency: 85% at full load.
   b. Minimum Operating Ambient Temperature: -20˚ C. (-4˚ F.)
   c. Input Voltage: 120 - 277V (±10%) at 60 Hz.
   d. Integral short circuit, open circuit, and overload protection.
   e. Power Factor: ≥ 0.95.
   f. Total Harmonic Distortion: ≤ 20%.
   g. Comply with FCC 47 CFR Part 15.
4. LED modules shall include the following features unless otherwise indicated:
   a. Comply with IES LM-79 and LM-80 requirements.
   b. Minimum CRI: 80 or higher. Minimum Color Fidelity Index (IES Rf): 80 or higher.
   c. Color temperature between 3500° - 5000°K and as specified in the drawings' LIGHTING FIXTURE SCHEDULE.
   d. Minimum Rated Life: 50,000 hours per IES L70.
   e. Light output lumens as indicated in the LIGHTING FIXTURE SCHEDULE.
   f. Exit light fixtures shall NOT be supplied with backup battery. Facility is on dedicated generator emergency backup power.

B. LED Downlights:
1. Housing, LED driver, and LED module shall be products of the same manufacturer.

C. LED Troffers:
1. LED drivers, modules, and reflector shall be accessible, serviceable, and replaceable from below the ceiling.
2. Housing, LED driver, and LED module shall be products of the same manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the NEC, manufacturer's instructions, and as shown on the drawings or specified.

B. Align, mount, and level the lighting fixtures uniformly.

C. Wall-mounted fixtures shall be attached to the studs in the walls, or to a 20 gauge metal backing plate that is attached to the studs in the walls. Lighting fixtures shall not be attached directly to gypsum board.

D. Lighting Fixture Supports:

1. Shall provide support for all of the fixtures. Supports may be anchored to channels of the ceiling construction, to the structural slab or to structural members within a partition, or above a suspended ceiling.
2. Shall maintain the fixture positions after cleaning and relamping.
3. Shall support the lighting fixtures without causing the ceiling or partition to deflect.
4. Hardware for recessed lighting fixtures:
    a. All fixture mounting devices connecting fixtures to the ceiling system or building structure shall have a capacity for a horizontal force of 100 percent of the fixture weight and a vertical force of 400 percent of the fixture weight.
    b. Mounting devices shall clamp the fixture to the ceiling system structure (main grid runners or fixture framing cross runners) at four points in such a manner as to resist spreading of these supporting members. Each support point device shall utilize a screw or approved hardware to "lock" the fixture housing to the ceiling system, restraining the fixture from movement in any direction relative to the ceiling. The screw (size No. 10 minimum) or approved hardware shall pass through the ceiling member (T-bar, channel or spline), or it may extend over the inside of the flange of the channel (or spline) that faces away from the fixture, in a manner that prevents any fixture movement.
    c. In addition to the above, the following is required for fixtures exceeding 9 kg (20 pounds) in weight.
        1) Where fixtures mounted in ASTM Standard C635 "Intermediate Duty" and "Heavy Duty" ceilings and weigh between 9 kg and 25 kg (20 pounds and 56 pounds), provide two 12 gauge safety hangers hung slack between diagonal corners of the fixture and the building structure.
        2) Where fixtures weigh over 25 kg (56 pounds), they shall be independently supported from the building structure by approved hangers. Two-way angular bracing of hangers shall be provided to prevent lateral motion.
    d. Where ceiling cross runners are installed for support of lighting fixtures, they must have a carrying capacity equal to that of the main ceiling runners and be rigidly secured to the main runners.
5. Surface mounted lighting fixtures:
    a. Fixtures shall be bolted against the ceiling independent of the outlet box at four points spaced near the corners of each unit. The bolts (or stud-clips) shall be minimum 6 mm (1/4 inch) bolt, secured to main ceiling runners and/or secured to cross runners. Non-turning studs may be attached to the main ceiling runners and cross runners with special non-friction clip devices designed for the purpose, provided they bolt through the runner, or are also secured to the building structure by 12 gauge safety hangers. Studs or bolts securing fixtures weighing in excess of 25 kg (56 pounds) shall be supported directly from the building structure.
    b. Where ceiling cross runners are installed for support of lighting fixtures, they must have a carrying capacity equal to that of the main ceiling runners and be rigidly secured to the main runners.
    c. Fixtures less than 6.8 kg (15 pounds) in weight and occupying less than 3715 sq cm (two square feet) of ceiling area may, when designed for the purpose, be supported directly from the outlet box when all the following conditions are met.
        1) Screws attaching the fixture to the outlet box pass through round holes (not key-hole slots) in the fixture body.
        2) The outlet box is attached to a main ceiling runner (or cross runner) with approved hardware.
        3) The outlet box is supported vertically from the building structure.
    d. Fixtures mounted in open construction shall be secured directly to the building structure with approved bolting and clamping devices.
6. Single or double pendant-mounted lighting fixtures:
    a. Each stem shall be supported by an approved outlet box mounted swivel joint and canopy which holds the stem captive and provides spring load (or approved

equivalent) dampening of fixture oscillations. Outlet box shall be supported vertically from the building structure.

7. Outlet boxes for support of lighting fixtures (where permitted) shall be secured directly to the building structure with approved devices or supported vertically in a hung ceiling from the building structure with a nine gauge wire hanger, and be secured by an approved device to a main ceiling runner or cross runner to prevent any horizontal movement relative to the ceiling.

E. Furnish and install the new lamps as specified for all lighting fixtures installed under this project, and for all existing lighting fixtures reused under this project.

F. The electrical and ceiling trades shall coordinate to ascertain that approved lighting fixtures are furnished in the proper sizes and installed with the proper devices (hangers, clips, trim frames, flanges, etc.), to match the ceiling system being installed.

G. Bond lighting fixtures to the grounding system as specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

H. At completion of project, replace all defective components of the lighting fixtures at no cost to the Government.

I. Dispose of lamps per requirements of Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT, and Section 02 41 00, DEMOLITION.

3.2 ACCEPTANCE CHECKS AND TESTS

A. Perform the following:
1. Visual Inspection:
   a. Verify proper operation by operating the lighting controls.
   b. Visually inspect for damage to fixtures, lenses, reflectors, diffusers, and louvers. Clean fixtures, lenses, reflectors, diffusers, and louvers that have accumulated dust, dirt, or fingerprints during construction.
2. Electrical tests:
   a. Exercise dimming components of the lighting fixtures over full range of dimming capability by operating the control devices(s) in the presence of the COR. Observe for visually detectable flicker over full dimming range, and replace defective components at no cost to the Government.
   b. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Government. Burn-in period to be 40 hours minimum, unless specifically recommended otherwise by the lamp manufacturer. Burn-in dimmed fluorescent and compact fluorescent lamps for at least 100 hours at full voltage, unless specifically recommended otherwise by the lamp manufacturer. Replace any lamps and ballasts which fail during burn-in.

3.3 FOLLOW-UP VERIFICATION

A. Upon completion of acceptance checks and tests, the Contractor shall show by demonstration in service that the lighting systems are in good operating condition and properly performing the intended function.

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SECTION 26 56 00
EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, and connection of exterior fixtures, poles, and supports. The terms “lighting fixtures”, “fixture” and “luminaire” are used interchangeably.

1.2 RELATED WORK

A. Section 03 30 00, CAST-IN-PLACE CONCRETE.

B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.

C. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low voltage power and lighting wiring.

D. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

E. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits, fittings, and boxes for raceway systems.

F. Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION: Underground handholes and conduits.

G. Section 26 09 23, LIGHTING CONTROLS: Controls for exterior lighting.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:

1. Shop Drawings:
   a. Submit the following information for each type of lighting fixture designated on the LIGHTING FIXTURE SCHEDULE, arranged in order of lighting fixture designation.
   b. Material and construction details, include information on housing and optics system.
   c. Physical dimensions and description.
   d. Wiring schematic and connection diagram.
   e. Installation details.
   f. Energy efficiency data.
   g. Photometric data based on laboratory tests complying with IES Lighting Measurements testing and calculation guides.
   h. Lamp data including lumen output (initial and mean), color rendition index (CRI), rated life (hours), and color temperature (degrees Kelvin).
   i. Ballast data including ballast type, starting method, ambient temperature, ballast factor, sound rating, system watts, and total harmonic distortion (THD).
   j. For LED lighting fixtures, submit US DOE LED Lighting Facts label, and IES L70 rated life.
   k. Submit site plan showing all exterior lighting fixtures with fixture tags consistent with Lighting Fixture Schedule as shown on drawings. Site plan shall show computer generated point–by-point illumination calculations. Include lamp lumen and light loss factors used in calculations.

2. Manuals:
   a. Submit, simultaneously with the shop drawings, complete maintenance and operating manuals, including technical data sheets, wiring diagrams, and information for ordering replacement parts.
   b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.
3. Certifications: Two weeks prior to final inspection, submit the following.
   a. Certification by the Contractor that the exterior lighting systems have been properly installed and tested.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only. The latest edition as of the specification issue date shall govern.

B. American Association of State Highway and Transportation Officials (AASHTO):
   LRFDLTS ..... Structural Supports for Highway Signs, Luminaires and Traffic Signals

C. American Concrete Institute (ACI):
   318 ..... Building Code Requirements for Structural Concrete

D. American National Standards Institute (ANSI):
   H35.1/H35 1M ..... American National Standard Alloy and Temper Designation Systems for Aluminum

E. American Society for Testing and Materials (ASTM):
   A123/A123M ..... Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
   A153/A153M..... Zinc Coating (Hot-Dip) on Iron and Steel Hardware
   B108/B108M ..... Aluminum-Alloy Permanent Mold Castings
   C1089 ..... Spun Cast Prestressed Concrete Poles

F. Federal Aviation Administration (FAA):
   AC 70/7460-IL ..... Obstruction Marking and Lighting
   AC 150/5345-43J ..... Specification for Obstruction Lighting Equipment

G. Illuminating Engineering Society of North America (IESNA):
   RP-8 ..... Roadway Lighting
   LM-72 ..... Directional Positioning of Photometric Data
   LM-79 ..... Approved Method for the Electrical and Photometric Measurements of Solid-Sate Lighting Products
   LM-80 ..... Approved Method for Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays and Modules
   TM-15 ..... Luminaire Classification System for Outdoor Luminaires

H. National Electrical Manufacturers Association (NEMA):
   C78.41 ..... Electric Lamps – Guidelines for Low-Pressure Sodium Lamps
   C78.42 ..... Electric Lamps – Guidelines for High-Pressure Sodium Lamps
   C78.43 ..... Electric Lamps – Single-Ended Metal-Halide Lamps
   C78.1381 ..... Electric Lamps – 70-Watt M85 Double-Ended Metal-Halide Lamps

C81.61 ..... Electrical Lamp Bases – Specifications for Bases (Caps) for Electric Lamps

C82.4 ..... Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type)

C136.3 ..... For Roadway and Area Lighting Equipment – Luminaire Attachments

C136.17..... Roadway and Area Lighting Equipment – Enclosed Side-Mounted Luminaires for Horizontal-Burning High-Intensity-Discharge Lamps – Mechanical Interchangeability of Refractors

ICS 2 ..... Controllers, Contactors and Overload Relays Rated 600 Volts

ICS 6 ..... Enclosures

I. National Fire Protection Association (NFPA):
70 ..... National Electrical Code (NEC)

101 ..... Life Safety Code

J. Underwriters Laboratories, Inc. (UL):
496 ..... Lampholders

773 ..... Plug-In, Locking Type Photocontrols for Use with Area Lighting

773A ..... Nonindustrial Photoelectric Switches for Lighting Control

1029 ..... High-Intensity-Discharge Lamp Ballasts

1598 ..... Luminaires

8750..... Light Emitting Diode (LED) Equipment for Use in Lighting Products

1.6 DELIVERY, STORAGE, AND HANDLING

A. Provide manufacturer's standard provisions for protecting pole finishes during transport, storage, and installation. Do not store poles on ground. Store poles so they are at least 305 mm (12 inches) above ground level and growing vegetation. Do not remove factory-applied pole wrappings until just before installing pole.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Luminaires, materials and equipment shall be in accordance with NEC, UL, ANSI, and as shown on the drawings and specified.

2.2 LUMINAIRES

A. Luminaires shall be weatherproof, heavy duty, outdoor types designed for efficient light utilization, adequate dissipation of lamp and ballast heat, and safe cleaning and relamping.

B. Illumination distribution patterns, BUG ratings and cutoff types as defined by the IESNA shall be as shown on the drawings.

C. Incorporate ballasts in the luminaire housing, except where otherwise shown on the drawings.

D. Lenses shall be frame-mounted, heat-resistant, borosilicate glass, with prismatic refractors, unless otherwise shown on the drawings. Attach the frame to the luminaire housing by hinges or chain. Use heat and aging-resistant, resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

E. Lamp sockets for high intensity discharge (H.I.D) fixture shall have locking-type porcelain enclosures in conformance to the applicable requirements of ANSI C81.61-09 and UL 496-08.

F. Pre-wire internal components to terminal strips at the factory.

G. Bracket-mounted luminaires shall have leveling provisions and clamp-type adjustable slip-fitters with locking screws.

H. Materials shall be rustproof. Latches and fittings shall be non-ferrous metal.

I. Provide manufacturer's standard finish, as scheduled on the drawings. Where indicated on drawings, match finish process and color of pole or support materials.

J. Luminaires shall carry factory labels, showing complete, specific lamp and ballast information.

2.3 LAMPS

A. Install the proper lamps in every luminaire installed and every existing luminaire relocated or reinstalled as shown on the drawings.

B. Lamps shall be general-service, outdoor lighting types.

C. High-Pressure Sodium (HPS) Lamps: Comply with NEMA C78.42, Color Rendering Index (CRI) 21 (minimum), wattage as indicated on fixture schedule. Lamps shall have minimum average rated life of 24,000 hours.

D. Low-Pressure Sodium (LPS) Lamps: Comply with NEMA C78.41, wattage as indicated on fixture schedule. Lamps shall have minimum average rated life of 18,000 hours.

E. LED sources shall meet the following requirements:
1. Operating temperature rating shall be between -40 degrees C (-40 degrees F) and 50 degrees C (120 degrees F).
2. Correlated Color Temperature (CCT): 4000K, 4500K, or 5000K as scheduled.
3. Color Rendering Index (CRI): ≥ 85..
4. The manufacturer shall have performed reliability tests on the LEDs luminaires complying with Illuminating Engineering Society (IES) LM79 for photometric performance and LM80 for lumen maintenance and L70 life.

F. Mercury vapor lamps shall not be used.

2.4 LED DRIVERS

A. LED drivers shall meet the following requirements:
1. Drivers shall have a minimum efficiency of 85%.
2. Starting Temperature: -40 degrees C (-40 degrees F).
3. Input Voltage: 120 to 480 (±10%) volt.
4. Power Supplies: Class I or II output.
5. Surge Protection: The system must survive 250 repetitive strikes of “C Low” (C Low: 6kV/1.2 x 50 µs, 10kA/8 x 20 µs) waveforms at 1-minute intervals with less than 10% degradation in clamping voltage. “C Low” waveforms are as defined in IEEE/ASNI C62.41.2-2002, Scenario 1 Location Category C.
6. Power Factor (PF): ≥ 0.90.
7. Total Harmonic Distortion (THD): ≤ 20%.
8. Comply with FCC Title 47 CFR Part 18 Non-consumer RFI/EMI Standards.
9. Drivers shall be reduction of hazardous substances (ROHS)-compliant.

2.5 EXISTING LIGHTING SYSTEMS

A. For modifications or additions to existing lighting systems, the new components shall be compatible with the existing systems.

B. New poles and luminaires shall have approximately the same configurations, dimensions, lamping and reflector type as the existing poles and luminaires, except where otherwise shown on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lighting in accordance with the NEC, as shown on the drawings, and in accordance with manufacturer's recommendations.

B. Install lamps in each luminaire.

C. Adjust luminaires that require field adjustment or aiming.

3.2 GROUNDING

A. Ground noncurrent-carrying parts of equipment, including metal poles, luminaires, mounting arms, brackets, and metallic enclosures, as specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS. Where copper grounding conductor is connected to a metal other than copper, provide specially-treated or lined connectors suitable and listed for this purpose.

3.3 ACCEPTANCE CHECKS AND TESTS

A. Verify operation after installing luminaires and energizing circuits.

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SECTION 27 05 00
COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section includes common requirements for communications installations and applies to all sections of Division 27 and Division 28.

1.2 REFERENCES

A. General provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections.

B. Architectural, Electrical, and Technology Drawings. Other systems drawings may apply. Division 26 Basic Electrical Materials and Methods sections apply to the work of this section.

1.3 SUMMARY

A. The term “provide” used throughout this specification and drawings shall mean “furnish, install, test, and certify”.

B. Coordinate project schedule, installation schedule, phasing and any other requirements deemed necessary with Construction Manager and/or General Contractor and all necessary trades to ensure successful completion of work.

C. Phasing, temporary distribution/equipment, cut-over and implementation shall be coordinated with the COR and the Office of Information Technology (OIT), Construction Manager and/or General Contractor, Architect, and Engineer

D. Extent of communications raceway infrastructure work is indicated by Division 27 specifications and Technology drawings and schedules and is hereby defined to include, but not by way of limitation, the provisions of:
   1. Raceway systems including but not limited to conduits, cable trays, sleeves, surface raceways, telecommunication services entrance, manholes, pull-boxes, junction boxes, back-boxes, etc. as required and specified in Division 27 sections and select Division 26 sections. The Construction Manager and/or General Contractor shall coordinate this with the Sub-Contractor performing work and determine how scope of work is assigned. The purpose of this specification is to establish design intent and general system scope.
   2. All communications raceway infrastructure (i.e. pathways and spaces) shall be provided as part of the Base Building Project including:
      a. Communication room hardware and component fit-out including cable tray, backboard, and raceways.
      b. Grounding and bonding of all metallic hardware components to the nearest telecommunications grounding bus (TGB) bar including but not limited to equipment racks, cabinets, cable trays, ladder rack, conduits, sleeves, metallic ductwork, and frames.
      c. Fire stopping as required. Contractor shall provide fire stopping for all low-voltage openings (including empty low voltage raceway) once cable installation is complete. Confirm specific fire stopping scope requirements with General Contractor and/or Construction Manager.
      d. Testing of the grounding systems as noted by specification, drawings, and applicable industry standards. Submit written testing results to OIT.
      e. Labeling of all communication infrastructure components with mechanically printed labels.
      f. Preparation and submission of product data, shop drawings, testing reports, as-built drawings, and cabling documentation as required in this specification.

g. Construction and Installation warranties.
h. Manufacturer components, channel and solutions warranties.
i. Installation and testing of all system and components.
j. Onsite administrative and user training.
k. Manufacturer training of components.

1.4 SUBMITTALS

A. General Description and Requirements
1. Assign a single communications project manager to serve as point of contact for Government, contractor, and design professional.
2. Communications Project Manager Responsibilities:
   a. Assume responsibility for overall telecommunications system integration and coordination of work among trades, subcontractors, and authorized system installers.
   b. Coordinate with related work indicated on drawings or specified.
   c. Manage work related to telecommunications system installation in a manner approved by manufacturer.
3. In addition to the requirements noted herein, refer to Division 1 Specification for additional requirements. As a minimum, Contractor shall ensure all requirements listed here are met.
4. Within 45 days after award of contract or as dictated by the construction schedule (whichever period of time is shorter), the Contractor shall submit prefabrication submittals consisting of product data and shop drawings for approval. Partial submittals will not be accepted without prior written approval from the Architect.
5. Review of the Prefabrication Submittals by the Architect is for purposes of tracking the work and contract administration and does not relieve the Contractor of responsibility for any deviation from the Contract Documents, or from providing equipment and/or services required by the Contract Documents which were omitted from the prefabrication submittals.
6. No portion of the project shall commence nor shall any equipment be procured until the prefabrication submittals have been approved in writing by the Architect. All installations shall be in accordance with the Contract Documents.
7. A detailed completion schedule shall be submitted with the prefabrication submittals.
8. Prefabrication submittals shall be accompanied by a letter of transmittal identifying the name of the project, Contractor's name, date submitted for review, and a list of items transmitted.

B. Product Data
1. Compliance Matrix: Provide full specification compliance matrix as described in the Specification Response section of this specification section.
2. Warranty Information: Provide all warranty information as described in this specification section for review and approval.
3. Component List: Provide complete submittal component list at the beginning of the submittal package. Component list shall identify each component name, manufacturer, and specific product/part number. All part numbers shall clearly indicate special options, color, accessories, etc. Component list and manufacturer cut-sheets shall be compiled to match the order of each Appendix.
4. Cut-Sheets: Submit manufacturer’s cut-sheets on all components listed within this specification and corresponding appendix. All components and parts being used shall be highlighted in color on cut-sheets to distinguish specific product/part numbers, options, colors, accessories, etc.
5. performance based, thus all products listed in Appendix 1: Equipment Schedule are benchmark products. The Contractor shall include the listed benchmark product lines in the initial bid as the “base” solution, unless noted otherwise. The Contractor may submit (as a proposed “alternate” solution) substitute manufacturers and models that may be

more cost effective or readily available. All substitutions shall meet or exceed the minimum functional, physical, and technical specifications. Acceptance of such substitutions is at the discretion of the COR, Architect, and Engineer. Additionally, the requirements of Division 1 Specifications shall apply and may supersede requirements noted herein.

C. Prefabrication Shop Drawings
1. Symbol Legend, Abbreviations, and Description: Provide drawings including descriptions of all abbreviations, symbols, typical mounting heights, project information, etc.
2. One-Line Wiring Diagrams: Include one-line wiring diagrams indicating all backbone and horizontal cabling, copper pair and fiber strand counts, cable quantities, splice enclosures, etc.
3. Site Plan: Provide complete site and exterior plans indicating all site and building façade mounted communication device outlets, equipment, and components proposed to be installed. Additionally, manholes, pull-boxes, and all major raceway routing shall be indicated for conduits 2-inches and larger. Shop drawings shall represent final conduit routing and manhole and/or pull-box placement as coordinated and/or confirmed with Service Provider, Civil Engineer and other trades.
4. Floor Plans: Indicating all communication device outlets, equipment, and components proposed to be installed. Floor plans shall indicate cable routing origin and labeling scheme for each cable and termination position. Additionally, major raceway routing shall be indicated for cable trays and conduits 2-inches and larger, based on final coordination with all other trades. Shop shall clearly indicate areas with cable tray clearance limitations and/or other cable access limitations for review and approval by the COR, Architect, and Engineer.
5. Enlarged Plans: Provide ¼” = 1’-0” enlarged plans of all communication rooms including Telecommunications Entrance Facilities (TEF), Telecommunications Rooms (TR), and Equipment Rooms (ER), indicating the position of equipment cabinets, racks, wiring terminals, patch panels, grounding equipment, cable tray, fiber and copper terminations, and other low voltage systems equipment layout within the rooms. Additionally, shop drawings shall clearly indicate final conduit/riser (core drill and/or block-out) locations and sizes as coordinated and/or confirmed with Structural Engineer and any field conditions that impact proposed location. Shop drawings shall clearly indicate areas where equipment clearances may be limited, for review and approval by the COR.
6. Details: Including method of attachment of racks to the floor and ladder tray systems, method of attachment of wall mounted distribution frames, grounding details indicating grounding method for cabinets, racks, cable tray, cable management, and power details for rack mounted power distribution.
7. Telecommunications Space Plans/Elevations: Provide enlarged floor plans of telecommunication spaces indicating layout of equipment and devices, including electrical receptacles and grounding provisions. Submit detailed plan views and elevations of telecommunication spaces showing enclosures, termination equipment, supporting electrical and mechanical infrastructure equipment, and cable paths. Include following rooms:
   a. Telecommunications Rooms (TRs) and Antenna Headend Rooms.
   b. Entrance Rooms.
   c. Computer Room.
8. Cable Plant Distribution Plans: Provide facility and campus plan drawings showing inside plant and outside plant diverse path distribution pathways, distances, media types, and equipment.
9. Computer Room Structured Cabling Plans: Provide logical, schematic, or plan drawings of the structured cabling system in the facility computer room showing diverse path distribution pathways, distances, media types, and equipment.
10. Logical Drawings: Provide logical riser or schematic drawings for cable plant and grounding/bonding systems. Show termination points and identify wiring connections.

11. IT Equipment Enclosure Elevation Drawings: Provide elevation drawings of racks and cabinets in all telecommunications spaces showing passive equipment layouts, grounding and bonding details, and power distribution equipment details.
12. Provide parts list including quantity of spare parts.
13. Provide manufacturer product information. Government reserves the right to request a list of installations where products have been in operation.
14. Elevations:
    a. Rack elevations indicating patch panels, fiber terminals and enclosures, vertical and horizontal cable managers, rack mounted power strips or distribution units, etc.
    b. Wall elevations of distribution frame with block size, cable routing, cable management, pair counts, method of attachment, etc.
15. Drawing Scale: Shop drawings shall be drawn to scale and completely dimensioned as to clearly show construction detail.
16. Labeling: Provide documentation of all labeling schemes for conduit, back-boxes, cables, outlets, wiring blocks and/or patch
17. Documentation: Provide a minimum of (1) hardcopy set of prints (in addition to electronic copies) for review or as indicated in Division-1 general conditions.

1.5 QUALITY ASSURANCE

A. Codes and Standards: All materials and installations shall comply with current applicable codes and standards, including but not limited to:
1. VA Infrastructure Standard for Telecommunications Spaces (ISTS)
   ANSI/EIA/TIA-526: Standard Test Procedures for Fiber Optic Systems.
2. ANSI/EIA/TIA-526: Standard Test Procedures for Fiber Optic Systems.
3. ANSI/EIA/TIA-568-C.0: Generic Communications Cabling for Customer Premises.
4. ANSI/EIA/TIA-568-C.1: Commercial Building Communications Cabling Standards, Part 1: General Requirements.
5. ANSI/EIA/TIA-568-C.2: Balanced Twisted-Pair Communications Cabling and Components Standard.
6. ANSI/EIA/TIA-568-C.3: Optical Fiber Cabling Components Standard.
7. ANSI/EIA/TIA-569-A: Commercial Building Standard for Telecommunications Pathways and Spaces.
8. ANSI/EIA/TIA-606-A: Administrative Standard for Commercial Telecommunications.
9. ANSI/J-STD-607-A: Commercial Building Grounding and Bonding Requirements for Communications.
10. TIA-758-A: Customer-Owned Outside Plant Communications Cabling Standard.
11. ANSI/TIA-942: Telecommunications Infrastructure Standard for Data Centers.
12. ASTM: American Society for Testing and Materials
13. BICSI CO-OSP Design Manual (current edition): Customer-Owned Outside-Plant Design Manual
14. BICSI Electronic Safety and Security (ESS) Design Reference Manual (current edition).
    14. BICSI Network Design Reference Manual (current edition).
15. BICSI TDM Telecommunications Distribution Methods Manual (current edition).
16. BICSI Wireless Design Reference Manual (current).
17. EIA/TIA TSB67: Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling.
18. ICEA: Insulated Cable Engineers Association
19. IEEE-802.11 a, g, n, a/c: Wireless Local Area Networks.
20. IEEE-802.3: 10 Mb/s, 100 Mb/s, 1 Gb/s, and 10 Gb/s Ethernet Standards as applicable based on media types (twisted pair copper, fiber optics, etc.)
21. IEEE-802.3ak: 10 Gb/s Ethernet (evolving copper standard).
22. IEEE-1100-1999: Recommended Practice for Powering and Grounding Sensitive Electronic Equipment.
23. IEEE-141: Recommended Practice
24. IEEE-241: Recommended Practice for Electric Power Systems in Commercial Buildings

25. ISO/IEC 11801: International Standard on Information Technology – Generic Cabling of Customer Premises. 27. NESC: National Electrical Safety Code
26. NEMA Stds Pub No. VE 1, Cable Tray Systems. Additionally, comply with current edition of NEC, as applicable to construction and installation of cable tray systems.
27. NEMA Std 250: Enclosures for Electrical Equipment (1000 Volts Maximum). 30. NFPA-70/NEC: National Electrical Code.
28. NFPA-72: National Fire Alarm and Signaling Code 32. UL Compliance: Provide products which are UL-listed and labeled.
29. USDA Bulletin 1751F-643: Underground Plant Design.

B. Manufacturer and Product Qualifications
1. Provide products from manufacturers regularly engaged in the production of communications infrastructure components, including but not limited to, raceway, horizontal copper cabling, copper and fiber optic backbone cabling, and connecting hardware.
2. Provide products from manufacturers whose products of similar types, capacities, and characteristics have been in satisfactory use in similar type projects for not less than five years.
3. Quality assurance requirements apply to equipment and systems described in the ISTS
4. Manufacturer's Qualifications: Manufacturer must produce, as a principal product, the equipment and material specified for this project and have manufactured item for at least three years.
5. Product and System Qualification:
   a. OEM must have three installations of equipment submitted presently in operation of similar size and type as this project, that have continuously operated for a minimum of three years.
   b. Government reserves the right to request a list of installations where products have been in operation before approval.
   c. Authorized representative of OEM must be responsible for design, satisfactory operation of installed system, and certification.
6. Comply with FAR clause 52.236-5 for material and workmanship.
7. When more than one unit of same class of equipment is required, units must be product of a single manufacturer.
8. Equipment Assemblies and Components:
   a. Components of an assembled unit need not be products of same manufacturer.
   b. Manufacturers of equipment assemblies, which include components made by others, to assume complete responsibility for final assembled unit.
   c. Provide compatible components for assembly and intended service.
   d. Constituent parts which are similar must be product of a single manufacturer.
9. Identify factory wiring on equipment being furnished and on wiring diagrams.
10. Testing Agencies: Government reserves the option of witnessing factory tests. Notify COR minimum 15 working days
11. When equipment fails to meet factory test and re-inspection is required, contractor is liable for additional expenses, including expenses of Government.

C. Contractor Qualifications
1. The company shall have a fully staffed office with technical installations support personnel within the metropolitan area. (Exceptions to this shall be confirmed through approval by the COR, Architect, and Engineer.)
2. The Low Voltage Raceway Contractor shall be a certified installer (current and in good standing with proven history) of the selected manufacturer's raceway systems and shall provide a 25-year warranty on installation and applications.

D. All materials shall be Underwriters Laboratories (UL) or Intertek Testing Services (ETL) Listed unless otherwise indicated.

E. Coordinate with electrical work and other trades to properly interface installation of communications raceway.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver equipment and components in factory-fabricated containers or wrappings, which properly protect equipment from damage.

B. Store equipment and components in original packaging. Store inside in a well-ventilated space protected from weather, moisture, soiling, humidity, and extreme temperatures.

C. Handle equipment and components carefully to prevent damage. Do not install damaged units or components; replace them with new.

D. Delivery and Acceptance Requirements:
   1. Government's approval of submittals must be obtained for equipment and material before delivery to job site.
   2. Deliver and store materials to job site in OEM's original unopened containers, clearly labeled with OEM's name and equipment catalog numbers, model and serial identification numbers for COR to inventory equipment

E. Storage and Handling Requirements
   1. Equipment and materials must be protected during shipment and storage against physical damage, dirt, moisture, cold and rain:
      a. Store and protect equipment in a manner that precludes damage or loss, including theft.
      b. Protect painted surfaces with factory installed removable heavy kraft paper, sheet vinyl or equivalent
      c. Protect enclosures, equipment, controls, controllers, circuit protective devices, and other like items, against entry of foreign matter during installation; vacuum clean both inside and outside before testing and operating.
   2. Coordinate storage.

1.7 SEQUENCING AND SCHEDULING

A. Contractor shall be proactive in scheduling work:
   1. Use of premises is restricted at times directed by COR.
   2. Movement of materials: Unload materials and equipment delivered to site. Pay costs for rigging, hoisting, lowering and moving equipment on and around site, in building or on roof.
   3. Coordinate installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
   4. Sequence, coordinate, and integrate installations of materials and equipment for efficient flow of Work. Plan for large equipment requiring positioning prior to closing in building.
   5. Coordinate connection of materials, equipment, and systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies; provide required connection for each service.
   6. Initiate and maintain discussion regarding schedule for ceiling construction and install cables to meet that schedule

B. All work shall be reviewed and coordinated with the COR and OIT Data Center & Infrastructure Engineering (DCIE) prior to commencing.

C. Communication systems, infrastructure, raceway and equipment are sensitive to environmental conditions including but not limited to temperature, dirt, dust, and water. The contractor shall ensure the storage and installation of all communication components are sequenced and scheduled accordingly to prevent any damage, loss of performance, and warranty void of such systems. All mis-installed components shall be replaced with new parts and re-installed at the Contractor’s expense.

D. Coordinate installation with Structural, Electrical, HVAC, Plumbing, Fire Protection, and other trades to eliminate disruption and/or conflict with other systems.

E. Sequence installation of communications systems and infrastructure with other work to minimize possibility of damage and soiling during remainder of construction.

1.8 PROJECT SITE CONDITIONS

A. Prior to submitting a proposal, the Contractor shall inspect the Contract Documents, and shall become fully informed as to laws, ordinances, VA construction documents, and regulations affecting the project. The Contractor shall immediately bring to COR's attention, in writing, any existing condition or statute that contradicts, is in conflict with, or negates the Contract Documents. Failure of the Contractor to become fully informed as to all above mentioned items shall in no way relieve the Contractor from any obligations with respect to their proposal.

B. The Technology Drawings depict equipment locations, backboxes, conduit runs, cabling, etc. in a schematic manner. Field conditions and coordination with related trades may warrant relocations of field devices. No additional compensation will be allowed due to these revisions.

1.9 WARRANTY

A. A one (1) year warranty on the work shall be provided by the Contractor. If, within one (1) year after the date of final acceptance of the installation or within such longer period of time as may be prescribed by law or by the terms of any applicable special warranty required by the Contract Documents or provided by a manufacturer, any of the work or equipment is found to be defective or not in accordance with the Contract Documents, the Contractor shall correct it promptly including all parts and labor after receipt of notice from the COR to do so unless the COR has previously given the Contractor a written acceptance of such condition. This obligation shall survive termination of the contract. The COR shall give such notice promptly after discovery of the condition. Such notice shall be provided by the COR, to be identified, either verbally or in writing

B. Nothing contained in the Contract Documents shall be construed to establish a shorter period of limitation with respect to any other obligation which the Contractor might have under the Contract Documents or any manufacturer's warranty. The establishment of the time period noted above, after the date of final acceptance or such longer period of time as may be prescribed by law or by the terms of any warranty required by the Contract Documents, relates only to the specific obligation of the Contractor to correct the work or equipment, and has no relationship to the time within which his obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to his obligations other than specifically to correct the work or equipment.

C. The agency reserves the right to expand or add to the system during the warranty period using firm(s) other than the Contractor for such expansion without affecting the Contractor's responsibilities, provided that the expansion is done by a firm which is an authorized dealer or agent for the equipment of system being expanded.

1.10 SPECIFICATION RESPONSE

A. Pricing
   1. Instructions to Bidders
      a. The following is a partial list of instructions. Bidders are responsible to provide a complete proposal inclusive of all information requested in the Contract Documents.
      b. Do not assume anything. Clarify your position in writing with your bid concerning any areas that may not be clear to you.
      c. Copies of the bid proposal shall be submitted to the COR, Architect, and Engineer for review and approval.
      d. Bidders shall prepare equipment lists showing each item included in the bid. Equipment Lists must include the quantity, model number, manufacturer and price of each item listed under the generic description.

e. Provide a detailed description of any and all voluntary alternates and include cost changes in the Voluntary Alternate Bid forms. Bidders should submit voluntary alternates that will either provide for a better system or reduce costs without degrading the system. This includes alternate manufacturer and product substitution.
f. In the instance where the Drawings and the Specifications do not directly coincide, or coincide individually, the item of better quality, greater quantity and/or higher cost shall be included in the base bid.

B. Compliance
1. Bidders shall submit a Statement of Qualifications with their bid proposal that shall include the following information:
   a. Company name, address, telephone number and contact person.
   b. Brief company history. c. Resumes of key personnel.
   c. Local staffing description (job descriptions and numbers of persons in each position).
   d. Local service capabilities (hours of operation and parts availability). f. Technician factory certifications.
   e. Description of local engineering and project management capabilities.
   f. Line sheet listing major suppliers of security equipment.
   g. Annual dollar value of sales, installation and service of each product line carried.
   h. List of references describing three (3) completed projects of similar size and complexity, including names and telephone numbers of the contact persons.
   i. List of references describing similar projects completed in the area including names and telephone number of the customer's contact person.
   j. List of similar projects currently under construction in the area including names and telephone numbers of the customer's contact person.
   k. Licensing information.
2. Provide a specification compliance matrix indicating compliance or deviation for each item in the specification. The matrix shall be comprised of a list of all numbered paragraphs that appear in this Specification. Indicate compliance of the proposed equipment and/or services by the word "Comply" following each paragraph number. Indicate an exception to the requirement by the word "Exception" following the applicable paragraph number. Should the proposed equipment and/or services not entirely comply with the requirements specified, but ultimately achieve the intent, the Bidder shall explain fully the extent, or lack thereof, of compliance for the applicable equipment and/or services proposed. Instances where there is no indication of compliance or exception shall be considered non-compliant. This matrix is critical for proposal evaluation. Failure to submit may result in the disqualification of the bid. Contractor shall submit Compliance Matrix with the Bid Proposal AND at the time of Product Data submittal (as indicated previously in this specification) so that a complete security system submittal reviewed can be performed.
3. Additionally, as described in this Specification, bidders shall submit the following information with their bid proposal:
   a. Manufacturer's literature sheets for all standard manufactured items included in the equipment list and as proposed in the Voluntary Alternate Bid form, if applicable.
   b. Workload and capability statements. The statements shall detail projects that will be active during the completion of this project, and the manpower that would be available for this project.
   c. Confidentiality and return statements. The statements shall guarantee that the Contract Documents shall not be copied or distributed physically or verbally. The Contractor shall also assure the COR that the Contract Documents shall be returned in their entirety upon request. The successful Contractor will be provided with as many copies as requested.
   d. Copy of manufacturer’s certification certificate.

4. Certain paragraphs of the Specification require the Bidder to provide information (possibly not listed above) in the proposal to demonstrate compliance with a requirement. If the Bidder fails to provide detailed responses to these items, the proposal will be deemed to be non-compliant to the paragraphs stated.
5. Number all pages of the bid submittal.

PART 2 - PRODUCTS

2.1 REFER TO THE FOLLOWING SPECIFICATIONSECTIONS FOR ADDITIONAL REQUIREMENTS:

A. 27 05 26 – GROUNDING AND BONDING FOR TELECOMMUNICATIONS SYSTEMS

B. 27 05 36 – CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

PART 3 - EXECUTION

3.1 GENERAL COMMUNICATION RACEWAYS:

A. Examine areas and conditions under which communications raceway systems are to be installed. Notify the COR, Architect, and Engineer in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer.

B. The Contractor shall be knowledgeable of work to be performed by other trades and take necessary steps to integrate and coordinate their work with other trades.

C. The Contractor shall be responsible for furnishing all materials indicated on the drawings or as specified herein for a complete communications raceway system

D. All communications raceway infrastructure shall be installed in an aesthetically pleasing fashion. All surface raceway in new buildings must be approved by the COR, Architect, and/or Engineer.

E. All communications raceway infrastructure shall be installed to allow for easy adds, moves, and other changes in the future.

F. Construction within communication rooms must be substantially complete before the installation of telecommunications cabling. This includes, but is not limited to, the installation of plywood backboard, cable tray or ladder rack, electrical outlets, light fixtures, sprinklers and ductwork.

G. Floor to floor distribution shall be provided with concrete floor sleeves or conduits as noted on the drawings, and as required by the Architectural Design.

H. Provide protective cable bushings on all conduits immediately after installation

I. Use only electrical 45º or 90º conduit elbows with long bend radii as follows:
   1. 6:1 bend radius of the inside conduit diameter for sizes 2” or less.
   2. 10:1 bend radius of the inside conduit diameter for sizes greater than 2”.
   3. 10:1 bend radius of the inside conduit diameter for sizes greater than 2”.

J. Fire seal all raceway penetrations and openings to maintain fire rating after communications cables are installed.

K. Furnish electronic certified test reports to COR prior to final inspection and not more than 90 days after completion of tests.

3.2 LABELING

A. All communications components shall be clearly labeled using labeling devices (i.e. hand written labels are not acceptable) with white label and black text. All labels shall be consistent font type and size (for respective components). All labeling shall comply with the current version of ISTS or ANSI-606.

B. The final labeling scheme shall be coordinated with the COR and OIT Data Center & Infrastructure Engineering (DCIE) prior to finalizing and initiating any work. A sample scheme shall be submitted for approval.

END OF SECTION 27 05 00

SECTION 27 05 11

REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section includes common requirements to communications installations and applies to all sections of Division 27 and Division 28.

B. Provide completely functioning communications systems.

C. Comply with VAAR 852.236.91 and FAR clause 52.236-21 in circumstance of a need for additional detail or conflict between drawings, specifications, reference standards or code.

1.2 REFERENCES

A. Abbreviations and Acronyms
1. Refer to http://www.cfm.va.gov/til/sdetail.asp for Division 00, ARCHITECTURAL ABBREVIATIONS.
2. Additional Abbreviations and Acronyms:

A	Ampere
AC	Alternating Current
AE	Architect and Engineer
AFF	Above Finished Floor
AHJ	Authority Having Jurisdiction
ANSI	American National Standards Institute
AWG	American Wire Gauge (refer to STP and UTP)
AWS	Advanced Wireless Services
BCT	Bonding Conductor for Telecommunications (also Telecommunications Bonding Conductor (TBC))
BDA	Bi-Directional Amplifier
BICSI	Building Industry Consulting Service International
BIM	Building Information Modeling
BOM	Bill of Materials
BTU	British Thermal Units
BUCR	Back-up Computer Room
BTS	Base Transceiver Station
CAD	AutoCAD
CBOPC	Community Based Out Patient Clinic
CBC	Coupled Bonding Conductor
CBOC	Community Based Out Patient Clinic (refer to CBOPC, OPC, VAMC)
CCS	TIP's Cross Connection System (refer to VCCS and HCCS)
CFE	Contractor Furnished Equipment

CFM	US Department of Veterans Affairs Office of Construction and Facilities Management
CFR	Consolidated Federal Regulations
CIO	Communication Information Officer (Facility, VISN or Region)
cm	Centimeters
CO	Central Office
COR	Contracting Officer Representative
CPU	Central Processing Unit
CSU	Customer Service Unit
CUP	Conditional Use Permit(s) – Federal/GSA for VA
dB	Decibel
dBm	Decibel Measured
dBmV	Decibel per milli-Volt
DC	Direct Current
DEA	United States Drug Enforcement Administration
DSU	Data Service Unit
EBC	Equipment Bonding Conductor
ECC	Engineering Control Center (refer to DCR, EMCR)
EDGE	Enhanced Data (Rates) for GSM Evolution
EDM	Electrical Design Manual
EMCR	Emergency Management Control Room (refer to DCR, ECC)
EMI	Electromagnetic Interference (refer to RFI)
EMS	Emergency Medical Service
EMT	Electrical Metallic Tubing or thin wall conduit
ENTR	Utilities Entrance Location (refer to DEMARC, POTS, LEC)
EPBX	Electronic Digital Private Branch Exchange
ESR	Vendor’s Engineering Service Report
FA	Fire Alarm
FAR	Federal Acquisition Regulations in Chapter 1 of Title 48 of Code of Federal Regulations
FMS	VA’s Headquarters or Medical Center Facility’s Management Service
FR	Frequency (refer to RF)
FTS	Federal Telephone Service
GFE	Government Furnished Equipment
GPS	Global Positioning System
GRC	Galvanized Rigid Metal Conduit
GSM	Global System (Station) for Mobile

HCCS	TIP's Horizontal Cross Connection System (refer to CCS & VCCS)
HDPE	High Density Polyethylene Conduit
HDTV	Advanced Television Standards Committee High-Definition Digital Television
HEC	Head End Cabinets(refer to HEIC, PA)
HEIC	Head End Interface Cabinets(refer to HEC, PA)
HF	High Frequency (Radio Band; Re FR, RF, VHF & UHF)
HSPA	High Speed Packet Access
HZ	Hertz
IBT	Intersystem Bonding Termination (NEC 250.94)
IC	Intercom
ICRA	Infectious Control Risk Assessment
IDEN	Integrated Digital Enhanced Network
IDC	Insulation Displacement Contact
IDF	Intermediate Distribution Frame
ILSM	Interim Life Safety Measures
IMC	Rigid Intermediate Steel Conduit
IRM	Department of Veterans Affairs Office of Information Resources Management
ISDN	Integrated Services Digital Network
ISM	Industrial, Scientific, Medical
IWS	Intra-Building Wireless System
LAN	Local Area Network
LBS	Location Based Services, Leased Based Systems
LEC	Local Exchange Carrier (refer to DEMARC, PBX & POTS)
LED	Light Emitting Diode
LMR	Land Mobile Radio
LTE	Long Term Evolution, or 4G Standard for Wireless Data Communications Technology
M	Meter
MAS	Medical Administration Service
MATV	Master Antenna Television
MCR	Main Computer Room
MCOR	Main Computer Operators Room
MDF	Main Distribution Frame
MH	Manholes or Maintenance Holes
MHz	Megaherts (10^6 Hz)

mm	Millimeter
MOU	Memorandum of Understanding
MW	Microwave (RF Band, Equipment or Services)
NID	Network Interface Device (refer to DEMARC)
NEC	National Electric Code
NOR	Network Operations Room
NRTL	OSHA Nationally Recognized Testing Laboratory
NS	Nurse Stations
NTIA	U.S. Department of Commerce National Telecommunications and Information Administration
OEM	Original Equipment Manufacturer
OI&T	Office of Information and Technology
OPC	VA's Outpatient Clinic (refer to CBOC, VAMC)
OSH	Department of Veterans Affairs Office of Occupational Safety and Health
OSHA	United States Department of Labor Occupational Safety and Health Administration
OTDR	Optical Time-Domain Reflectometer
PA	Public Address System (refer to HE, HEIC, RPEC)
PBX	Private Branch Exchange (refer to DEMARC, LEC, POTS)
PCR	Police Control Room (refer to SPCC, could be designated SCC)
PCS	Personal Communications Service (refer to UPCS)
PE	Professional Engineer
PM	Project Manager
PoE	Power over Ethernet
POTS	Plain Old Telephone Service (refer to DEMARC, LEC, PBX)
PSTN	Public Switched Telephone Network
PSRAS	Public Safety Radio Amplification Systems
PTS	Pay Telephone Station
PVC	Poly-Vinyl Chloride
PWR	Power (in Watts)
RAN	Radio Access Network
RBB	Rack Bonding Busbar
RE	Resident Engineer or Senior Resident Engineer
RF	Radio Frequency (refer to FR)
RFI	Radio Frequency Interference (refer to EMI)
RFID	RF Identification (Equipment, System or Personnel)

RMC	Rigid Metal Conduit
RMU	Rack Mounting Unit
RPEC	Radio Paging Equipment Cabinets(refer to HEC, HEIC, PA)
RTLS	Real Time Location Service or System
RUS	Rural Utilities Service
SCC	Security Control Console (refer to PCR, SPCC)
SMCS	Spectrum Management and Communications Security (COMSEC)
SFO	Solicitation for Offers
SME	Subject Matter Experts (refer to AHJ)
SMR	Specialized Mobile Radio
SMS	Security Management System
SNMP	Simple Network Management Protocol
SPCC	Security Police Control Center (refer to PCR, SMS)
STP	Shielded Balanced Twisted Pair (refer to UTP)
STR	Stacked Telecommunications Room
TAC	VA's Technology Acquisition Center, Austin, Texas
TCO	Telecommunications Outlet
TER	Telephone Equipment Room
TGB	Telecommunications Grounding Busbar (also Secondary Bonding Busbar (SBB))
TIP	Telecommunications Infrastructure Plant
TMGB	Telecommunications Main Grounding Busbar (also Primary Bonding Busbar (PBB))
TMS	Traffic Management System
TOR	Telephone Operators Room
TP	Balanced Twisted Pair (refer to STP and UTP)
TR	Telecommunications Room (refer to STR)
TWP	Twisted Pair
UHF	Ultra High Frequency (Radio)
UMTS	Universal Mobile Telecommunications System
UPCS	Unlicensed Personal Communications Service (refer to PCS)
UPS	Uninterruptible Power Supply
USC	United States Code
UTP	Unshielded Balanced Twisted Pair (refer to TP and STP)
UV	Ultraviolet
V	Volts

VAAR	Veterans Affairs Acquisition Regulation
VACO	Veterans Affairs Central Office
VAMC	VA Medical Center (refer to CBOC, OPC, VACO)
VCCS	TIP's Vertical Cross Connection System (refer to CCS and HCCS)
VHF	Very High Frequency (Radio)
VISN	Veterans Integrated Services Network (refers to geographical region)
VSWR	Voltage Standing Wave Radio
W	Watts
WEB	World Electronic Broadcast
WiMAX	Worldwide Interoperability (for MW Access)
WI-FI	Wireless Fidelity
WMTS	Wireless Medical Telemetry Service
WSP	Wireless Service Providers

B. Definitions:

1. Access Floor: Pathway system of removable floor panels supported on adjustable pedestals to allow cable placement in area below.
2. BNC Connector (BNC): United States Military Standard MIL-C-39012/21 bayonet-type coaxial connector with quick twist mating/unmating, and two lugs preventing accidental disconnection from pulling forces on cable.
3. Bond: Permanent joining of metallic parts to form an electrically conductive path to ensure electrical continuity and capacity to safely conduct any currents likely to be imposed to earth ground.
4. Bundled Microducts: All forms of jacketed microducts.
5. Conduit: Includes all raceway types specified.
6. Conveniently Accessible: Capable of being reached without use of ladders, or without climbing or crawling under or over obstacles such as, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.
7. Distributed (in house) Antenna System (DAS): An Emergency Radio Communications System installed for Emergency Responder (or first responders and Government personnel) use while inside facility to maintain contact with each respective control point; refer to Section 27 53 19, DISTRIBUTED RADIO ANTENNA (WITHIN BUILDING) EQUIPMENT AND SYSTEMS.
8. DEMARC, Extended DMARC or ENTR: Service provider's main point of demarcation owned by LEC or service provider and establishes a physical point where service provider's responsibilities for service and maintenance end. This point is called NID, in data networks.
9. Effectively Grounded: Intentionally bonded to earth through connections of low impedance having current carrying capacity to prevent buildup of currents and voltages resulting in hazard to equipment or persons.
10. Electrical Supervision: Analyzing a system's function and components (i.e. cable breaks / shorts, inoperative stations, lights, LEDs and states of change, from primary to backup) on a 24/7/365 basis; provide aural and visual emergency notification signals to minimum two remote designated or accepted monitoring stations.
11. Electrostatic Interference (ESI) or Electrostatic Discharge Interference: Refer to EMI and RFI.
12. Emergency Call Systems: Wall units (in parking garages and stairwells) and pedestal mounts (in parking lots) typically provided with a strobe, camera and two-way audio communication functions.

13. Project 25 (2014) (P25 (TIA-102 Series)): Set of standards for local, state and Federal public safety organizations and agencies digital LMR services. P25 is applicable to LMR equipment authorized or licensed under the US Department of Commerce National Telecommunications and Information Administration or FCC rules and regulations, and is a required standard capability for all LMR equipment and systems.
14. Grounding Electrode Conductor: (GEC) Conductor connected to earth grounding electrode.
15. Grounding Electrode System: Electrodes through which an effective connection to earth is established, including supplementary, communications system grounding electrodes and GEC.
16. Grounding Equalizer or Backbone Bonding Conductor (BBC): Conductor that interconnects elements of telecommunications grounding infrastructure.
17. Head End (HE): Equipment, hardware and software, or a master facility at originating point in a communications system designed for centralized communications control, signal processing, and distribution that acts as a common point of connection between equipment and devices connected to a network of interconnected equipment, possessing greatest authority for allowing information to be exchanged, with whom other equipment is subordinate.
18. Microducts: All forms of air blown fiber pathways.
19. Ohm: A unit of restive measurement.
20. Received Signal Strength Indication (RSSI): A measurement of power present in a received RF signal.
21. Service Provider Demarcation Point (SPDP): Not owned by LEC or service provider, but designated by Government as point within facility considered the DEMARC.
22. Sound (SND): Changing air pressure to audible signals over given time span.
23. System: Specific hardware, firmware, and software, functioning together as a unit, performing task for which it was designed.
24. Telecommunications Bonding Backbone (TBB): Conductors of appropriate size (minimum 53.49 mm2 [1/0 AWG]) stranded copper wire, that connect to Grounding Electrode System and route to telecommunications main grounding busbar (TMGB) and circulate to interconnect various TGBs and other locations shown on drawings.
25. Voice over Internet Protocol (VoIP): A telephone system in which voice signals are converted to packets and transmitted over LAN network using Transmission Control Protocol (TCP)/Internet Protocol (IP). VA'S VoIP is not listed or coded for life and public safety, critical, emergency or other protection functions. When VoIP system or equipment is provided instead of PBX system or equipment, each TR (STR) and DEMARC requires increased AC power provided to compensate for loss of PBX's telephone instrument line power; and, to compensate for absence of PBX's UPS capability.
26. Wide Area Network (WAN): A digital network that transcends localized LANs within a given geographic location. VA'S WAN/LAN is not nationally listed or coded for life and public safety, critical, emergency or other safety functions.

1.3 APPLICABLE PUBLICATIONS

A. Applicability of Standards: Unless documents include more stringent requirements, applicable construction industry standards have same force and effect as if bound or copied directly into the documents to extent referenced. Such standards are made a part of these documents by reference.
   1. Each entity engaged in construction must be familiar with industry standards applicable to its construction activity.
   2. Obtain standards directly from publication source, where copies of standards are needed to perform a required construction activity.
   3. Latest edition as of the specification issue date shall govern.

B. Government Codes, Standards and Executive Orders: Refer to http://www.cfm.va.gov/TIL/cPro.asp:

1. Federal Communications Commission, (FCC) CFR, Title 47:

Part 15 ..... Restrictions of use for Part 15 listed RF Equipment in Safety of Life Emergency Functions and Equipment Locations

Part 47 ..... Chapter A, Paragraphs 6.1-6.23, Access to Telecommunications Service, Telecommunications Equipment and Customer Premises Equipment

Part 58 ..... Television Broadcast Service

Part 73 ..... Radio and Television Broadcast Rules

Part 90 ..... Rules and Regulations, Appendix C

Form 854 ..... Antenna Structure Registration

Chapter XXIII ..... National Telecommunications and Information Administration (NTIA, P/O Commerce, Chapter XXIII) the 'Red Book'– Chapters 7, 8 & 9 compliments CFR, Title 47, FCC Part 15, RF Restriction of Use and Compliance in "Safety of Life" Functions & Locations

2. US Department of Agriculture, (Title 7, USC, Chapter 55, Sections 2201, 2202 & 2203:RUS 1755Telecommunications Standards and Specifications for Materials, Equipment and Construction:

RUS Bull 1751F-630 ..... Design of Aerial Cable Plants

RUS Bull 1751F-640 ..... Design of Buried Cable Plant, Physical Considerations

RUS Bull 1751F-643 ..... Underground Plant Design

RUS Bull 1751F-815 ..... Electrical Protection of Outside Plants,

RUS Bull 1753F-201 ..... Acceptance Tests of Telecommunications Plants (PC-4)

RUS Bull 1753F-401 ..... Splicing Copper and Fiber Optic Cables (PC-2)

RUS Bull 345-50 ..... Trunk Carrier Systems (PE-60)

RUS Bull 345-65 ..... Shield Bonding Connectors (PE-65)

RUS Bull 345-72 ..... Filled Splice Closures (PE-74)

RUS Bull 345-83 ..... Gas Tube Surge Arrestors (PE-80)

3. US Department of Commerce/National Institute of Standards Technology,(NIST):

FIPS PUB 1-1 ..... Telecommunications Information Exchange

FIPS PUB 100/1 ..... Interface between Data Terminal Equipment (DTE) Circuit Terminating Equipment for operation with Packet Switched Networks, or Between Two DTEs, by Dedicated Circuit

FIPS PUB 140/2 ..... Telecommunications Information Security Algorithms

FIPS PUB 143 ..... General Purpose 37 Position Interface between DTE and Data Circuit Terminating Equipment

FIPS 160/2 ..... Electronic Data Interchange (EDI),

FIPS 175 ..... Federal Building Standard for Telecommunications Pathway and Spaces

FIPS 191 ..... Guideline for the Analysis of Local Area Network Security

FIPS 197 ..... Advanced Encryption Standard (AES)

FIPS 199 ..... Standards for Security Categorization of Federal Information and Information Systems

4. US Department of Defense, (DoD):

MIL-STD-188-110 ..... Interoperability and Performance Standards for Data Modems

MIL-STD-188-114 ..... Electrical Characteristics of Digital Interface Circuits

MIL-STD-188-115 ..... Communications Timing and Synchronizations Subsystems

MIL-C-28883 ..... Advanced Narrowband Digital Voice Terminals

MIL-C-39012/21 ..... Connectors, Receptacle, Electrical, Coaxial, Radio Frequency, (Series BNC (Uncabled), Socket Contact, Jam Nut Mounted, Class 2)

5. US Department of Health and Human Services:

The Health Insurance Portability and Accountability Act of 1996 (HIPAA) Privacy, Security and Breach Notification Rules

6. US Department of Justice:

2010 Americans with Disabilities Act Standards for Accessible Design (ADAAD).

7. US Department of Labor, (DoL) - Public Law 426-62 – CFR, Title 29, Part 1910, Chapter XVII - Occupational Safety and Health Administration (OSHA), Occupational Safety and Health Standards):

Subpart 7 ..... Approved NRTLs; obtain a copy at https://www.osha.gov/dts/otpca/nrtl/nrtllist.html

Subpart 35..... Compliance with NFPA 101, Life Safety Code

Subpart 36..... Design and Construction Requirements for Exit Routes

Subpart 268..... Telecommunications

Subpart 305..... Wiring Methods, Components, and Equipment for General Use

Subpart 508 ..... Americans with Disabilities Act Accessibility Guidelines; technical requirement for accessibility to buildings and facilities by individuals with disabilities

8. US Department of Transportation, (DoT):
   a. Public Law 85-625, CFR, Title 49, Part 1, Subpart C – Federal Aviation Administration (FAA):AC 110/460-ID & AC 707 / 460-2E – Advisory Circulars Standards for Construction of Antenna Towers, and 7450 and 7460-2 – Antenna Construction Registration Forms.
9. US Department of Veterans Affairs (VA): Office of Telecommunications (OI&T), MP-6, PART VIII, TELECOMMUNICATIONS, CHAPTER 5, AUDIO, RADIO AND TELEVISION (and COMSEC) COMMUNICATIONS SYSTEMS: Spectrum Management and COMSEC Service (SMCS), AHJ for:
   a. CoG, “Continuance of Government” communications guidelines and compliance.
   b. COMSEC,“VA wide coordination and control of security classified communication assets.”
   c. COOP, “Continuance of Operations” emergency communications guidelines and compliance.
   d. FAA, FCC, and US Department of Commerce National Telecommunications and Information Administration, “VA wide RF Co-ordination, Compliance and Licensing.”
   e. Handbook 6100 – Telecommunications: Cyber and Information Security Office of Cyber and Information Security, and Handbook 6500 – Information Security Program.
   f. Low Voltage Special Communications Systems “Design, Engineering, Construction Contract Specifications and Drawings Conformity, Proof of Performance Testing, VA Compliance and Life Safety Certifications for CFM and VA Facility Low Voltage

Special Communications Projects (except Fire Alarm, Telephone and Data Systems)."

g. SATCOM, "Satellite Communications" guidelines and compliance, and Security and Law Enforcement Systems – "Coordinates the Design, Engineering, Construction Contract Specifications and Drawings Conformity, Proof of Performance Testing, VA Compliance, DEA and Public Safety Certification(s) for CFM and VA Facility Security Low Voltage Special Communications and Physical Security Projects.

h. VHA's National Center for Patient Safety – Veterans Health Administration (VHA) Warning System, Failure of Medical Alarm Systems using Paging Technology to Notify Clinical Staff, July 2004.

i. VA's CEOSH, concurrence with warning identified in VA Directive 7700.

j. Wireless and Handheld Devices, "Guidelines and Compliance,"

k. Office of Security and Law Enforcement: VA Directive 0730 and Health Special Presidential Directive (HSPD)-12.

C. NRTL Standards: Refer to https://www.osha.gov/laws-regs/regulations/standardnumber/1926

1. Canadian Standards Association (CSA); same tests as presented by UL
2. Communications Certifications Laboratory (CEL); same tests as presented by UL.
3. Intertek Testing Services NA, Inc., (ITSNA), formerly Edison Testing Laboratory (ETL) same tests as presented by UL).
4. Underwriters Laboratory (UL):

1 ..... Flexible Metal Conduit

5 ..... Surface Metal Raceway and Fittings

6 ..... Rigid Metal Conduit

44 ..... Thermoset-Insulated Wires and Cables

50 ..... Enclosures for Electrical Equipment

65 ..... Wired Cabinets

83 ..... Thermoplastic-Insulated Wires and Cables

96 ..... Lightning Protection Components

96A ..... Installation Requirements for Lightning Protection Systems

360 ..... Liquid-Tight Flexible Steel Conduit

444 ..... Communications Cables

467 ..... Grounding and Bonding Equipment

486A-486B ..... Wire Connectors

486C ..... Splicing Wire Connectors

486D ..... Sealed Wire Connector Systems

486E ..... Standard for Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors

493 ..... Thermoplastic-Insulated Underground Feeder and Branch Circuit Cable

497/497A/497B/497C

497D/497E ..... Protectors for Paired Conductors/Communications Circuits/Data Communications and Fire Alarm Circuits/coaxial circuits/voltage protections/Antenna Lead In

510 ..... Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape

514A ..... Metallic Outlet Boxes

514B ..... Fittings for Cable and Conduit

514C ..... Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers

651 ..... Schedule 40 and 80 Rigid PVC Conduit

651A ..... Type EB and A Rigid PVC Conduit and HDPE Conduit

797 ..... Electrical Metallic Tubing

884 ..... Underfloor Raceways and Fittings

1069 ..... Hospital Signaling and Nurse Call Equipment

1242 ..... Intermediate Metal Conduit

1449 ..... Standard for Transient Voltage Surge Suppressors

1479 ..... Fire Tests of Through-Penetration Fire Stops

1480 ..... Speaker Standards for Fire Alarm, Emergency, Commercial and Professional use

1666 ..... Standard for Wire/Cable Vertical (Riser) Tray Flame Tests

1685 ..... Vertical Tray Fire Protection and Smoke Release Test for Electrical and Fiber Optic Cables

1861 ..... Communication Circuit Accessories

1863 ..... Standard for Safety, communications Circuits Accessories

1865 ..... Standard for Safety for Vertical-Tray Fire Protection and Smoke-Release Test for Electrical and Optical-Fiber Cables

2024 ..... Standard for Optical Fiber Raceways

2024 ..... Standard for Cable Routing Assemblies and Communications Raceways

2196 ..... Standard for Test of Fire Resistive Cable

60950-1 ed. 2 ..... Information Technology Equipment Safety

D. Industry Standards:

1. Advanced Television Systems Committee (ATSC):

A/53 Part 1: ..... ATSC Digital Television Standard, Part 1, Digital Television System

A/53 Part 2: ..... ATSC Digital Television Standard, Part 2, RF/Transmission System Characteristics

A/53 Part 3: ..... ATSC Digital Television Standard, Part 3, Service Multiplex and Transport System Characteristics

A/53 Part 4: ..... ATSC Digital Television Standard, Part 4, MPEG-2 Video System Characteristics

A/53 Part 5: ..... ATSC Digital Television Standard, Part 5, AC-3 Audio System Characteristics

A/53 Part 6: ..... ATSC digital Television Standard, Part 6, Enhanced AC-3 Audio System Characteristics

2. American Institute of Architects (AIA): 2006 Guidelines for Design & Construction of Health Care Facilities.

3. American Society of Mechanical Engineers (ASME):

A17.1 ..... Safety Code for Elevators and Escalators Includes Requirements for Elevators, Escalators, Dumbwaiters, Moving Walks, Material Lifts, and Dumbwaiters with Automatic Transfer Devices

17.3 ..... Safety Code for Existing Elevators and Escalators

17.4 ..... Guide for Emergency Personnel

17.5 ..... Elevator and Escalator Electrical Equipment

4. American Society for Testing and Materials (ASTM):

B1 ..... Standard Specification for Hard-Drawn Copper Wire

B8 ..... Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

D1557 ..... Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort 56,000 ft-lbf/ft3 (2,700 kN-m/m3)

D2301 ..... Standard Specification for Vinyl Chloride Plastic Pressure Sensitive Electrical Insulating Tape

B258-02 ..... Standard Specification for Standard Nominal Diameters and Cross-Sectional Areas of AWG Sizes of Solid Round Wires Used as Electrical Conductors

D709-01..... Standard Specification for Laminated Thermosetting Materials

D4566 ..... Standard Test Methods for Electrical Performance Properties of Insulations and Jackets for Telecommunications Wire and Cable

5. American Telephone and Telegraph Corporation (AT&T) - Obtain following AT&T Publications at https://ebiznet.sbc.com/sbcnebs/

ATT-TP-76200 ..... Network Equipment and Power Grounding, Environmental, and Physical Design Requirements

ATT-TP-76300..... Merged AT&T Affiliate Companies Installation Requirements

ATT-TP-76305 ..... Common Systems Cable and Wire Installation and Removal Requirements - Cable Racks and Raceways

ATT-TP-76306 ..... Electrostatic Discharge Control

ATT-TP-76400 ..... Detail Engineering Requirements

ATT-TP-76402 ..... AT&T Raised Access Floor Engineering and Installation Requirements

ATT-TP-76405 ..... Technical Requirements for Supplemental Cooling Systems in Network Equipment Environments

ATT-TP-76416 ..... Grounding and Bonding Requirements for Network Facilities

ATT-TP-76440 ..... Ethernet Specification

ATT-TP-76450 ..... Common Systems Equipment Interconnection Standards for AT&T Network Equipment Spaces

ATT-TP-76461 ..... Fiber Optic Cleaning

ATT-TP-76900 ..... AT&T Installation Testing Requirement

ATT-TP-76911 ..... AT&T LEC Technical Publication Notice

6. British Standards Institution (BSI):

BS EN 50109-2 ..... Hand Crimping Tools - Tools for The Crimp Termination of Electric Cables and Wires for Low Frequency and Radio Frequency Applications – All Parts & Sections. October 1997

7. Building Industry Consulting Service International(BICSI):

ANSI/BICSI 002 ..... Data Center Design and Implementation Best Practices

ANSI/BICSI 004 ..... Information Technology Systems Design and Implementation Best Practices for Healthcare Institutions and Facilities

ANSI/NECA/BICSI

568 ..... Standard for Installing Commercial Building Telecommunications Cabling

NECA/BICSI 607 ..... Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings

ANSI/BICSI 005 ..... Electronic Safety and Security (ESS) System Design and Implementation Best Practices

8. Electronic Components Assemblies and Materials Association,(ECA).

ECA EIA/RS-270 Tools, Crimping, Solderless Wiring Devices – Recommended Procedures for User Certification

EIA/ECA 310-E ..... Cabinets, and Associated Equipment

9. Facility Guidelines Institute: 2010 Guidelines for Design and Construction of Health Care Facilities.

10. Insulated Cable Engineers Association (ICEA):

ANSI/ICEA

S-80-576..... Category 1 & 2 Individually Unshielded Twisted-Pair Indoor Cables for Use in Communications Wiring Systems

ANSI/ICEA

S-84-608..... Telecommunications Cable, Filled Polyolefin Insulated Copper Conductor, S-87-640(2011) Optical Fiber Outside Plant Communications Cable

ANSI/ICEA

S-90-661..... Category 3, 5, & 5e Individually Unshielded Twisted-Pair Indoor Cable for Use in General Purpose and LAN Communication Wiring Systems

S-98-688 ..... Broadband Twisted Pair Cable Aircore, Polyolefin Insulated, Copper Conductors

S-99-689 ..... Broadband Twisted Pair Cable Filled, Polyolefin Insulated, Copper Conductors

ICEA S-102-700

..... Category 6 Individually Unshielded Twisted Pair Indoor Cables (With or Without an Overall Shield) for use in Communications Wiring Systems Technical Requirements

11. Institute of Electrical and Electronics Engineers (IEEE):

ISSN 0739-5175 ..... March-April 2008 Engineering in Medicine and Biology Magazine, IEEE (Volume: 27, Issue:2) Medical Grade-Mission Critical-Wireless Networks

IEEE C2..... National Electrical Safety Code (NESC)

C62.41.2

Cor 1 IEEE ..... Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits 4)

C62.45 ..... IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits

81 IEEE ..... Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System

100 ..... IEEE the New IEEE Standards Dictionary of Electrical and Electronics Terms

602 ..... IEEE Recommended Practice for Electric Systems in Health Care Facilities

1100 ..... IEEE Recommended Practice for Powering and Grounding Electronic Equipment

12. International Code Council:
AC193 ..... Mechanical Anchors in Concrete Elements

13. International Organization for Standardization (ISO):
ISO/TR 21730 ..... Use of Mobile Wireless Communication and Computing Technology in Healthcare Facilities - Recommendations for Electromagnetic Compatibility (Management of Unintentional Electromagnetic Interference) with Medical Devices

14. National Electrical Manufacturers Association (NEMA):
NEMA 250 ..... Enclosures for Electrical Equipment (1,000V Maximum)

ANSI C62.61 ..... American National Standard for Gas Tube Surge Arresters on Wire Line Telephone Circuits

ANSI/NEMA FB 1 Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing EMT) and Cable

ANSI/NEMA OS 1 Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports

NEMA SB 19 ..... NEMA Installation Guide for Nurse Call Systems

TC 3 ..... Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing

NEMA VE 2 ..... Cable Tray Installation Guidelines

15. National Fire Protection Association (NFPA):
70E ..... Standard for Electrical Safety in the Workplace

70 ..... National Electrical Code (NEC)

72 ..... National Fire Alarm Code

75 ..... Standard for the Fire Protection of Information Technological Equipment

76 ..... Recommended Practice for the Fire Protection of Telecommunications Facilities

77 ..... Recommended Practice on Static Electricity

90A ..... Standard for the Installation of Air Conditioning and Ventilating Systems

99 ..... Health Care Facilities Code

101 ..... Life Safety Code

241 ..... Safeguarding construction, alternation and Demolition Operations

255 ..... Standard Method of Test of Surface Burning Characteristics of Building Materials

262 ..... Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces

780 ..... Standard for the Installation of Lightning Protection Systems

1221 ..... Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems

5000 ..... Building Construction and Safety Code

16. Society for Protective Coatings (SSPC):
SSPC SP 6/NACE No.3 Commercial Blast Cleaning

17. Society of Cable Telecommunications Engineers (SCTE):
ANSI/SCTE 15 ..... Specification for Trunk, Feeder and Distribution Coaxial Cable

18. Telecommunications Industry Association (TIA):
TIA-120 Series ..... Telecommunications Land Mobile communications (APCO/Project 25) (January 2014)

TIA TSB-140..... Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fiber Cabling Systems (2004)

TIA-155..... Guidelines for the Assessment and Mitigation of Installed Category 6 Cabling to Support 10GBASE-T (2010)

TIA TSB-162-A..... Telecommunications Cabling Guidelines for Wireless Access Points (2013)

TIA-222-G..... Structural Standard for Antenna Supporting Structures and Antennas (2014)

TIA/EIA-423-B ..... Electrical Characteristics of Unbalanced Voltage Digital Interface Circuits (2012)

TIA-455-C..... General Requirements for Standard Test Procedures for Optical Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices, and other Fiber Optic Components (August 2014)

TIA-455-53-A..... FOTP-53 Attenuation by Substitution Measurements for Multimode Graded-Index Optical Fibers in Fiber Assemblies (Long Length) (September 2001)

TIA-455-61-A..... FOTP-61 Measurement of Fiber of Cable Attenuation Using an OTDR (July 2003)

TIA-472D000-B ..... Fiber Optic Communications Cable for Outside Plant Use (July 2007)

ANSI/TIA-492-B ..... 62.5-µ Core Diameter/125-um Cladding Diameter Class 1a Graded-Index Multimode Optical Fibers (November 2009)

ANSI/TIA-492AAAB-A ..... 50-um Core Diameter/125-um Cladding Diameter Class IA Graded-Index Multimode Optically Optimized American Standard Fibers (November 2009

TIA-492CAAA.....Detail Specification for Class IVa Dispersion- Unshifted Single-Mode Optical Fibers (September 2002)

TIA-492E000 .....Sectional Specification for Class IVd Nonzero- Dispersion Single-Mode Optical Fibers for the 1,550 nm Window (September 2002)

TIA-526-7-B.....Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant – OFSTP-7 (December 2008)

TIA-526.14-A.....Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant – SFSTP-14 (August 1998)

TIA-568.....Revision/Edition: C Commercial Building Telecommunications Cabling Standard Set: (TIA-568-C.0-2 Generic Telecommunications Cabling for Customer Premises (2012), TIA-568-C.1-1 Commercial Building Telecommunications Cabling Standard Part 1: General Requirements (2012), TIA-568-C.2 Commercial Building Telecommunications Cabling Standard—Part 2: Balanced Twisted Pair Cabling Components (2009), TIA-568-C.3-1 Optical Fiber Cabling Components Standard, (2011) AND TIA-568-C.4 Broadband Coaxial Cabling and Components Standard (2011) with addendums and erratas

TIA-569.....Revision/Edition C Telecommunications Pathways and Spaces (March 2013)

TIA-574.....Position Non-Synchronous Interface between Data Terminal equipment and Data Circuit Terminating Equipment Employing Serial Binary Interchange (May 2003)

TIA/EIA-590-A .....Standard for Physical Location and Protection of Below Ground Fiber Optic Cable Plant (July 2001)

TIA-598-D .....Optical Fiber Cable Color Coding (January 2005)

TIA-604-10-B.....Fiber Optic Connector Intermateablility Standard (August 2008)

ANSI/TIA-606-B.....Administration Standard for Telecommunications Infrastructure (2012)

TIA-607-B .....Generic Telecommunications Bonding and Grounding (Earthing) For Customer Premises (January 2013)

TIA-613.....High Speed Serial Interface for Data Terminal Equipment and Data Circuit Terminal Equipment (September 2005)

ANSI/TIA-758-B.....Customer-owned Outside Plant Telecommunications Infrastructure Standard (April 2012)

ANSI/TIA-854 .....A Full Duplex Ethernet Specification for 1000 Mb/s (1000BASE-TX) Operating over Category 6 Balanced Twisted-Pair Cabling (2001)

ANSI/TIA-862-A.....Building Automation Systems Cabling Standard (April 2011)

TIA-942-A .....Telecommunications Infrastructure Standard for Data Centers (March 2014)

TIA-1152.....Requirements for Field Testing Instruments and Measurements for Balanced Twisted Pair Cabling (September 2009)

TIA-1179.....Healthcare Facility Telecommunications Infrastructure Standard (July 2010)

1.4 SINGULAR NUMBER

A. Where any device or part of equipment is referred in singular number (such as " rack"), reference applies to as many such devices as are required to complete installation.

1.5 RELATED WORK

A. Specification Order of Precedence: FAR Clause 52.236-21, VAAR Clause 852.236-71.
1. Field Cutting and Patching: Section 09 91 00, PAINTING.
2. Additional submittal requirements: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
3. Availability and source of references and standards specified in applicable publications: Section 01 42 19, REFERENCE STANDARDS.
4. Control of environmental pollution and damage for air, water, and land resources: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
5. Requirements for non-hazardous building construction and demolition waste: Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.
6. General requirements and procedures to comply with various federal mandates and U.S. Department of Veterans Affairs (VA) policies for sustainable design: Section 01 81 13,SUSTAINABLE DESIGN REQUIREMENTS.
7. Closures of openings in walls, floors, and roof decks against penetration of flame, heat, and smoke or gases in fire resistant rated construction: Section 07 84 00, FIRESTOPPING.
8. Sealant and caulking materials and their application: Section 07 92 00, JOINT SEALANTS.
9. General electrical requirements that are common to more than one section of Division 26: Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
10. Electrical conductors and cables in electrical systems rated 600 V and below: Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW).
11. Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents: Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
12. Conduit and boxes: Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS.
13. Wiring devices: Section 26 27 26, WIRING DEVICES.
14. Underground ducts, raceways, precast manholes and pull boxes: Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION.
15. Lightning protection: Section 26 41 00, FACILITY LIGHTNING PROTECTION.
16. General requirements common to more than one section in Division 28: Section 28 05 00, COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY.
17. Conductors and cables for electronic safety and security systems: Section 28 05 13, CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY.
18. Low impedance path to ground for electronic safety and security system ground fault currents: Section 28 05 26, GROUNDING AND BONDING FOR SECURITY SYSTEMS.
19. Conduits and partitioned telecommunications raceways for Electronic Safety and Security systems: Section 28 05 28.33, CONDUITS AND BACK BOXES FOR ELECTRONIC SAFETY AND SECURITY.
20. Physical Access Control System field-installed controllers connected by data transmission network: Section 28 13 00, PHYSICAL ACCESS DETECTION.
21. Detection and screening systems: Section 28 13 53, SECURITY ACCESS DETECTION.
22. Intrusion sensors and detection devices, and communication links to perform monitoring, alarm, and control functions: Section 28 16 00, INTRUSION DETECTION EQUIPMENT AND SYSTEMS.
23. Video surveillance system cameras, data transmission wiring, and control stations with associated equipment: Section 28 23 00, VIDEO SURVEILLANCE EQUIPMENT AND SYSTEMS.

24. Duress-panic alarms, emergency phones or call boxes, intercom systems, data transmission wiring and associated equipment: Section 28 26 00, ELECTRONIC PERSONAL PROTECTION EQUIPMENT AND SYSTEMS.
25. Alarm initiating devices, alarm notification appliances, control units, fire safety control devices, annunciators, power supplies, and wiring: Section 28 31 00, FIRE DETECTION AND ALARM.
26. Emergency Call telephones, intercom systems, with blue strobe light and equipment: Section 28 52 31, SECURITY EMERGENCY CALL/DURESS ALARM/COMMUNICATIONS SYSTEM AND EQUIPMENT.

1.6 ADMINISTRATIVE REQUIREMENTS

A. Assign a single communications project manager to serve as point of contact for Government, contractor, and design professional.

B. Be proactive in scheduling work.
1. Use of premises is restricted at times directed by COR.
2. Movement of materials: Unload materials and equipment delivered to site. Pay costs for rigging, hoisting, lowering and moving equipment on and around site, in building or on roof.
3. Coordinate installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
4. Sequence, coordinate, and integrate installations of materials and equipment for efficient flow of Work. Plan for large equipment requiring positioning prior to closing in building.
5. Coordinate connection of materials, equipment, and systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies; provide required connection for each service.
6. Initiate and maintain discussion regarding schedule for ceiling construction and install cables to meet that schedule.

C. Contact the Office of Telecommunications, Special Communications Team (005OP2H3) (202)461-5310 to have a Government-accepted Telecommunications COR assigned to project for telecommunications review, equipment and system approval and coordination with other VA personnel.

D. Communications Project Manager Responsibilities:
1. Assume responsibility for overall telecommunications system integration and coordination of work among trades, subcontractors, and authorized system installers.
2. Coordinate with related work indicated on drawings or specified.
3. Manage work related to telecommunications system installation in a manner approved by manufacturer.

1.7 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Provide parts list including quantity of spare parts.

C. Provide manufacturer product information. Government reserves the right to require a list of installations where products have been in operation.

D. Provide Source Quality Control Submittal:
1. Submit written certification from OEM indicating that proposed supervisor of installation and proposed provider of warranty maintenance are authorized representatives of OEM. Include individual's legal name, contact information and OEM credentials in certification.
2. Submit written certification from OEM that wiring and connection diagrams meet Government Life Safety Guidelines, NFPA, NEC, NRTL, these specifications, and Joint Commission requirements and instructions, requirements, recommendations, and guidance set forth by OEM for the proper performance of system.

3. Pre-acceptance Certification: Certification in accordance with procedure outlined in Section 01 00 00, GENERAL REQUIREMENTS and specific Division 27 qualification documentation.

E. Installer Qualifications: Submit three installations of similar size and complexity furnished and installed by installer; include:
1. Installation location and name.
2. Owner's name and contact information including, address, telephone and email.
3. Date of project start and date of final acceptance.
4. System project number.
5. Three paragraph description of each system related to this project; include function, operation, and installation.

F. Provide delegated design submittals (e.g. seismic support design).

G. Submittals are required for all equipment anchors and supports. Include weights, dimensions, center of gravity, standard connections, manufacturer's recommendations and behavior problems (e.g., vibration, thermal expansion,) associated with equipment or conduit. Anchors and supports to resist seismic load based on seismic design categories per section 4.0 of VA seismic design requirements H-18-8 dated August, 2013.

H. Test Equipment List:
1. Supply test equipment of accuracy better than parameters to be tested.
2. Submit test equipment list including make and model number:
3. ANSI/TIA-1152 Level IV twisted pair cabling test instrument.
4. Fiber optic insertion loss power meter with light source.
5. Optical time domain reflectometer (OTDR).
6. Volt-Ohm meter.
7. Digital camera.
8. Bit Error Test Set (BERT).
9. Signal level meter.
10. Time domain reflectometer (TDR) with strip chart recorder (Data and Optical Measuring).
11. Spectrum analyzer.
12. Supply only test equipment with a calibration tag from Government-accepted calibration service dated not more than 12 months prior to test.
13. Provide sample test and evaluation reports.

I. Submittal Drawings:
1. Telecommunications Space Plans/Elevations: Provide enlarged floor plans of telecommunication spaces indicating layout of equipment and devices, including receptacles and grounding provisions. Submit detailed plan views and elevations of telecommunication spaces showing racks, termination blocks, and cable paths. Include following rooms:
2. Telecommunications rooms.
3. Building Entrance Facility/Demarcation rooms.
4. Server rooms/Data Center.
5. Equipment rooms.
6. Antenna Head End rooms.
7. Logical Drawings: Provide logical riser or schematic drawings for all systems.
8. Provide riser diagrams systems and interconnection drawings for equipment assemblies; show termination points and identify wiring connections.
9. Access Panel Schedule on Submittal Drawings: Coordinate and prepare a location, size, and function schedule of access panels required to fully service equipment.

J. Provide sustainable design submittals.

K. Furnish electronic certified test reports to COR prior to final inspection and not more than 90 days after completion of tests.

1.8 CLOSEOUT SUBMITTALS

A. Provide following closeout submittals prior to project closeout date:
   1. Warranty certificate.
   2. Evidence of compliance with requirements such as low voltage certificate of inspection.
   3. Project record documents.
   4. Instruction manuals and software that are a part of system.

B. Maintenance and Operation Manuals: Submit in accordance with Section 01 00 00, GENERAL REQUIREMENTS.
   1. Prepare a manual for each system and equipment specified.
   2. Furnish on portable storage drive in PDF format or equivalent accepted by COR.
   3. Furnish complete manual as specified in specification section, fifteen days prior to performance of systems or equipment test.
   4. Furnish remaining manuals prior to final completion.
   5. Identify storage drive "MAINTENANCE AND OPERATION MANUAL" and system name.
   6. Include name, contact information and emergency service numbers of each subcontractor installing system or equipment and local representatives for system or equipment.
   7. Provide a Table of Contents and assemble files to conform to Table of Contents.
   8. Operation and Maintenance Data includes:
   9. Approved shop drawing for each item of equipment.
   10. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of equipment.
   11. A control sequence describing start-up, operation, and shutdown.
   12. Description of function of each principal item of equipment.
   13. Installation and maintenance instructions.
   14. Safety precautions.
   15. Diagrams and illustrations.
   16. Test Results and testing methods.
   17. Performance data.
   18. Pictorial "exploded" parts list with part numbers. Emphasis to be placed on use of special tools and instruments. Indicate sources of supply, recommended spare parts, and name of servicing organization.
   19. Warranty documentation indicating end date and equipment protected under warranty.
   20. Appendix; list qualified permanent servicing organizations for support of equipment, including addresses and certified personnel qualifications.

C. Record Wiring Diagrams:
   1. Red Line Drawings: Keep one E size 91.44 cm x 121.92 cm (36 inches x 48 inches) set of floor plans, on site during work hours, showing installation progress marked and backbone cable labels noted. Make these drawings available for examination during construction meetings or field inspections.
   2. General Drawing Specifications: Detail and elevation drawings to be D size 61 cm x 91.44 cm (24 inches x 36 inches) with a minimum scale of 0.635 cm = 30.48 cm (1/4 inch = 12 inches). ER, TR and other enlarged detail floor plan drawings to be D size 61 cm x 91.44 cm (24” x 36”) with a minimum scale of 0.635 cm = 30.48 cm (1/4 inch = 12 inches). Building composite floor plan drawings to be D size 61 cm x 91.44 cm (24 inches x 36 inches) with a minimum scale of 3.175 mm = 30.48 cm (1/8 inch = 1’ 0 inch).
   3. Building Composite Floor Plans: Provide building floor plans showing work area outlet locations and configuration, types of jacks, distance for each cable, and cable routing locations.
   4. Floor plans to include:
   5. Final room numbers and actual backbone cabling and pathway locations and labeling.
   6. Inputs and outputs of equipment identified according to labels installed on cables and equipment
   7. Device locations with labels.

8. Conduit.
9. Head-end equipment.
10. Wiring diagram.
11. Labeling and administration documentation.
12. Submit Record Wiring Diagrams within five business days after final cable testing.
13. Deliver Record Wiring Diagrams as CAD files in .dwg or .PDF formats as determined by COR.
14. Deliver four complete sets of electronic record wiring diagrams to COR on portable storage drive.

D. Service Qualifications: Submit name and contact information of service organizations providing service to this installation within four hours of receipt of notification service is needed.

1.9 MAINTENANCE MATERIAL SUBMITTALS

A. After approval and prior to installation, furnish COR with the following:
1. A 300 mm (12 inch) length of each type and size of wire and cable along with tag from coils of reels from which samples were taken.
2. One coupling, bushing and termination fitting for each type of conduit.
3. Samples of each hanger, clamp and supports for conduit and pathways.
4. Duct sealing compound.

1.10 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Manufacturer must produce, as a principal product, the equipment and material specified for this project, and have manufactured item for at least three years.

B. Product and System Qualification:
1. OEM must have three installations of equipment submitted presently in operation of similar size and type as this project, that have continuously operated for a minimum of three years.
2. Government reserves the right to require a list of installations where products have been in operation before approval.
3. Authorized representative of OEM must be responsible for design, satisfactory operation of installed system, and certification.

C. Trade Contractor Qualifications: Trade contractor must have completed three or more installations of similar systems of comparable size and complexity with regards to coordinating, engineering, testing, certifying, supervising, training, and documentation. Identify these installations as a part of submittal.

D. System Supplier Qualifications: System supplier must be authorized by OEM to warranty installed equipment.

E. Telecommunications technicians assigned to system must be trained, and certified by OEM on installation and testing of system; provide written evidence of current OEM certifications for installers.

F. Manufactured Products:
1. Comply with FAR clause 52.236-5 for material and workmanship.
2. When more than one unit of same class of equipment is required, units must be product of a single manufacturer.
3. Equipment Assemblies and Components:
4. Components of an assembled unit need not be products of same manufacturer.
5. Manufacturers of equipment assemblies, which include components made by others, to assume complete responsibility for final assembled unit.
6. Provide compatible components for assembly and intended service.
7. Constituent parts which are similar must be product of a single manufacturer.
8. Identify factory wiring on equipment being furnished and on wiring diagrams.

G. Testing Agencies: Government reserves the option of witnessing factory tests. Notify COR minimum 15 working days prior to manufacturer performing the factory tests.
   1. When equipment fails to meet factory test and re-inspection is required, contractor is liable for additional expenses, including expenses of Government.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements:
   1. Government's approval of submittals must be obtained for equipment and material before delivery to job site.
   2. Deliver and store materials to job site in OEM's original unopened containers, clearly labeled with OEM's name and equipment catalog numbers, model and serial identification numbers for COR to inventory cable, patch panels, and related equipment.

B. Storage and Handling Requirements:
   1. Equipment and materials must be protected during shipment and storage against physical damage, dirt, moisture, cold and rain:
   2. Store and protect equipment in a manner that precludes damage or loss, including theft.
   3. Protect painted surfaces with factory installed removable heavy kraft paper, sheet vinyl or equivalent.
   4. Protect enclosures, equipment, controls, controllers, circuit protective devices, and other like items, against entry of foreign matter during installation; vacuum clean both inside and outside before testing and operating.

C. Coordinate storage.

1.12 FIELD CONDITIONS

A. Where variations from documents are requested in accordance with GENERAL CONDITIONS and Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, connecting work and related components must include additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.

B. A contract adjustment or additional time will not be granted because of field conditions pursuant to FAR 52.236-2 and FAR 52.236-3; a contract adjustment or additional time will not be granted for additional work required for complete and usable construction and systems pursuant to FAR 52.246-12.

1.13 WARRANTY

A. Comply with FAR clause 52.246-21, except as follows:
   1. Warranty material and equipment to be free from defects, workmanship, and remain so for a period of one year for Emergency Systems from date of final acceptance of system by Government; provide OEM’s equipment warranty document to COR.
   2. Government maintenance personnel must have ability to contact OEM for emergency maintenance and logistic assistance, remote diagnostic testing, and assistance in resolving technical problems at any time; contractor and OEM must provide this capability.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

A. Provide communications spaces and pathways conforming to TIA 569, at a minimum.

B. In cases of renovations in historic or otherwise restrictive buildings, where it has been determined as impossible to follow above stated guidelines, exceptions must not modify maximum distances set forth in TIA 568 and 569; and exceptions must not in any way effect performance of entire TIP system.

2.2 EQUIPMENT IDENTIFICATION

A. Provide laminated black phenolic resin with a white core nameplates with minimum 6 mm (1/4 inch) high engraved lettering.

B. Nameplates furnished by manufacturer as standard catalog items, unless other method of identification is indicated.

2.3 UNDERGROUND WARNING TAPE

A. Underground Warning: Standard 4-Mil polyethylene 76 mm (3 inch) wide tape detectable type; red with black letters imprinted with “CAUTION BURIED ELECTRIC LINE BELOW”, orange with black letters imprinted with “CAUTION BURIED TELEPHONE LINE BELOW” or orange with black letters imprinted with “CAUTION BURIED FIBER OPTIC LINE BELOW”, as applicable.

2.4 WIRE LUBRICATING COMPOUND

A. Provide non-hardening or forming adhesive coating cable lubricants suitable for cable jacket material and raceway.

2.5 FIREPROOFING TAPE

A. Provide flexible, conformable fabric tape of organic composition and coated one side with flame-retardant elastomer.

B. Tape must be self-extinguishing and cannot support combustion; arc-proof and fireproof.

C. Tape cannot deteriorate when subjected to water, gases, salt water, sewage, or fungus; and tape must be resistant to sunlight and ultraviolet light.

D. Application must withstand a 200-ampere arc for minimum 30 seconds.

E. Securing Tape: Glass cloth electrical tape minimum 0.18 mm (7 mils) thick and 19 mm (3/4 inch) wide.

2.6 UNDERGROUND CABLES

A. Provide buried closure suitable for enclosing a straight, butt, and branch splice in a container into which can be poured an encapsulating compound.

B. Provide closure of adequate strength to protect splice and maintain cable shield electrical continuity in buried environment.

C. Provide re-enterable encapsulating compound maintaining chemical stability of closure.

D. Provide filled splice cases in accordance with RUS Bull 345-72.

E. Provide gel filled cable meeting requirements of ICEA S-99-689 and RUS 1755.890.

F. In Vault or Manhole:
   1. Provide underground closure suitable to house a straight, butt, and branch splice in a protective housing into which can be poured an encapsulating compound
   2. Closure must be suitable thermoplastic, thermo-set, or stainless steel material supplying structural strength to pass mechanical and electrical requirements in a vault or maintenance hole (manhole) environment.

G. Re-Enterable Encapsulating Compound: Product maintaining chemical stability of closure.

H. Provide gel-filled splice cases in accordance with RUS Bull 345-72.

2.7 ACCESS PANELS

A. Panels: 304 mm x 304 mm (12 inches by 12 inches), or size allowed by location to provide optimum access to equipment for maintenance and service.

B. Provide access panels and doors as required to allow service of materials and equipment that require inspection, replacement, repair or service.

C. Provide access panels where items installed require access and are concealed in floor, wall, furred space or above ceiling; ceilings consisting of lay-in or removable splined tiles do not require access panels.

D. Provide access panels with same fire rating classification as surface penetrated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Penetrations and Sleeves:
1. Lay out penetration and sleeve openings in advance, to permit provision in work.
2. Set sleeves in forms before concrete is poured.
3. Set sleeves prior to installation of structure for passage of pipes, conduit, ducts, etc.
4. Provide sleeves and packing materials at penetrations of foundations, walls, slabs, partitions, and floors.
5. Make sleeves that penetrate outside walls, basement slabs, footings, and beams waterproof.
6. Fill slots, sleeves and other openings in floors or walls if not used.
7. Fill spaces in openings after installation of conduit or cable.
8. Provide fill for floor penetrations to prevent passage of water, smoke, fire, and fumes.
9. Provide fire resistant fill in rated floors and walls, to prevent passage of air, smoke and fumes.
10. Install sleeves through floors watertight and extend minimum 50.8 mm (2 inches) above floor surface.
11. Match and set sleeves flush with adjoining floor, ceiling, and wall finishes where raceways passing through openings are exposed in finished rooms.
12. Annular space between conduit and sleeve must be minimum 6 mm (1/4 inch).
13. Do not provide sleeves for slabs-on-grade, unless specified or indicated otherwise.
14. Comply with requirements for firestopping, for sleeves through rated fire walls and smoke partitions.
15. Do not support piping risers or conduit on sleeves.
16. Identify unused sleeves and slots for future installation.
17. Provide core drilling if walls are poured or otherwise constructed without sleeves and wall penetration is required; do not penetrate structural members.

B. Core Drilling:
1. Avoid core drilling whenever possible.
2. Coordinate openings with other trades and utilities, and prevent damage to structural reinforcement.
3. Investigate existing conditions in vicinity of required opening prior to coring, including an x-ray of floor if determined necessary by competent person or COR.
4. Protect areas from damage.

C. Verification of In-Place Conditions:
1. Verify location, use and status of all material, equipment, and utilities that are specified, indicated, or determined necessary for removal.
2. Verify materials, equipment, and utilities to be removed are inactive, not required, or in use after completion of project.
3. Replace with equivalent any material, equipment and utilities that were removed by contractor that are required to be left in place.
4. Existing Utilities: Do not interrupt utilities serving facilities occupied by Government or others unless permitted under following conditions and then only after arranging to provide temporary utility services, according to requirements indicated:
5. Notify COR in writing at least 14 days in advance of proposed utility interruptions.
6. Do not proceed with utility interruptions without Government’s written permission.

D. Provide suspended platforms, strap hangers, brackets, shelves, stands or legs for floor, wall and ceiling mounting of equipment as required.

E. Provide steel supports and hardware for installation of hangers, anchors, guides, and other support hardware.

F. Obtain and analyze catalog data, weights, and other pertinent data required for coordination of equipment support provisions and installation.

G. Verify site conditions and dimensions of equipment to ensure access for proper installation of equipment without disassembly that would void warranty.

3.2 INSTALLATION - GENERAL

A. Coordinate systems, equipment, and materials installation with other building components.

B. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings.

C. Conform to VAAR 852.236.91 arrangements indicated, recognizing that work may be shown in diagrammatic form or have been impracticable to detail all items because of variances in manufacturers' methods of achieving specified results.

D. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed in both exposed and un-exposed spaces.

E. Install equipment according to manufacturers' written instructions.

F. Install wiring and cabling between equipment and related devices.

G. Install cabling, wiring, and equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum interference of adjacent other installations.

H. Provide access panel or doors where units are concealed behind finished surfaces.

I. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for wiring, cabling, and equipment installations.

J. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide maximum headroom and access for service and maintenance as possible.

K. Install systems, materials, and equipment giving priority to systems required to be installed at a specified slope.

L. Avoid interference with structure and with work or other trades, preserving adequate headroom and clearing doors and passageways to satisfaction of COR and code requirements.

M. Install equipment and cabling to distribute equipment loads on building structural members provided for equipment support under other sections; install and support roof-mounted equipment on structural steel or roof curbs as appropriate.

N. Provide supplementary or miscellaneous items, appurtenances, devices and materials for a complete installation.

3.3 EQUIPMENT INSTALLATION

A. Locate equipment as close as practical to locations shown on drawings.

B. Note locations of equipment requiring access on record drawings.

C. Access and Access Panels: Verify access panel locations and construction with COR.

D. Inaccessible Equipment:
   1. Where Government determines that contractor has installed equipment not conveniently accessible for operation and maintenance, equipment must be removed and reinstalled as directed and without additional cost to Government.

2. Refer to Section 27 11 00, TELECOMMUNICATIONS ROOM FITTINGS for communication equipment cabinet assembly.
3. Refer to Section 27 11 00, TELECOMMUNICATIONS ROOM FITTINGS for equipment labeling.

3.4 EQUIPMENT IDENTIFICATION

A. Install an identification sign which clearly indicates information required for use and maintenance of equipment.

B. Secure identification signs with screws.

3.5 CUTTING AND PATCHING

A. Perform cutting and patching according to contract general requirements and as follows:
1. Remove samples of installed work as specified for testing.
2. Perform cutting, fitting, and patching of equipment and materials required to uncover existing infrastructure in order to provide access for correction of improperly installed existing or new work.
3. Remove and replace defective work.
4. Remove and replace non-conforming work.

B. Cut, remove, and legally dispose of selected equipment, components, and materials, including removal of material, equipment, devices, and other items indicated to be removed and items made obsolete by new work.

C. Provide and maintain temporary partitions or dust barriers adequate to prevent spread of dust and dirt to adjacent areas.

D. Protect adjacent installations during cutting and patching operations.

E. Protect structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

F. Patch finished surfaces and building components using new materials specified for original installation and experienced installers.

3.6 FIELD QUALITY CONTROL

A. Provide work according to VAAR 852.236.91 and FAR clause 52.236-5.

B. Provide minimum clearances and work required for compliance with NFPA 70, National Electrical Code (NEC), and manufacturers' instructions; comply with additional requirements indicated for access and clearances.

C. Verify all field conditions and dimensions that affect selection and provision of materials and equipment, and provide any disassembly, reassembly, relocation, demolition, cutting and patching required to provide work specified or indicated, including relocation and reinstallation of existing wiring and equipment.
1. Protect facility, equipment, and wiring from damage.

D. Submit written notice that:
1. Project has been inspected for compliance with documents.
2. Work has been completed in accordance with documents.

E. Non-Conforming Work: Conduct project acceptance inspections, final completion inspections, substantial completion inspections, and acceptance testing and demonstrations after verification of system operation and completeness by Contractor.

F. For project acceptance inspections, final completion inspections, substantial completion inspections, and testing/demonstrations that require more than one site visit by COR or design professional to verify project compliance for same material or equipment, Government reserves right to obtain compensation from contractor to defray cost of additional site visits that result

from project construction or testing deficiencies and incompleteness, incorrect information, or non-compliance with project provisions.

1. COR will notify contractor, of hourly rates and travel expenses for additional site visits, and will issue an invoice to Contractor for additional site visits.
2. Contractor is not be eligible for extensions of project schedule or additional charges resulting from additional site visits that result from project construction or testing deficiencies/incompleteness, incorrect information, or non-compliance with Project provisions.

G. Tests:

1. Interim inspection is required at approximately 50 percent of installation.
2. Request inspection ten working days prior to interim inspection start date by notifying COR in writing; this inspection must verify equipment and system being provided adheres to installation, mechanical and technical requirements of construction documents.
3. Inspection to be conducted by OEM and factory-certified contractor representative, and witnessed by COR, facility and SMCS 0050P2H3 representatives.
4. Check each item of installed equipment to ensure appropriate NRTL listing labels and markings are fixed in place.
5. Verify cabling terminations in DEMARC, MCR, TER, SCC, ECC, TRs and head end rooms, workstation locations and TCO adhere to color code for T568B pin assignments and cabling connections are in compliance with TIA standards.
6. Visually confirm minimum Category 6A cable marking at TCOs, CCSs locations, patch cords and origination locations.
7. Review entire communications circulating ground system, each TGB and grounding connection, grounding electrode and outside lightning protection system.
8. Review cable tray, conduit and path/wire way installation practice.
9. OEM and contractor to perform:
10. Fiber optical cable field inspection tests via attenuation measurements on factory reels; provide results along with OEM certification for factory reel tests.
11. Coaxial cable field inspection tests via attenuation measurements on factory reels; provide results along with OEM certification for factory reel tests.
12. Baseband cable field inspection tests via attenuation measurements on factory reels and provide results along with OEM certification for factory reel tests.
13. Relocate failed cable reels to a secured location for inventory, as directed by COR, and then remove from project site within two working days; provide COR with written confirmation of defective cable reels removal from project site.
14. Provide results of interim inspections to COR.
15. If major or multiple deficiencies are discovered, additional interim inspections could be required until deficiencies are corrected, before permitting further system installation.
16. Additional inspections are scheduled at direction of COR.
17. Re-inspection of deficiencies noted during interim inspections, must be part of system's Final Acceptance Proof of Performance Test.
18. The interim inspection cannot affect the system's completion date unless directed by COR.
19. Facility COR will ensure test documents become a part of system's official documentation package.

H. Pretesting: Re-align, re-balance, sweep, re-adjust and clean entire system and leave system working for a "break-in" period, upon completing installation of system and prior to Final Acceptance Proof of Performance Test. System RF transmitting equipment must not be connected to keying or control lines during "break-in" period.

1. Pretesting Procedure:
2. Verify systems are fully operational and meet performance requirements, utilizing accepted test equipment and spectrum analyzer.
3. Pretest and verify system functions and performance requirements conform to construction documents and, that no unwanted physical, aural and electronic effects, such as signal distortion, noise pulses, glitches, audio hum, poling noise are present.

4. Measure and record signal, aural and control carrier levels of each DAS RF, voice and data channel, at each of the following minimum points in system:
5. Utility provider entrance.
6. Buried conduit duct locations.
7. Maintenance Holes (Manholes) and hand holes.
8. ENTR or DEMARC.
9. PBX interconnections.
10. MCR interconnections.
11. MCOR interconnections.
12. TER interconnections.
13. TOR interconnections.
14. Control room interconnections.
15. TR interconnections.
16. System and lightning ground interconnections.
17. Communications circulating ground system.
18. UPS areas.
19. Emergency generator interconnections.
20. Each general floor areas.
21. Others as required by AHJ (SMCS 005OP2H3).
22. Provide recorded system pretest measurements and certification that the system is ready for formal acceptance test to COR.

I. Acceptance Test:
1. Schedule an acceptance test date after system has been pretested, and pretest results and certification submitted to COR.
2. Give COR fifteen working days written notice prior to date test is expected to begin; include expected duration of time for test in notification.
3. Test in the presence of the following:
4. COR.
5. OEM representatives.
6. Facility:
    1) FMS Service Chief, Bio-Medical Engineering and facility representatives.
    2) OI&T Service Chief and OI&T representatives.
    3) Safety Officer, Police Chief and facility safety representatives.
7. Test system utilizing accepted test equipment to certify proof of performance and Life and Public Safety compliance, FCC, NRTL, NFPA and OSHA compliance.
8. Rate system as acceptable or unacceptable at conclusion of test; make only minor adjustments and connections required to show proof of performance.
    1) Demonstrate and verify that system complies with performance requirements under operating conditions.
    2) Failure of any part of system that precludes completion of system testing, and which cannot be repaired within four hours, terminates acceptance test of that portion of system.
    3) Repeated failures that result in a cumulative time of eight hours to affect repairs is cause for entire system to be declared unacceptable.
    4) If system is declared unacceptable, retesting must be rescheduled at convenience of Government and costs borne by the contractor.

J. Acceptance Test Procedure:
1. Physical and Mechanical Inspection: The test team representatives must tour major areas to determine system and sub-systems are completely and properly installed and are ready for acceptance testing.
2. A system inventory including available spare parts must be taken at this time.
3. Each item of installed equipment must be re-checked to ensure appropriate NRTL (i.e. UL) certification listing labels are affixed.
4. Confirm that deficiencies reported during Interim Inspections and Pretesting are corrected prior to start of Acceptance Test.

5. Inventory system diagrams, record drawings, equipment manuals, pretest results.
6. Failure of system to meet installation requirements of specifications is grounds for terminating testing and to schedule re-testing.

K. Operational Test:
1. Individual Item Test: COR may select individual items of equipment for detailed proof of performance testing until 100 percent of system has been tested and found to meet requirements of the construction documents.
2. Government's Condition of Acceptance of System Language:
3. Without Acceptance: Until system fully meets conditions of construction documents, system's ownership, use, operation and warranty commences at Government's final acceptance date.
4. With Conditional Acceptance: Stating conditions that need to be addressed by contractor or OEM and stating system's use and operation to commence immediately while its warranty commences only at Government's agreed final extended acceptance date.
5. With Full Acceptance: Stating system's ownership, use, operation and warranty to immediately commence at Government's agreed to date of final acceptance.

L. Acceptance Test Conclusion: Reschedule testing on deficiencies and shortages with COR, after COR and SMCS AHJ jointly agree to results of the test, using the generated punch list or discrepancy list. Perform retesting to comply with these specifications at contractor's expense.

M. Proof of Performance Certification:
1. If system is declared acceptable, AHJ (SMCS 005OP2H3) provides COR notice stating system processes to required operating standards and functions and is Government accepted for use by facility.
2. Validate items with COR needing to be provided to complete project contract (i.e. charts & diagrams, manuals, spare parts, system warranty documents executed, etc.). Once items have been provided, COR contacts FMS service chief to turn over system from CFM oversight for beneficial use by facility.
3. If system is declared unacceptable without conditions, rescheduled testing expenses are to be borne by contractor.

3.7 CLEANING

A. Remove debris, rubbish, waste material, tools, construction equipment, machinery and surplus materials from project site and clean work area, prior to final inspection and acceptance of work.

B. Put building and premises in neat and clean condition.

C. Remove debris on a daily basis.

D. Remove unused material, during progress of work.

E. Perform cleaning and washing required to provide acceptable appearance and operation of equipment to satisfaction of COR.

F. Clean exterior surface of all equipment, including concrete residue, dirt, and paint residue, after completion of project.

G. Perform final cleaning prior to project acceptance by COR.

H. Remove paint splatters and other spots, dirt, and debris; touch up scratches and mars of finish to match original finish.

I. Clean devices internally using methods and materials recommended by manufacturer.

J. Tighten wiring connectors, terminals, bus joints, and mountings, to include lugs, screws and bolts according to equipment manufacturer's published torque tightening values for equipment connectors. In absence of published connection or terminal torque values, comply with torque values specified in UL 486A-486B.

3.8 TRAINING

A. Provide training in accordance with subsection, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.

B. Provide training for equipment or system as required in each associated specification.

C. Develop and submit training schedule for approval by COR, at least 30 days prior to planned training.

3.9 PROTECTION

A. Protection of Fireproofing:
   1. Install clips, hangers, clamps, supports and other attachments to surfaces to be fireproofed, if possible, prior to start of spray fireproofing work.
   2. Install conduits and other items that would interfere with proper application of fireproofing after completion of spray fire proofing work.
   3. Patch and repair fireproofing damaged due to cutting or course of work must be performed by installer of fireproofing and paid for by trade responsible for damage.

B. Maintain equipment and systems until final acceptance.

C. Ensure adequate protection of equipment and material during installation and shutdown and during delays pending final test of systems and equipment because of seasonal conditions.

- - - E N D - - -

SECTION 27 05 26
GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section identifies common and general grounding and bonding requirements of communication installations and applies to all sections of Divisions 27 and 28.

B. This section specifies grounding and bonding requirements of communications installations based on the requirements of ANSI/TIA-607-D, Telecommunications Bonding and Grounding (Earthing) for Customer Premises. Work covered by this Section shall consist of furnishing supplies, labor, materials, equipment, labeling, and tools. Testing is required unless otherwise specified. An operable grounding and bonding infrastructure is required as described on the Drawings and/or required by these specifications. All materials shall be listed by a nationally recognized testing laboratory (NRTL).

1.2 SUMMARY

A. Section includes:
1. Required Bonding Busbars.
2. Supplemental Bonding Networks.
3. Telecommunications Bonding Conductors.
4. Joining Requirements.
5. Overvoltage Surge Protectors.

1.3 REFERENCES

A. VA Infrastructure Standard for Telecommunications Spaces.

B. ANSI/TIA-607-D, Telecommunications Bonding and Grounding (Earthing) for Customer Premises.

C. NFPA 70, National Electrical Code (NEC).

D. International Annealed Copper Standard (IACS).

E. BICSI Information Technology Systems Installation Methods Manual (ITSIMM), Recommended Testing Procedures and Criteria.

F. UL 497 & UL 497A, UL Standards for Primary & Secondary Safety Protectors for Paired-Conductor Communications Circuits.

1.4 RELATED WORK

A. Facility grounding and bonding requirements: Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

B. Information Technology equipment enclosures: Section 27 11 16, COMMUNICATION CABINETS, RACKS, FRAMES, AND ENCLOSURES.

C. Cable trays: Section 27 05 36, CABLE TRAYS FOR COMMUNICATIONS SYSTEMS.

1.5 SUBMITTALS

A. Submit in accordance with Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS SYSTEMS.

B. Provide riser diagram indicating location of communications grounding system connections indicating routing of grounding conductors.

C. Closeout Submittals: Provide test reports of ground resistance to each primary or secondary bonding busbar (PBB/SBB) located in each telecommunications space impacted by the work.

D. Certifications: Two weeks prior to final inspection, submit following to COR:
   1. Certification materials and installation is in accordance with construction documents.
   2. Certification complete installation has been installed and tested.

PART 2 - PRODUCTS

2.1 BONDING BUSBARS.

A. Bonding busbars are located in each telecommunications space and in each network rack/cabinet. Bonding busbars provide common locations in the telecommunications space for the connection of the telecommunications bonding conductors.

B. Common Requirements.
   1. Provided with holes for use with correctly-matched UL Listed two-hole lugs and hardware.
   2. Constructed of copper or copper alloy with a minimum of 95% conductivity when annealed.
   3. Annealed as specified by the International Annealed Copper Standard (IACS).
   4. Installation resulting in a maximum 4.0Ω to ground resistance measured from any point in the system.
   5. Installation is insulated from the mounting surface through the use of appropriate insulators.
   6. UL Listed.

C. Primary Bonding Busbar (PBB). The PBB is a dedicated extension of the building grounding electrode system for the telecommunications infrastructure. The PBB also serves as the central attachment point for Secondary Bonding Busbars (SBB) via Telecommunications Bonding Backbone (TBB).
   1. Pre-drilled copper with holes to accommodate lug mounting holes.
   2. Sized for current applications and future growth.
   3. Insulated from its supports.
   4. Electro-tin plated is acceptable.
   5. Maintain a 2” min clearance between busbar and finished wall.
   6. Size must be 0.25” thick by 4” wide by 20” length.

D. Secondary Bonding Busbar (SBB). The SBB is a common point of connection for telecommunications system and equipment bonding to a ground located in each Telecommunications Room.
   1. Pre-drilled holes to accommodate dual-lug mounting holes.
   2. 0.25” thick x 2” wide with varying length to be sized for current applications and future growth.
   3. Maintain a 2” min clearance between the finished wall and busbar.
   4. Copper or tin annealed copper.

E. Rack Bonding Busbar (RBB). The RBB is a busbar located in a cabinet, rack, or frame.
   1. Mounting. Horizontal mounting to an EIA-310-D 19” equipment rack is specified.
   2. Capacity: 10 Double-hole lugs via a minimum of 20 pre-drilled and tapped holes, on an angled pattern.
   3. Size & material Minimum 0.75” wide / maximum 1.75” wide x 19” nominal length x 0.1875”-0.25” thick – tin annealed copper.

2.2 SUPPLEMENTAL BONDING NETWORKS.

A. Also known as Signal Reference Grids (SRGs), Mesh Bonding Networks (Mesh-BN), or Isolated Bonding Networks (IBNs), the requirements for supplemental bonding networks are not

specified in this document. Supplemental bonding networks may not be used to replace a standards-compliant bonding infrastructure.

2.3 TELECOMMUNICATIONS BONDING BACKBONE (TBB).

A. The TBB bonds the facility Primary Bonding Busbar (PBB) to telecommunications space Secondary Bonding Busbars (SBBs).

B. Material. Stranded copper wire with a green jacket (or per NEC depending on size), run as a continuous conductor.

C. Size. The TBB shall be sized to meet the requirements of ANSI/TIA-607-D and will be as straight as practicable avoiding bends.

D. Bonding the TBB to the PBB and each SBB will require a UL Listed irreversible compression (crimp) dual-lug connector.

2.4 BONDING CONDUCTORS.

A. Telecommunications Equipment Bonding Conductor (TEBC). The TEBC connects the cabinets and racks in the telecommunications space to the space's bonding busbar (PBB or SBB).
   1. Material. Stranded copper wire with a green jacket (or per NEC depending on size), run as a continuous conductor.
   2. Size. The TBB shall be sized to meet the requirements of ANSI/TIA-607-D. The minimum size for the TEBC shall be AWG 6.
   3. Bonding. Bonded to the telecommunications space bonding busbar (PBB or SBB) via a UL Listed two-hole compression lug. Rack Bonding Conductors (RBCs) are connected to the TEBC using UL Listed irreversible compression (crimp) connectors.

B. Rack Bonding Conductor (RBC). The RBC is a bonding conductor from the cabinet or Rack Bonding Busbar (RBB) to the Telecommunications Equipment Bonding Conductor (TEBC).
   1. Material. Stranded copper wire with a green jacket run as a continuous conductor.
   2. Size. The minimum size for the RBC shall be AWG 6.
   3. Bonding. Bonded to the Telecommunications Equipment Bonding Conductor (TEBC) using UL Listed irreversible compression (crimp) connectors.
      a. Where connected to a server cabinet, the RBC extends to the bottom of the server cabinet allowing Equipment Bonding Conductors to be attached at any point in the cabinet.
      b. Where connected to a network rack/cabinet, the Rack Bonding Conductor (RBC) is bonded to the Rack Bonding Busbar (RBB) via a UL Listed two-hole compression lug.

C. Equipment/Unit Bonding Conductor (EBC/UBC). The Equipment/Unit Bonding Conductor connects individual equipment in a cabinet or rack to the Rack Bonding Conductor (RBC) or Rack Bonding Busbar (RBB). Equipment Bonding conductors are also used as cable tray bonding conductors to bond cable tray sections to the Telecommunications Equipment Bonding Conductor (TEBC).
   1. Material. Stranded copper wire with a green jacket run as a continuous conductor.
   2. Size. The minimum size for the RBC shall be AWG 6.
   3. Bonding.
      a. Where used in a server cabinet, bonded to the Rack Bonding Connector (RBC) using UL Listed irreversible compression (crimp) connectors and to IT equipment via a UL Listed two-hole compression lug. (Some IT equipment may require one-hole lugs.)
      b. Where used in a network cabinet/rack, bonded to the Rack Bonding Busbar (RBB) via a UL Listed two-hole compression lug and to IT equipment via a UL Listed two-hole compression lug. (Some IT equipment may require one-hole lugs.)
      c. Where used as a cable tray bonding conductor connecting cable tray sections, bonded to each adjoining section of the cable tray using UL Listed two-hole compression lugs.

d. Where used as a cable tray bonding conductor connecting cable tray sections to the Telecommunications Equipment Bonding Conductor (TEBC), bonded to the TEBC using UL Listed irreversible compression (crimp) connectors and to the cable tray via a UL Listed two-hole compression lug.

4. Contractor shall furnish a minimum of ten (10) EBCs for each RBB. Five (5) EBCs shall be outfitted as described here and shall be six (6) feet in length. Five (5) EBCs shall be outfitted as decried here and shall be nine (9) feet in length. Contractor shall use field measurements to determine EBC cable length when directed by VA project managers.

2.5 OVERVOLTAGE SURGE PROTECTORS.

A. Protectors are voltage-limiting devices intended to protect equipment, wiring, and personnel against the effects of excessive potentials and currents in communications lines caused by lightning, contacts with power conductors, power induction, and rises in ground potential.
   1. Compliance. Protectors shall be compliant with UL 497 and/or UL 497A, as applicable.
   2. Performance. Protectors shall be rated to support copper UTP performance Category 5e at 100MHz.
   3. Protection. Voltage suppression shall be via low capacitance solid state protectors only, rated at 18V for copper backbone applications or 65V for VOIP or PoE applications.
   4. Construction. Provide protection for each pair.
   5. Termination shall be insulation-displacement contact.
   6. Mounting. Protectors shall be wall-mounted.

PART 3 - EXECUTION

3.1 IMPLEMENTATION

A. Components of the telecommunications bonding system will be installed and connected using materials and techniques required by ANSI/TIA-607-D. The use of antioxidant joint compound is required for all connections excluding protector 110 block connections.

B. Testing.
   1. Perform tests per BICSI Information Technology Systems Installation Methods Manual (ITSIMM), Recommended Testing Procedures and Criteria.
   2. Perform two-point bond test using trained installers qualified to use test equipment.
   3. Conduct continuity tests to verify that metallic pathways in telecommunications spaces are bonded to PBB or SBB.
   4. Conduct electrical continuity test to verify that PBB is effectively bonded to the facility grounding electrode conductor.
   5. Perform resistance tests to ensure rack and cabinet bonding connection resistance measures less than 4Ω to PBB or SBB.

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SECTION 27 05 33
CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies conduit, fittings, and boxes to form raceway systems for communications cabling. **Raceways are required for communications cabling** unless shown or specified otherwise. This section identifies common raceways and boxes and applies to all sections of Divisions 27 and 28.

1.2 RELATED WORK

A. Bedding of conduits: Section 31 20 00, EARTH MOVING.

B. Sealing around penetrations to maintain integrity of fire rated construction: Section 07 84 00, FIRESTOPPING.

C. Fabrications for deflection of water away from building envelope at penetrations: Section 07 60 00, FLASHING AND SHEET METAL.

D. Sealing around conduit penetrations through building envelope to prevent moisture migration into building: Section 07 92 00, JOINT SEALANTS.

E. Identification and painting of conduit and other devices: Section 09 91 00, PAINTING.

F. Requirements for personnel safety and to provide a low impedance path for possible ground fault currents: Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.

1.3 SUBMITTALS

A. In accordance with Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS SYSTEMS, submit the following:
   1. Size and location of cabinets, splice boxes, and pull boxes.
   2. Layout of required conduit penetrations through structural elements.
   3. Catalog cuts marked with specific item proposed and area of application identified.

B. Certification: Provide letter prior to final inspection, certifying material is in accordance with construction documents and properly installed.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Minimum Conduit Size: 19 mm (3/4 inch).

B. Conduit:
   1. Rigid Galvanized Steel: Conform to UL 6, ANSI C80.1.
   2. Rigid Aluminum: Conform to UL 6A, ANSI C80.5.
   3. Rigid Intermediate Steel Conduit (IMC): Conform to UL 1242, ANSI C80.6.
   4. Electrical Metallic Tubing (EMT):
      a. Maximum Size: 105 mm (4 inches).
      b. Install only for cable rated 600 volts or less.
      c. Conform to UL 797, ANSI C80.3.
   5. Flexible Galvanized Steel Conduit: Conform to UL 1.
   6. Liquid-tight Flexible Metal Conduit: Conform to UL 360.
   7. Direct Burial Plastic Conduit: Conform to UL 651 and UL 651A, heavy wall PVC, or high density polyethylene (HDPE).

8. Surface Metal Raceway: Conform to UL 5.

C. Conduit Fittings:
1. Rigid Galvanized Steel and Rigid Intermediate Steel Conduit Fittings:
   a. Provide fittings meeting requirements of UL 514B and ANSI/ NEMA FB 1.
   b. Sealing: Provide threaded cast iron type. Use continuous drain type sealing fittings to prevent passage of water and vapor. In concealed work, install sealing fittings in flush steel boxes with blank cover plates having same finishes as other electrical plates in room.
   c. Standard Threaded Couplings, Locknuts, Bushings, and Elbows: Only steel or malleable iron materials are acceptable. Integral retractable type IMC couplings are also acceptable.
   d. Locknuts: Bonding type with sharp edges for digging into metal wall of an enclosure.
   e. Bushings: Metallic insulating type, consisting of an insulating insert molded or locked into metallic body of fitting. Bushings made entirely of metal or nonmetallic material are not permitted.
   f. Erickson (union-type) and Set Screw Type Couplings:
      1) Couplings listed for use in concrete are permitted for use to complete a conduit run where conduit is installed in concrete.
      2) Use set screws of case hardened steel with hex head and cup point to seat in conduit wall for positive ground.
   g. Provide OEM approved fittings.
2. Rigid Aluminum Conduit Fittings:
   a. Standard Threaded Couplings, Locknuts, Bushings, and Elbows: Malleable iron, steel or aluminum alloy materials; Zinc or cadmium plate iron or steel fittings. Aluminum fittings containing more than 0.4 percent copper are not permitted.
   b. Locknuts and Bushings: As specified for rigid steel and IMC conduit.
   c. Set Screw Fittings: Not permitted for use with aluminum conduit.
3. Electrical Metallic Tubing Fittings:
   a. Conform to UL 514B and ANSI/ NEMA FB1; only steel or malleable iron materials are acceptable.
   b. Couplings and Connectors: Concrete tight and rain tight, with connectors having insulated throats.
      1) Use gland and ring compression type couplings and connectors for conduit sizes 50 mm (2 inches) and smaller.
      2) Use set screw type couplings with four set screws each for conduit sizes over 50 mm (2 inches).
      3) Use set screws of case-hardened steel with hex head and cup point to seat in wall of conduit for positive grounding.
   c. Indent type connectors or couplings are not permitted.
   d. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are not permitted.
   e. Provide OEM approved fittings.
4. Flexible Steel Conduit Fittings:
   a. Conform to UL 514B; only steel or malleable iron materials are acceptable.
   b. Provide clamp type, with insulated throat.
   c. Provide OEM approved fittings.
5. Liquid-tight Flexible Metal Conduit Fittings:
   a. Conform to UL 514B and ANSI/ NEMA FB1; only steel or malleable iron materials are acceptable.
   b. Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening.
   c. Provide connectors with insulated throats to prevent damage to cable jacket.
   d. Provide OEM approved fittings.

6. Direct Burial Plastic Conduit Fittings: Provide fittings meeting requirements of UL 514C and NEMA TC3, and as recommended by conduit manufacturer.
7. Expansion and Deflection Couplings:
   a. Conform to UL 467 and UL 514B.
   b. Accommodate 19 mm (3/4 inch) deflection, expansion, or contraction in any direction, and allow 30-degree angular deflections.
   c. Include internal flexible metal braid sized to ensure conduit ground continuity and fault currents in accordance with UL 467, and NEC code tables for ground conductors.
   d. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber material with stainless steel jacket clamps.
8. Rigid Aluminum Fittings:
   a. Provide malleable iron, steel or aluminum alloy materials; zinc or cadmium plate iron or steel fittings. Aluminum fittings containing more than 0.4 percent copper are prohibited.
   b. Locknuts and Bushings: As specified for rigid steel and IMC conduit.
   c. Set Screw Fittings: Not permitted for use with aluminum conduit.
   d. Indent type connectors or couplings are prohibited.
   e. Die-cast or pressure-cast zinc-alloy fittings or fittings made of “pot metal” are not permitted.
   f. Provide OEM approved fittings.

D. Conduit Supports:
1. Parts and Hardware: Provide zinc-coat or equivalent corrosion protection.
2. Individual Conduit Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.
3. Multiple Conduit (Trapeze) Hangers: Minimum 38 mm by 38 mm (1-1/2 by 1-1/2 inch), 2.78 mm (12 gage) steel, cold formed, lipped channels; with minimum 9 mm (3/8 inch) diameter steel hanger rods.
4. Solid Masonry and Concrete Anchors: Self-drilling expansion shields, or machine bolt expansion.

E. Outlet, Splice, and Pull Boxes:
1. Conform to UL-50 and UL-514A.
2. Cast metal where required by NEC or shown, and equipped with rustproof boxes.
3. Sheet Metal Boxes: Galvanized steel, except where otherwise shown.
4. Install flush mounted wall or ceiling boxes with raised covers so that front face of raised cover is flush with wall.
5. Install surface mounted wall or ceiling boxes with surface style flat or raised covers.

F. Warning Tape: Standard, 4-Mil polyethylene 76 mm (3 inch) wide tape detectable type, red with black letters, and imprinted with “CAUTION BURIED COMMUNICATIONS CABLE BELOW”.

G. Flexible Nonmetallic Communications Raceway (Innerduct) and Fittings:
1. General: Provide UL 910 listed plenum, riser, and general purpose corrugated pliable communications raceway.
2. Provide Communications Raceway with a factory installed 567 kg (1250 lb.) tensile pre-lubricated pull tape.
3. Use only metallic straps, hangers and fittings to support raceway from building structure. Cable ties are not permitted for securing raceway to building structure.
4. Provide fittings to be installed in spaces used for environmental air made of materials that do not exceed flammability, smoke generation, ignitibility, and toxicity requirements of environmental air space.
5. Size: Metric Designator 53 (trade size 2) or smaller.
6. Outside Plant: Plenum-rated where each innerduct is 75 mm (3 inches) and larger.
7. Inside Plant: Listed and marked for installation in plenum airspaces and minimum 25 mm (1 inch) inside diameter.
8. Plenum: Non-metallic communications raceway.

9. Constructed of low smoke emission, flame retardant PVC with corrugated construction.
10. UL 94 V-O rating for flame spreading limitation.
11. Provide innerduct reel lengths as necessary to ensure ducts are continuous.
12. Provide pulling accessories used for innerduct including but not limited to, inner duct lubricants, spreaders, applicators, grips, swivels, harnesses, and line missiles (blown air) compatible with materials being pulled.

H. Outlet Boxes:
1. Flush wall mounted 12.7 cm (5 inches) square x 7.3 cm (2-7/8 inches); deep pressed galvanized steel.
2. 2-Gang Tile Box:
   a. Flush backbox type for installation in block walls.
   b. Minimum 92 mm (3-5/8 inches) deep.

I. Weatherproof Outlet Boxes: Surface mount two gang, 67 mm (2-5/8 inches) deep weatherproof cast aluminum with powder coated finish internal threads on hubs 19 mm (3/4 inch) minimum.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION AND REQUIREMENTS

A. Penetrations:
1. Cutting or Holes:
   a. Locate holes in advance of installation. Where proposed in structural sections, obtain approval of structural engineer and COR prior to drilling through structural sections.
   b. Make holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not permitted; COR may grant limited permission by request, in condition of limited working space.
   c. Fire Stop: Where conduits, wireways, and other communications raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING.
      1) Fill and seal clearances between raceways and openings with fire stop material.
      2) Install only retrofittable, non-hardening, and reusable firestop material that can be removed and reinstalled to seal around cables inside conduits.
   d. Waterproofing at Floor, Exterior Wall, and Roof Conduit Penetrations: Seal clearances around conduit and make watertight as specified in Section 07 92 00, JOINT SEALANTS or directed by waterproofing manufacturer.

B. Conduit Installation:
1. Minimum conduit size of 19 mm (3/4 inch), but not less than size required for 40 percent fill.
2. Install insulated bushings on all conduit ends.
3. Install pull boxes after every 180 degrees of bends (two 90-degree bends) or every 100ft. Size boxes per TIA 569.
4. Extend vertical conduits/sleeves through floors minimum 75 mm (3 inches) above floor and minimum 75 mm (3 inches) below ceiling of floor below.
5. Terminate conduit runs to and from a backboard in a TR or interstitial space at top or bottom of backboard. Install conduits to enter telecommunication rooms next to wall and flush with backboard.
6. Where drilling is necessary for vertical conduits, locate holes so as not to affect structural sections.

7. Seal empty conduits located in telecommunications rooms or on backboards to prevent entrance of moisture and gases and to meet fire resistance requirements.
8. Provide pull wire in all empty conduits; sleeves through floor are exceptions.
9. Complete each entire conduit run installation before pulling in cables.
10. Flattened, dented, or deformed conduit is not permitted.
11. Ensure conduit installation does not encroach into ceiling height head room, walkways, or doorways.
12. Cut conduit square with a hacksaw, ream, remove burrs, and draw tight.
13. Install conduit mechanically continuous.
14. Independently support conduit at 2.44 m (8 feet) on center; do not use other supports (i.e., suspended ceilings, suspended ceiling supporting members, luminaires, conduits, mechanical piping, or mechanical ducts).
15. Support conduit within 300 mm (1 foot) of changes of direction, and within 300 mm (1 foot) of each enclosure to which connected.
16. Close ends of empty conduit with plugs or caps to prevent entry of debris, until cables are pulled in.
17. Attach conduits to cabinets, splice cases, pull boxes and outlet boxes with bonding type locknuts. For rigid and IMC conduit installations, provide a locknut on inside of enclosure, made up wrench tight. Do not make conduit connections to box covers.
18. Do not use aluminum conduits in wet locations.
19. Unless otherwise indicated on drawings or specified herein, conceal conduits within finished walls, floors and ceilings.
20. Conduit Bends:
    a. Make bends with standard conduit bending machines; observe minimum bend radius for cable type and outside diameter.
    b. Conduit hickey is permitted only for slight offsets, and for straightening stubbed conduits.
    c. Bending of conduits with a pipe tee or vise is not permitted.
    d. Minimum radius of communication conduit bends:

Sizes of Conduit Trade Size	Radius of Conduit Bends mm, Inches
3/4	150 (6)
1	230 (9)
1-1/4	350 (14)
1-1/2	430 (17)
2	525 (21)
2-1/2	635 (25)
3	775 (31)
3-1/2	900 (36)
4	1125 (45)

21. Layout and Homeruns - Deviations: Make only where necessary to avoid interferences and only after drawings showing proposed deviations have been submitted and approved by COR.

C. Concealed Work Installation:
1. In Concrete:
    a. Conduit: Rigid steel or IMC.
    b. Align and run conduit in direct lines.

c. Install conduit through concrete beams only when the following occurs:
   1) Where shown on structural drawings.
   2) As accepted by COR prior to construction, and after submittal of drawing showing location, size, and position of each penetration.
d. Installation of conduit in concrete that is less than 75 mm (3 inches) thick is prohibited.
   1) Conduit outside diameter larger than 1/3 of slab thickness is prohibited.
   2) Space between Conduits in Slabs: Approximately six conduit diameters apart, except one conduit diameter at conduit crossings.
   3) Install conduits approximately in center of slab to ensure a minimum of 19 mm (3/4 inch) of concrete around conduits.
e. Make couplings and connections watertight. Use thread compounds that are NRTL listed conductive type to ensure low resistance ground continuity through conduits. Tightening set screws with pliers is not permitted.

D. Furred or Suspended Ceilings and in Walls:
1. Rigid steel, IMC or rigid aluminum. Different type conduits mixed indiscriminately in same system is not permitted.
2. Align and run conduit parallel or perpendicular to building lines.
3. Tightening set screws with pliers is not permitted.

E. Exposed Work Installation:
1. Unless otherwise indicated on drawings, exposed conduit is only permitted in telecommunications rooms.
   a. Provide rigid steel, IMC or rigid aluminum.
   b. Different type of conduits mixed indiscriminately in system is not permitted.
2. Align and run conduit parallel or perpendicular to building lines.
3. Install horizontal runs close to ceiling or beams and secure with conduit straps.
4. Support horizontal or vertical runs at not over 2400 mm (96 inches) intervals.
5. Painting:
   a. Paint exposed conduit as specified in Section 09 91 00, PAINTING.
   b. Refer to Section 09 91 00, PAINTING for preparation, paint type, and exact color.
   c. Provide labels where conduits pass through walls and floors and at maximum 6000 mm (20 foot) intervals in between.

F. Expansion Joints:
1. Conduits 75 mm (3 inches) and larger, that are secured to building structure on opposite sides of a building expansion joint, require expansion and deflection couplings. Install couplings in accordance with manufacturer's recommendations.
2. Provide conduits smaller than 75 mm (3 inches) with pull boxes on both sides of expansion joint. Connect conduits to expansion and deflection couplings as specified.
3. Install expansion and deflection couplings where shown.

G. Seismic Areas:
1. In seismic areas, follow H-18-8 Seismic Design Requirements.
2. Rigidly secure conduit to building structure on opposite sides of a building expansion joint with pull boxes on both sides of joint.
3. Connect conduits to pull boxes with 375 mm (15 inches) of slack flexible conduit.
4. Install green copper wire minimum #6 AWG in flexible conduit for bonding jumper.

H. Conduit Supports, Installation:
1. Select AC193 code listed mechanical anchors or fastening devices with safe working load not to exceed 1/4 of proof test load.
2. Use pipe straps or individual conduit hangers for supporting individual conduits. Maximum distance between supports is 2.5 m (8 foot) on center.
3. Support multiple conduit runs with trapeze hangers. Use trapeze hangers designed to support a load equal or greater than sum of the weights of the conduits, wires, hanger

itself, and 90 kg (200 pounds). Attach each conduit with U-bolts or other accepted fasteners.

4. Support conduit independent of pull boxes, luminaires, suspended ceiling components, angle supports, duct work, and similar items.
5. Fastenings and Supports in Solid Masonry and Concrete:
   a. New Construction: Use steel or malleable iron concrete inserts set in place prior to placing concrete.
   b. Existing Construction:
      1) Code AC193 listed wedge type steel expansion anchors minimum 6 mm (1/4 inch) bolt size and minimum 28 mm (1-1/8 inch) embedment.
      2) Power set fasteners minimum 6 mm (1/4 inch) diameter with depth of penetration minimum 75 mm (3 inches).
      3) Use vibration and shock resistant anchors and fasteners for attaching to concrete ceilings.
6. Fastening to Hollow Masonry: Toggle bolts are permitted.
7. Fastening to Metal Structures: Use machine screw fasteners or other devices designed and accepted for application.
8. Bolts supported only by plaster or gypsum wallboard are not acceptable.
9. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.
10. Do not support conduit from chain, wire, or perforated strap.
11. Spring steel type supports or fasteners are not permitted except horizontal and vertical supports/fasteners within walls.
12. Vertical Supports:
    a. Install riser clamps and supports for vertical conduit runs in accordance with NEC.
    b. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

I. Box Installation:
1. Boxes for Concealed Conduits:
   a. Flush mounted.
   b. Provide raised covers for boxes to suit wall or ceiling, construction and finish. In spaces not controlled by VA (i.e., common hallways) covers must be lockable.
2. In addition to boxes shown, install additional boxes where needed to prevent damage to cables during pulling.
3. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.
4. Stencil or install phenolic nameplates on covers of boxes identified on riser diagrams; for example "SIG-FA JB No. 1".
5. Outlet boxes mounted back-to-back in same wall are not permitted. A minimum 600 mm (24 inches) center-to-center lateral spacing must be maintained between boxes.

J. Flexible Nonmetallic Communications Raceway (Innerduct), Installation:
1. Install Innerduct in cable tray. Innerduct may not be free-hung.
2. Install only in accessible spaces not subject to physical damage or corrosive influences.
3. Make bends manually to assure internal diameter of tubing is not effectively reduced.
4. Extend each segment of innerduct minimum 300 mm (12 inches) beyond end of service conduit tie or cable tray. Restrain innerduct ends with wall mount clamps and seal when cable is installed.

3.2 TESTING

A. Examine fittings and locknuts for secureness.

B. Test RMC, IMC and EMT systems for electrical continuity and resistance to ground.

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SECTION 27 05 36
CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies requirements for telecommunications cabling cable tray and raceway equipment.

1.2 SUMMARY

A. Section Includes:
1. Cable Tray.
2. Fiber Optic Cable Raceway.
3. Ladder Rack.

1.3 REFERENCES

A. VA Infrastructure Standard for Telecommunications Spaces.

1.4 RELATED WORK:

A. Grounding and bonding: Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.

1.5 SUBMITTALS:

A. Submit in accordance with Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS SYSTEMS.

PART 2 - PRODUCTS

2.1 CABLE TRAY.

A. Design. Wire basket with tray insert. Maximum 2” x 4” wire mesh construction. Constructed of round, smooth wire with continuous top side to minimize cable sheath damage.

B. Finish. Coated to prevent rust.

C. Size. Cable tray shall be sized to hold the maximum expected cable load at not more than 40% fill and not more than 6” maximum cable depth.

D. Accessories. Provide and install the following components and accessories as necessary to achieve the design:
1. Overhead mounting equipment (thread-rod, unistrut, nuts, washers, etc.) suitable for the supporting structural elements.
2. Tray section splicing hardware.
3. Tray insert.
4. Cable waterfalls.
5. Ground strap kits.
6. Bend radius limiters.

2.2 FIBER OPTIC CABLE RACEWAY.

A. Design. Raceway system shall be a modular system of channels, fittings, and brackets, able to be assembled with couplers. Fittings for cable spillout shall maintain a minimum 2” bend radius.

B. Materials. Raceway shall be constructed of rigid PVC and ABS plastics.

C. Size. Raceway shall be nominally sized 4”x4”.

D. Accessories. Provide and install the following components and accessories as necessary to achieve the design:
   1. Overhead mounting equipment (thread-rod, unistrut, nuts, washers, etc.) suitable for the supporting structural elements.
   2. Channel covers.
   3. Raceway section couplers.
   4. Channel corners and intersections.
   5. Spillway fittings.

2.3 LADDER RACK.

A. Design. Ladder rack system shall be a modular system of ladder, turns, splices, supports, and accessories able to be assembled with couplers. Ladder rack shall be used in vertical applications.

B. Finish. Coated to prevent rust.

C. Materials. Ladder rack shall be manufactured from tubular steel. Stringers will be 3/8” by 1-1/2” tubular steel. Cross members will be 1” x 1/2". Steel elements shall have a minimum 0.065” wall thickness.

D. Size. Ladder rack shall be nominally sized 12” width.

E. Accessories. Provide and install the following components and accessories as necessary to achieve the design:
   1. Overhead mounting equipment (thread-rod, unistrut, nuts, washers, etc.) suitable for the supporting structural elements.
   2. Ladder rack section couplers (splices).
   3. Ladder rack radius bends.
   4. Ground strap kits.

PART 3 - EXECUTION

3.1 IMPLEMENTION:

A. Cable tray shall be used in horizontal applications. Ladder rack is used in vertical applications.

B. Cable tray and ladder rack sections shall be bonded together with bonding conductors and the system bonded to the bonding busbar in the space.

C. Support horizontal cable tray not less than every 5’ (shorter spans if recommended by the equipment manufacturer).

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SECTION 27 05 53
IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies labeling and identification requirements for information technology (IT) equipment cabinets, racks, and cabling.

1.2 SUMMARY

A. Section Includes:
   1. Equipment and component labels.
   2. Labeling implementation requirements.

1.3 REFERENCES

A. VA Infrastructure Standard for Telecommunications Spaces.

1.4 RELATED WORK:

A. Server cabinets and network racks: Section 27 11 16, COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES.

B. Cable management equipment: Section 27 11 23, COMMUNICATIONS CABLE MANAGEMENT AND LADDER RACK.

C. Copper UTP cabling: Section 27 13 13, COMMUNICATIONS COPPER BACKBONE CABLING.

D. Fiber optic cabling: Section 27 13 23, COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING.

1.5 SUBMITTALS:

A. Submit in accordance with Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS SYSTEMS.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND COMPONENT LABELS.

A. Materials. Materials used for labeling equipment, components, and telecommunications cabling shall be appropriate for the installation environment, durable and permanent, and heat-resistant if necessary for labeling in high-temperature environments.

PART 3 - EXECUTION

3.1 IMPLEMENTION:

A. Governing Standard. Labeling and identification of equipment, components, and telecommunications cabling shall be based on ANSI/TIA-606-C, Administration Standard for Telecommunications Infrastructure, and NFPA 70, National Electrical Code, as modified by guidance in the VA Infrastructure Standard for Telecommunications Spaces.

B. All passive infrastructure equipment, components, and telecommunications cabling installed shall be labeled at the time of installation.

C. Telecommunications cable labeling shall include delivery of complete and accurate connection documentation (where each cable terminates at each end) matching the installed labels.

D. Label locations shall be as specified in the VA Infrastructure Standard for Telecommunications Spaces.

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SECTION 27 08 00

COMMISSIONING OF COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section includes requirements for commissioning facility communications systems, related subsystems and related equipment. This Section supplements general requirements specified in Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

B. Complete list of equipment and systems to be commissioned is specified in Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS and Specification 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

C. Commissioned Systems:
1. Commissioning of systems specified in Division 27 and 28 is part of project's construction process including documentation and proof of performance testing of these systems, as well as training of VA's Operation and Maintenance personnel in accordance with requirements of Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS and Division 27, in cooperation with Government and Commissioning Agent.
2. The facility exterior closure systems commissioning includes communications systems listed in Section 01 91 00 GENERAL COMMISSIONING REQUIRMENTS and 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

1.2 RELATED WORK

A. System tests: Section 01 00 00, GENERAL REQUIREMENTS.

B. Commissioning process requires review of selected submittals that pertain to systems to be commissioned: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

C. Construction phase commissioning process and procedures including roles and responsibilities of commissioning team members and user training: Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

1.3 COORDINATION

A. Commissioning Agent will provide a list of submittals that must be reviewed by Commissioning Agent simultaneously with engineering review; do not proceed with work of sections identified without engineering and Commissioning Agent's review completed.

B. Commissioning of communications systems require inspection of individual elements of communications system construction throughout construction period. Coordinate with Commissioning Agent in accordance with Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS and commissioning plan to schedule communications systems inspections as required to support the commissioning process.

1.4 CLOSEOUT SUBMITTALS

A. Refer to Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS for submittal requirements for pre-functional checklists, equipment startup reports, and other commissioning documents.

B. Pre-Functional Checklists:
1. Complete pre-functional checklists provided by commissioning agent to verify systems, subsystems, and equipment installation is complete and systems are ready for Systems Functional Performance Testing.
2. Submit completed checklists to COR and to Commissioning Agent. Commissioning Agent can spot check a sample of completed checklists. If Commissioning Agent determines

that information provided on the checklist is not accurate, Commissioning Agent then returns the marked-up checklist to Contractor for correction and resubmission.

3. If Commissioning Agent determines that a significant number of completed checklists for similar equipment are not accurate, Commissioning Agent can select a broader sample of checklists for review.
4. If Commissioning Agent determines that a significant number of broader sample of checklists is also inaccurate, all checklists for the type of equipment will be returned to Contractor for correction and resubmission.

C. Submit training agendas and trainer resumes in accordance with requirements of Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Contractor's Tests:
1. Scheduled tests required by other sections of Division 27 must be documented in accordance with Section 01 00 00, GENERAL REQUIREMENTS.
2. Incorporate all testing into project schedule. Provide minimum seven calendar days' notice of testing for Commissioning Agent to witness selected Contractor tests at sole discretion of Commissioning Agent.
3. Complete tests prior to scheduling Systems Functional Performance Testing.

B. Systems Functional Performance Testing:
1. Commissioning process includes Systems Functional Performance Testing that is intended to test systems functional performance under steady state conditions, to test system reaction to changes in operating conditions, and system performance under emergency conditions.
2. Commissioning Agent prepares detailed Systems Functional Performance Test procedures for review and acceptance by COR.
3. Provide required labor, materials, and test equipment identified in test procedure to perform tests.
4. Commissioning Agent must witness and document the testing.
   a. Provide test reports to Commissioning Agent. Commissioning Agent will sign test reports to verify tests were performed.

3.2 TRAINING

A. Training of Government's operation and maintenance personnel is required in cooperation with COR and Commissioning Agent.

B. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning location, operation, and troubleshooting of installed systems.

C. Schedule instruction in coordination with COR after submission and approval of formal training plans.

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SECTION 27 10 00
STRUCTURED CABLING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies requirements for telecommunications structured cabling systems.

1.2 SUMMARY

A. Section includes:
1. Computer Room Backbone Structured Cabling.
2. Computer Room Horizontal Structured Cabling.
3. Facility Backbone Structured Cabling.
4. Facility Horizontal Structured Cabling.

1.3 REFERENCES

A. VA Infrastructure Standard for Telecommunications Spaces.

1.4 RELATED WORK

A. Cabling labeling and identification: Section 27 05 53, IDENTIFICATION FOR COMMUNICATIONS SYSTEMS.

B. Cable termination locations and equipment: Section 27 11 19, COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS.

1.5 SUBMITTALS

A. Submit in accordance with Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS SYSTEMS.

PART 2 - PRODUCTS

2.1 COMPUTER ROOM BACKBONE STRUCTURED CABLING

Backbone structured cabling in the computer room environment (first level backbone) connects the Main Distribution Areas (MDAs) to the Horizontal Distribution Areas (HDAs).

A. Install first level backbone structured cabling in overhead cable tray and fiber raceway systems following diverse path routing.

B. All cabling used shall be pre-terminated and procured to the specific length required by the design (horizontal and vertical paths) with no more than 1 meter of excess length on each end.

C. Terminate first level backbone structured cabling in the top RU positions of each network rack or cabinet, working downward, with patch panel equipment mounted on the front rails.

D. Mirror distribution on the A-side and B-side MDA and HDA elements.
1. In MDA network racks
   a. Install angled UTP patch panel(s) for each backbone UTP patch panel in the same-side HDA in the computer room beginning in RU45.
   b. Install an angled panel cover on the lowest UTP patch panel.
   c. Install a blanking panel in the RU below the UTP patch panels.
   d. Install fiber optic distribution cabinets to support the backbone fiber distribution from each HDA.
   e. Install a blanking panel in the RU below the fiber optic distribution cabinet(s).
2. In HDA network racks:
   a. Install fiber optic distribution cabinet(s) and populate with fiber optic distribution cassettes starting in RU45.

b. Install a blanking panel in the RU below the last fiber cabinet.
c. Install UTP patch panel(s) below the blanking panel.
d. Install a blanking panel in the RU below the last UTP patch panel.

E. Install UTP cables between the same-side MDAs and HDAs.

F. Install 12- or 24-strand multimode fiber optic cables between each fiber cassette in the HDA to either the same-side MDA or the opposite side MDA as appropriate.

2.2 COMPUTER ROOM HORIZONTAL STRUCTURED CABLING.

Horizontal structured cabling in the computer room environment connects the Equipment Distributors (EDs) in the server cabinets to each supported Horizontal Distribution Area (HDA).

A. Install horizontal structured cabling in overhead cable tray and fiber raceway systems following diverse path routing.

B. All cabling used shall be pre-terminated and procured to the specific length required by the design (horizontal and vertical paths) with no more than 1 meter of excess length on each end.

C. In the server cabinets, terminate horizontal structured cabling in EDs located in the top 5U of each cabinet, with patch panel equipment mounted on the rear rails.
1. Install fiber optic distribution cabinet(s) starting in RU45 and populate with fiber optic distribution cassettes to support the requirement.
2. Install a blanking panel in the RU below the last fiber cabinet.
3. Install copper UTP patch panel(s) below the blanking panel.

D. In the HDAs, terminate horizontal structured cabling in the RU positions immediately below the first level backbone structured cabling equipment of each network rack, working downward, with patch panel equipment mounted on the front rails.
1. Install fiber optic distribution cabinet(s) and populate with fiber optic distribution cassettes to support each server cabinet.
2. Install a blanking panel in the RU below the fiber optic distribution cabinet(s).

E. Install 12- or 24-strand multimode fiber optic cables between the server cabinet ED and both HDAs.

F. Install UTP cables between the server cabinet ED and both HDAs.

2.3 FACILITY BACKBONE STRUCTURED CABLING.

Backbone structured cabling (inter-building and intra-building first level backbone) connects the Entrance Rooms to the Main Distribution Areas (MDAs) in the computer room, and connects the Main Distribution Areas to each Telecommunications Room (TR). This specification describes facility backbone structured cabling when the Entrance Rooms and computer room are in the same building, connected entirely by environmentally conditioned pathways (no outside plant pathways are transited).

A. Interior to each telecommunications space, install facility backbone structured cabling in overhead cable tray and fiber raceway systems.

B. All facility backbone structured cabling shall be redundant and follow diverse path routing.

C. Facility backbone cabling shall be field-terminated (fusion spliced).

D. In the Entrance Room, MDA, and TR network racks or cabinets/ designated for facility backbone distribution, install fiber optic distribution cabinets as required for the quantity of fibers installed.

E. Between each Entrance Room and the computer room:
1. Provide 2 diversely routed paths of backbone cabling from each Entrance Room. One path will terminate on the A-side MDA and one path will terminate on the B-side MDA.
2. Install a minimum of 24 strands of multimode fiber optic cabling and 12 strands of single-mode fiber optic cabling per path.

3. Populate the fiber optic distribution cabinets on each end with a sufficient quantity of multimode OM4 and single-mode OS1 fiber optic splice cassettes per path.

F. Between each MDA and each TR:
1. No zone/intermediate distribution areas (ZDAs/IDAs) intermediate cross-connects (ICCs) shall be used. All facility backbone cabling between the MDAs and TRs shall be run directly and continuously.
2. Provide 2 diversely routed paths of backbone cabling, one from the A-side MDA and one from the B-side MDA.
3. Where the TR is located in the same building as the computer room MDAs (does not transit outside plant pathways) and the path distance is less than 400 meters, install a minimum of 24 strands of multimode fiber optic cabling and 12 strands of single-mode fiber optic cabling per path.
   a. Populate the fiber optic distribution cabinets on each end with a sufficient quantity of multimode OM4 and single-mode OS1 fiber optic splice cassettes per path.
4. Where the TR is located in a different building as the computer room (transits outside plant pathways) or the path distance is greater than 400m, install a minimum of 24 strands of single-mode fiber optic cabling per path.
   a. Populate the fiber optic distribution cabinets on each end with a sufficient quantity of single-mode OS2 fiber optic splice cassettes per path.

2.4 FACILITY HORIZONTAL STRUCTURED CABLING.

Facility horizontal structured cabling (horizontal distribution) connects the Telecommunications Room (TR) to each end-user Work Area Outlet (WAO).

A. Interior to each TR, install horizontal distribution structured cabling in overhead cable tray systems.

B. All horizontal distribution structured cabling shall have a minimum of 2 cables per WAO.

C. Horizontal distribution structured cabling may be field-terminated.

D. In each TR install sufficient UTP patch panels to support the quantity of WAOs in the TR's serving zone.
1. Plan network racks such that patch panels and horizontal cable managers are located in the top 1/3 (RU31-45), switching equipment in the middle 1/3 (RU16-30), and power distribution and other services in the bottom 1/3 (RU1-15).

E. Install a minimum of 2 UTP cables between the TR UTP patch panels and each work area faceplate.

F. Each typical end-user receptacle shall be constructed of a single-gang workbox with one connector chassis, a minimum of two non-proprietary Category 6A 8P8C media interface connectors (RJ-45), and a four-position keystone faceplate.
1. Modular plug terminated links (MPTL) are permitted to service wireless access points (WAPs), cameras, and other Power over Ethernet (PoE) devices where mating will be very infrequent.

PART 3 - EXECUTION

3.1 IMPLEMENTION:

A. Coordination/shop drawings submitted by the General Contractor shall include drawings detailing the computer room and facility/campus structured cabling systems, including:
1. Cable media performance categories for each type of run.
2. Cabling and equipment quantities.
3. Elevation drawings showing equipment placement in individual enclosures.
4. Full interconnection diagram for all structured cabling.
5. Port map and cable label matrices.

B. All cabling and equipment shall be labeled per the requirements of the VA Infrastructure Standard for Telecommunications Spaces.

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SECTION 27 11 00

TELECOMMUNICATIONS ROOM FITTINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies equipment cabinets, interface enclosures, relay racks, and associated hardware in service provider DEMARC, computer and telecommunications rooms.

B. Telephone system is defined as an Emergency Critical Care Communication System by the National Fire Protection Association (NFPA). Adhere to Seismic reference standards for systems connecting to or extending telephone system and cabling.

1.2 RELATED WORK

A. Wiring devices: Section 26 27 26, WIRING DEVICES.

B. General electrical requirements that are common to more than one section in Division 27: Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

C. Requirements for personnel safety and to provide a low impedance path for possible ground fault currents: Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.

D. Conduits for cables and wiring: Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS.

E. Low voltage cabling system infrastructure: Section 27 10 00, CONTROL, COMMUNICATION AND SIGNAL WIRING.

1.3 SUBMITTALS

A. Submit in accordance with Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATION.

B. Separate submittal into sections for each subsystem containing the following:
   1. Pictorial layouts of each Telecommunications Room and Cross Connection Space (VCCS, and HCCS termination cabinets), each distribution cabinet layout, and TCO as each is expected to be installed and configured.
   2. Equipment technical literature detailing electrical and technical characteristics of each item of equipment to be furnished.

C. Environmental Requirements: Identify environmental specifications for housing system as initial and expanded system configurations.
   1. Floor loading for batteries and cabinets.
   2. Minimum floor space and ceiling height.
   3. Minimum door size for equipment passage.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. Provide components of cabinet system (cabinet, thermal, cable and power management accessories) from a single manufacturer.

B. Equipment Standards and Testing:
   1. Equipment must be listed by a NRTL where a UL standard is in existence; active and passive equipment must conform with each UL standard in effect for equipment, on the submittal date.

2. Each item of electronic equipment must be labeled by a NRTL that warrants equipment has been tested in accordance with and conforms to specified standards.

C. Equipment Cabinets (Enclosures):
1. Fully enclose and physically secure internally mounted and connected, active and passive equipment.
2. Types of Equipment Enclosures accepted for specific VA Spectrum Management, FMS and OI&T applications in CFM and Facility Projects:

CABINET	FUNCTION
Communications	FMS Special Communications Equipment
Server / Router	OI&T Data/LAN/WAN Equipment
Seismic	Either FMS or OI&T use, specify need
Environmental	Either FMS or OI&T use, specify need

3. Each cabinet to be:
   a. Provided in head end, MCR, TER, PCR, EMGR, each TR at a minimum.
   b. Fabricated with minimum 1.59 mm (16 gauge) steel.
   c. Provided with manufacturer's standard painted finish in a color accepted by COR with concurrence from FMS Service Chief.
   d. Mounted on floor or wall.
   e. Lockable; tubular locks keyed alike. Provide six keys to COR for each cabinet.
4. Provide equipment mounting shelves; attach to front and rear mounting rails and allowing equipment to be secured to respective mounting rails.
5. Each enclosure to include:
   a. Floor or wall mounting.
   b. Knock out holes for conduit connections or cable entrance.
   c. Front and rear locking doors; wall mounted cabinets require only front locking door.
   d. Power outlet strips.
6. Provide quiet ventilation fan with non-disposable locally cleanable air filter.
7. Size each cabinet in order to contain and maintain internal mounted equipment items.
8. Provide OEM's fully assembled unit.
9. Provide OEM assembled side-by-side enclosures in a single unit, at locations requiring more than two enclosures.
10. Provide minimum one cabinet with blank rack space, for additional system expansion equipment.
11. Bond to communications circulating grounding system.
12. Technical Characteristics:
    a. External:
       1) Overall Height:
          a) Communications/Server: Maximum 2,184 mm (86 inches).
          b) Seismic: Maximum 1,905 mm (75 inches).
       2) Overall Depth:
          a) Communications/Server: Maximum 914 mm (36 inches).
          b) Seismic: Maximum 762 mm (30 inches).
       3) Overall Width - All: Maximum 864 mm (34 inches).
    b. Front Panel Openings:
       1) Width:
          a) Communications: 482.6 mm (19 inches), per EIA.
          b) Server: 483 mm (19 inches), per EIA/ECA 310.
             584 mm (23 inches), per EIA/ECA 310.
             Seismic: 483 mm (19 inches), per EIA/ECA 310.
       2) Height:
          a) Communications/Server: Maximum 2,000 mm (78-3/4 inches or 45 Rack Units, RU), per EIA/ECA 310.
          b) Seismic: Maximum 1,689 mm (66-1/2 inches or 38 RUs, per EIA/ECA 310).
    c. Heavy Duty Cycle: Maximum 544 kilograms (1,200 pounds) capacity.

d. Certification:
   1) NRTL (i.e. UL): For communications and server cabinets.
   2) Telcordia Technologies: #63-GR-CORE, (2012) for seismic cabinets.
   3) Seismic: Provide cabinet OEM constructed to seismic design category.

13. Cabinet Internal Components:
   a. AC Power:
      1) Standard “Quad AC Box”:
         a) Power capacity: 20 Ampere, single phase, 120 VAC continuous duty.
         b) Wire gauge: #12 AWG, solid copper, connected to room’s internal AC Power Panel, or as directed by COR.
         c) Number of AC power outlets: Minimum 4 receptacles.
         d) Enclosure: Fully self-contained, metal 102 mm (4 inch) x 102 mm (4 inches) x 64 mm (2-1/2 inches) with cover
         e) Connection: Minimum 25.4 mm (1 inch) conduit connected to room’s AC Power Panel, or as directed by COR
         f) Number of boxes: One.
         g) Compliance: NRTL (i.e. UL); NPFA - 70 (NEC).
   b. AC Outlet Strips:
      1) Power Capacity: 15 Ampere, single phase, 120 VAC continuous duty.
      2) Wire Gauge: Minimum #12 AWG, solid copper.
      3) Number of AC Power Outlets: Minimum 10 “U” grounded.
      4) Enclosure: Fully self-contained; typically metal.
      5) Connecting Wire: Minimum 2 m (6 feet) long, with three prong self-grounding AC plug connected to cabinet’s internal AC “Quad” box.
      6) Number of Strips: 2.
      7) Certification: NRTL (i.e. UL).
   c. AC Power Line Surge Protector and Filter Construction:
      1) Input Voltage Range: 120 VAC + 15 percent at 50/60 Hz, single phase.
      2) Power Service Capacity: 20 AMP, 120 VAC.
      3) Voltage Output Regulation: +5.0 percent, instantaneous of input.
      4) Circuit Breaker: 15 AMP; may be self-contained.
      5) AC Outlets: Minimum four duplex grounded NEMA 5-20R.
      6) Response Time: 5.0 nanosecond.
      7) Suppression: Isolate and filter any noise, surge spikes
         a) Surge: Minimum 20,000 AMP.
         b) Noise:
      8) Common: -40 dB.
      9) Differential: -45 dB.
      10) Clamping Voltage: Minimum 300 V.
      11) Enclosure: One; self-contained.
      12) Mounting: Internal to cabinet floor or on internal mounting rail shelf, allowing two plugs from two plug strips.
      13) AC Power Cord: Required; minimum 1,628 mm (6 feet), three wire (green ground); minimum #14 AWG stranded.
      14) Compliance: NRTL (i.e. UL60950-1).
   d. Uninterruptible Power Supply (UPS): Provide each cabinet with an internal UPS which may be combined with surge protector and filter if system’s 50 percent expansion requirement is met. Provide at least one hour continuous full load two hours if working with a emergency uninterruptible system primary AC Power, with a 50 percent 30 min respectively in the event of facility primary or emergency AC power failure.
      1) UPS to include:
         a) On-Off Switch: This function is required to be a part of system’s electronic supervision requirements.

b) First/Fast Charge Unit: Must provide clean predicable charge voltage/current. Function is required to be a part of system's electronic supervision requirements.
c) Over Voltage/Current Protect: Cannot short circuit AC power line at any time. This function is required to be a part of system's electronic supervision requirements.
d) Trickle Charge Unit: Must be capable of maintaining a suitable internal battery charge without damaging batteries.
e) Mounting: Provide per OEM's direction.
f) Proper Ventilation: Do not override cabinets' ventilation system.
g) Power Change from AC Input: Accomplish change without interruption to communications link or subsystem being protected. Generate visual and aural alarms in electrical supervision system, local and remote, to annunciating panels via direct connection for trouble indication.

2) Specific requirements for current and surge protection to include:
a) Voltage Protection: Threshold, line to neutral, starts at maximum 200 Volts peak. Transient voltage cannot exceed 330 Volts peak. Furnish documentation on peak clamping Voltage as a function of transient waveform.
b) Peak Power Dissipation: Minimum 35 Joules per phase, as measured for l.0 millisecond at sub branch panels, l00 Joules per phase at branch panels and 300 Joules per phase at service entrance panels. Typically, power dissipation is 12,000 Watts (W) for l.0 mS (or l2 Joules). Provide explanation of how ratings were measured or empirically derived.
c) Surge Protector (may be combined with On-Off switch of UPS): Must not short circuit AC power line at any time.

3) Components must be minimum silicon semi-conductors.
4) Secondary stages, if used, may include other types of rugged devices.
5) Indicators: Provide visual device indicating surge suppression component is functioning.
6) Electrical Supervision: Required; must be audile and visual, local and remote to annunciating panels via direct connection for trouble indication.
a) Provide current and surge protection on ancillary equipment.
b) Equip each cabinet with the following:

7) Equipment Mounting Rails (Front & Rear): Fully adjustable internal equipment mounting rails allowing front or rear equipment mounting with pre-drilled EIA/ECA 310-E Standard tapped holes. Support entire equipment by supplementary support in addition to face mounting screws on rails.
8) Cabinet Ground: Stainless steel adjustable, lug connected to cabinet's main structure providing an internal cabinet ground for all installed equipment properly bolted to rail and with ground wire connected.
9) Grounding Terminals: A separate mounting hole on equipment mounting rail, with stainless steel connecting bolt bonded by minimum #10 AWG copper wire to cabinet's internal grounding lug.

14. Ground Interconnection: Bond cabinet's common grounding lug to room's communications circulating ground busbar with a minimum #4 AWG stranded copper wire.
15. Blank Panels: Provide at every unused rack space.
a. Match cabinet color.
b. Provide panels of 3 mm (1/8 inch) thick aluminum with vertical dimensions in increments of one rack unit (RMU) or 45 mm (1-3/4 inch) with mounting holes spaced to correspond to EIA/ECA 310-E Standard 483 mm (19 inch) rack dimensions.

c. Fill large unused openings with single standard large panel instead of numerous types.
d. Leave one blank rack space (RMU), covered with a blank panel, between each item of equipment, for minimum internal air flow.
e. Leave 356 mm (14 inches)(8.0 RMU) open space, covered with blank cover panel, for additional expansion equipment.
f. Wire Management: System that connects each item of installed equipment to room wire management system.
g. Knock-out Holes: Provide for cable entrance/exits via conduits, cable duct/trays.

D. Environmental Cabinet:
1. Enclosure must fully contain installed equipment, including electronics, in same manner as standard cabinet. Provide climate control for installed equipment as if they were in a standalone air handling area, regardless of local area air handling capabilities.
2. Provide an OEM's fully assembled unit enclosure.
3. If more than two enclosures are required in any system location, provide OEM-assembled enclosures, in a single unit, side-by-side.
4. Technical Characteristics:
a. Environmental Control: Automatic, heating and cooling as required.
b. Temperature Conditions (rated at 1,300 W of install equipment heat generation):
1) Internal Range: Maintains 26.67 degree to 37.78 degree C (80 degree to 100 degree f) of internal heat conditions.
2) External Range: Maximum 37.78 degrees + -3.89 degrees C (100 degrees + 25 degrees F).
c. Forced Air Unit: Required with non-disposable air filter; unobstructed and uninterruptible.
d. Air Conditioning: As required; fully internal mounted.
e. Heater: As required; fully internal mounted.
f. UPS: Required; fully internal mounted.
g. Front Door: Full length, see through, EMI resistant and lockable, keyed alike with 7-pin tubular lock and Police Service SMS card access .
h. Rear door: Full length, see through, EMI resistant, and lockable keyed alike with 7-pin tubular lock and Police Service SMS card access .
i. Conduit Wiring Entrance: Top or bottom; fully sealed.
j. Input Power: Minimum 2 each; maximum 120 VAC at 20A, independent circuit, conduit for fixed or armored cable for moveable installations.
k. Dimensions:
1) Height: Maximum 1980 mm (78 inches).
2) Width: Maximum 635 mm (25 inches).
3) Depth: Maximum 965 mm (38 inches).
4) Front Panel Opening: 480 mm (19 inches), w/ EIA/ECA 310 mounting hole spacing.
l. Trouble Annunciator Panel: Refer to specific requirements in equipment cabinet.
m. Audio Monitor Panel: Refer to specific requirements in equipment cabinet.

E. Wall Mounted Distribution or System Interface Cabinet:
1. Construct of minimum 1.59 mm (16 gauge) cold rolled steel, with top, side and bottom panels.
2. Provide double-hinged front door and main cabinet body allowing access to all internal equipment and wiring; mount to solid walls or internal studs.
3. Provide baked-on iron phosphate primer and baked enamel paint finish in a color to be selected by the using FMS Chief or COR.
4. Provide integral and adjustable EIA/ECA 310 standard predrilled rack mounting rails to allow front panel equipment mounting and access.
5. After equipment, doors and panels are installed, snap-in-place chrome trim strip covers all front panel screw fasteners.

6. Provide full-length vertical piano hinge to allow entire front portion of cabinet to “swing out” from wall for access to installed equipment, wires and cable; maintain minimum OSHA Safety clearances and NFPA operational functions.
7. Provide an OEM’s fully assembled unit enclosure.
8. Equip these cabinets same as equipment cabinets, except mount UPS on floor below cabinet with AC power connection in conduit to AC service panel.
9. Technical Characteristics:
   a. Overall Height: Maximum 1,218 mm (48 inches).
   b. Overall Depth: Maximum 558 mm (22 inches).
   c. Overall Width: Maximum 610 mm (24 inches).
   d. Front Panel Horizontal: Maximum width 483 mm (19 inches).
   e. Capacity: Maximum 180 kilograms (400 pounds).
   f. Lockable:
      1) Tubular lock with 7-pin security.
      2) Key cabinets alike.
      3) Police SMS access card system.

F. Stand Alone Open Equipment Rack:
1. Construct of minimum 1.59 mm (16 gauge) cold rolled steel with manufacturer's standard paint finish, in a color to be selected by COR with concurrence from facility’s FMS Service Chief.
2. Floor-mount as directed by COR with concurrence from facility’s FMS Service Chief.
3. Equip rack same as equipment cabinet, except mount UPS with additional support for weight and AC power connection in conduit to AC service panel.
4. Provide an OEM fully assembled unit.
5. Technical Characteristics:
   a. Overall Height: Maximum 2,180 mm (85-7/8 inches).
   b. Overall Depth: Maximum 650 mm (25-1/2 inches).
   c. Overall Width: Maximum 535 mm (21-1/16 inches).
   d. Front Panel Opening: 483 mm (19 inches), EIA/ECA 310 horizontal width.
   e. Hole Spacing: Per EIA/ECA 310.
   f. Load Capacity: Maximum 680.4 kg (1,500 lbs).
   g. Certifications:
      1) EIA/ECA: 310-E.
      2) NRTL (i.e. UL): OEM specific.

G. Wire Management Equipment:
1. Provide an orderly horizontal and vertical interface between outside and inside wires and cables, distribution and interface wires and cables, interconnection wires and cables and associated equipment, jumper cables, and provide an uniform connection media for system fire-retardant wires and cables and other subsystems.
2. Interface to each cable tray, duct, wireway, or conduit used in the system.
3. Interconnection or distribution wires and cables must enter system at top (or from a wireway in the floor) via overhead protection system and be uniformly routed down either or both sides at same time, of the frames side protection system, then laterally for termination on rear of each respective terminating assembly.
4. Custom configure to meet 30 percent fill system design and user needs.

H. Vertical Cable Managers:
1. Use same make, style and size of vertical cable manager on rack/frame or in between racks/frames when more than one cable manager is used on a rack/frame or group of racks/frames.
2. Match color and cover style of racks/frames and cable managers.

I. Horizontal Cable Managers:
1. Use same make and style of cable manager on rack/frame or racks/frames, when more than one horizontal cable manager is used on a rack/frame or group of racks/frames.
2. Match color of racks/frames and cable managers.

J. Telecommunication Room (TR): In hostile TR locations identified on drawings, where it has been determined (by COR or Facility Chief Engineer) that proper TR climate or external signal radiation cannot be maintained or controlled, provide a minimum of two individual and properly sized self-contained climate controlled equipment cabinet enclosures; one designated for voice, and one designated for data, and one additional cabinet designated for analog RF service.

K. Provide installation hardware when enclosures or racks are attached to structural floor.

L. Provide noise filters and surge protectors for each equipment interface cabinet, switch equipment cabinet, control console, and local and remote active equipment locations to ensure protection from input primary AC power surges so as a consequence noise glitches are not induced into low voltage data circuits.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate cabinet installation such that doors fully close and lock, with active and passive equipment installed and connected.

B. Verify equipment dimensions and brackets allow mounting with cabinet doors closed. Front door or rear door of any cabinet that does not close and lock may result in immediate cancellation of inspections or tests.

3.2 INSTALLATION

A. Equipment Cabinets:
   1. Install cabinets in a manner that complies with OEM instructions, requirements of this specification, and in a manner which does not constitute a safety hazard.
   2. Provide weatherproof equipment installed outdoors or install in NEMA 3S rated enclosures with hinged doors and locks with two keys.
   3. Install equipment indoors in NEMA 4 rated metal cabinets with hinged doors and locks with two keys.

B. Grounding:
   1. Bond equipment, including identified Government furnished equipment, to ground so total ground resistance measures maximum 0.1 Ohm.
      a. Install lightning arrestors and grounding in accordance with NFPA.
      b. Install gas protection devices at nearest point of entrance in buildings where protection is required and on same circuits as MDF in telephone switch room.
      c. Do not use AC neutral, including in power panel or receptacle outlet, for system control, subcarrier or audio reference ground.
      d. Use of conduit, signal duct or cable trays as system or electrical ground is not permitted.
   2. Connect each equipment grounding terminal to a separate mounting hole on equipment mounting rail, to right as one looks at it from rear, with a minimum #12 AWG stranded copper wire with protective green jacket.
   3. Extend common ground bus of minimum #10 AWG solid copper wire throughout each equipment cabinet and bond to TGB. Provide a separate isolated ground connection from each equipment cabinet ground bus to system ground. Do not tie equipment ground buses together.
   4. Bond equipment to cabinet bus with copper braid equivalent to #12 AWG. Self-grounding equipment enclosures, racks or cabinets, that provide OEM certified functional ground connections through physical contact with installed equipment, are acceptable alternatives.
   5. Bond cable shields to cabinet ground bus with minimum #12 AWG stranded copper wire at only one end of cable run. Insulate cable shields from each other, faceplates, equipment racks, consoles, enclosures or cabinets, except at system common ground

point. Bond coaxial and audio cables only at source; in all cases, keep cable shield ground connections to a minimum.

C. Equipment Assembly:
1. Cabinets:
a. Install and adjust cabinet/frame accessories to position, including thermal management accessories, vertical cable managers, vertical power managers and equipment-mounting rails, using manufacturer's installation instructions prior to baying or placing cabinet for attachment to building and before installing any rack-mount equipment into cabinet. Shelves, horizontal cable managers and filler panels (rack-mount accessories), if used, may be installed after cabinet is placed.
b. When used in a multi-cabinet bay, attach cabinets side-by-side using baying kits according to manufacturer's instructions.
c. Attach overhead ladder rack or cable tray to ceiling or top of cabinet. Maintain minimum 75 mm (3 inches) clearance between top of cabinet and bottom of ladder rack/cable tray. Position ladder rack/cable tray so that it does not interfere with hot air exhaust through cabinet's top panel. Use radius drops where cable enters or exits ladder rack/cable tray.
d. Install ladder rack with side stringers facing rack or cabinet so that ladder forms an inverted U-shape and so that welds between stringers (sides) and cross members (middle) face away from cables.
e. Secure ladder rack to tops of equipment racks or cabinets using manufacturer's recommended supports and appropriate hardware.
f. Attach bonding conductor sized per TIA-607-B between telecommunications grounding busbar and cabinet. Attach bonding conductor to cabinet using a ground terminal block according to manufacturer's installation instructions.
g. Provide bonding conductor and other hardware required to make connections between cabinet and telecommunications grounding busbar.
h. Install rack mounted equipment normally requiring adjustment or observation so operational adjustments can be conveniently made.
i. Mount heavy equipment with rack slides or rails to allow servicing from front of enclosure. Provide support in addition to front panel mounting screws for heavy equipment.
j. Provide with cable slack to permit servicing by removal of installed equipment from front of enclosure.
k. Install color-matched blank panel spacer 44 mm (1.75 inches) high between each piece of active and passive equipment to ensure adequate air circulation for efficient equipment cooling and air ventilation.
l. Provide quiet fans and non-disposable air filters at each console or cabinet.
m. Install enclosures and racks plumb and square, permanently attached to building structure and held in place.
n. Provide 381 mm (15 inches) of front vertical space opening for additional equipment.
o. Install equipment located indoors in metal racks or enclosures with hinged doors to allow access for maintenance without causing interference to other nearby equipment.
p. Cables must enter equipment racks or enclosures in such a manner to allow doors or access panels to open and close without disturbing or damaging cables.
q. Mount distribution hardware in a manner that allows access to connections for testing and provides room for doors or access panels to open and close without disturbing the cables.
2. Racks:
a. Assemble racks according to manufacturer's instructions.
b. Verify that equipment mounting rails are sized properly for rack-mount equipment before attaching rack to floor.

c. Attach assembled racks to floor in four places using appropriate floor mounting anchors. When placed over a raised floor, threaded rods should pass through raised floor tile and be secured in structural floor below.
d. Bond racks to telecommunications grounding busbar using appropriate hardware provided by contractor.
e. Ladder rack may be attached to top of rack to deliver cables to rack. Do not drill rack to attach; use appropriate hardware from rack manufacturer.
f. Provide radius drops to guide cable where cable exits or enters side of overhead ladder rack to access a rack, frame, cabinet or wall-mounted rack, cabinet or termination field.
g. Evenly distribute equipment load on rack. Place large and heavy equipment towards bottom of rack. Secure equipment to rack with equipment mounting screws.

3. Vertical Cable Managers:
   a. Provide vertical managers so number of cables in each manager does not exceed OEM fill capacity.
   b. Attach vertical cable managers to side of rack/frame using manufacturer's installation instructions and hardware.
   c. Attach vertical cable manager to both racks/frames when a single vertical cable manager is used between two racks/frames.
   d. Dress cables through openings in between T-shaped guides on manager so that cables make gradual bends as they exit or enter cable manager into rack-mount space (RMU). Do not twist, coil or make sharp bends in cables.
   e. Attach doors to cable manager in closed position after cabling is complete.
4. Horizontal Cable Managers:
   a. Attach horizontal cable managers to rack/frame with minimum four screws according to manufacturer's installation instructions. Center each cable manager within allocated rack-mount space (RMU).
   b. Provide horizontal managers located so number of cables each manager supports is less than cable manager's cable fill capacity.
   c. Dress cables through openings in between T-shaped guides on cable manager so that cables make gradual bends as they exit or enter cable manager into rack-mount space (RMU). Do not twist, coil or make sharp bends in cables.
   d. Attach covers to cable manager in closed position after cabling is complete.

D. Labeling: Permanently label each enclosure in accordance with TIA-606-B using laser printers handwritten labels are not acceptable.
   1. Equipment: Label system equipment with contrasting plastic laminate or bakelite material on face of unit corresponding to its source.
   2. Conduit, Cable Duct, and/or Cable Tray: Label conduit, duct and tray, including utilized GFE, with permanent marking devices or spray painted stenciling a minimum of 3 m (10 feet), identifying system.

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SECTION 27 11 16
COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies Information Technology (IT) equipment enclosures for use in VA telecommunications spaces.

1.2 SUMMARY

A. Section includes:
1. Server Cabinets.
2. Network Channel Racks.
3. Network Cabinets.
4. Telecommunications Enclosures.
5. Pathway Racks.

1.3 REFERENCES

A. VA Infrastructure Standard for Telecommunications Spaces.

B. EDICT QA Job Aid: Rack Operations Preparation & Power Distribution Guidance.

1.4 RELATED WORK:

A. Cabling termination equipment, rack-mounted: Section 27 11 19, COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS.

B. Cable management equipment: Section 27 05 36, CABLE TRAYS FOR COMMUNICATIONS SYSTEMS.

C. Power distribution equipment: Section 27 11 26, COMMUNICATIONS RACK MOUNTED POWER PROTECTION AND POWER STRIPS.

D. Grounding and bonding equipment: Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.

E. Labeling and identification requirements: Section 27 05 53, IDENTIFICATION FOR COMMUNICATIONS SYSTEMS.

F. Seismic bracing: Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS (TELECOMMUNICATIONS).

1.5 SUBMITTALS:

A. Submit in accordance with Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS SYSTEMS.

PART 2 - PRODUCTS

2.1 SERVER CABINETS.

A. Height. Cabinets shall provide 45 standard rack units (RU) of space (45U) for mounting equipment.

B. Dimensions. Nominal dimensions for server cabinets are 84” (2134mm) tall, 23.6” (600mm) wide, and 48” (1220mm) deep, including side panels and doors. Minimum depth is 46” (1168mm). Maximum width is 30”.

C. Doors and Panels.

1. Front Door. Provide a single locking, latched, hinged metal front door for the server cabinet with minimum 75% open perforated design for airflow.
2. Rear Door. Provide a locking, latched, hinged metal rear door for the server cabinet.
   a. If a vertical exhaust duct (VED, “chimney”) is specified for the server cabinet, the rear door shall be solid.
   b. If no VED is specified, the rear door shall be perforated with a minimum of 75% open design for airflow.
3. Side Panels. Provide removable, locking solid metal side panels. Side panels shall have cable pass-through cut-outs protected with brushed grommets on each side, aligned on each side to allow Rack PDU cables to pass between enclosures to Zone PDUs.

D. Locks. All locks on a server cabinet shall be keyed the same. Provide two keys per cabinet.

E. Color. The cabinet and all components shall be white in color.

F. Equipment Mounting Rack. The cabinet shall provide an EIA-310-E compliant 19” racking system with front and rear rails using standard 3/8” x 3/8” square hole mounting.
   1. Rear Rails. Position rear rails with a minimum of 6” of clearance between the rails and the rear doors to accommodate rear-mounted angled patch panels and up to four (4) vertical rack PDUs.

G. Components. The cabinet shall be supplied with the following standard equipment:
   1. Air dams for left and right of the front rails.
   2. Finger cable managers.
   3. Bottom panel with brushed grommets.
   4. Top panel with brushed grommets.
   5. Toolless mounting brackets for vertical Rack PDUs.
   6. 45U of 1RU blanking panels.

H. Vertical Exhaust Duct. Provide a vertical exhaust duct (VED, or “chimney”) matched to the height of the cabinet and facility horizontal return duct.

2.2 NETWORK CHANNEL RACKS.

A. Height. Racks shall provide 45 standard rack units (RU) of space (45U) for mounting equipment.

B. Dimensions. Nominal dimensions for network racks are 86” (2184mm) tall, 24” (610mm) wide, and 40” (1220mm) deep (30”/762mm between front and rear mounting rails).

C. Side Panels. The rack shall have integral metal side panels (a “channel” rack) constructed with a cable management pattern of staggered shapes (circles, hexagons, etc.) to allow for connection points for cable management accessories.

D. Security Doors. Provide locking, latched, hinged metal doors and mounting hardware for the network rack. Doors shall be perforated with a minimum of 50% open design for airflow.
   1. Locks. All locks on a network rack shall be keyed the same. Provide two keys per cabinet.

E. Color. The rack and all components shall be white in color.

F. Equipment Mounting Rack. The rack shall provide an EIA-310-E compliant 19” racking system with front and rear rails using -tapped 10-32 holes.

G. Components. The rack shall be supplied with the following standard equipment:
   1. Toolless mounting brackets for vertical Rack PDUs.
   2. 30U of 1RU blanking panels.
   3. Vertical cable managers (VCM) with doors on both left and right of the rack, on the front and the rear (size commensurate with the requirement). VCM between network racks must be minimum 10” width to accommodate PDU brackets for Rack PDUs serving the adjacent racks.

4. Cable management accessories as necessary to maintain cable bend radii, uniformity, and neatness (e.g. d-rings, spools, bend radius limiters, finger cable managers, waterfalls, etc.).

2.3 NETWORK CABINETS.

A. Height. Cabinets shall provide 45 standard rack units (RU) of space (45U) for mounting equipment.

B. Dimensions. Nominal dimensions for server cabinets are 84” (2134mm) tall, 31.5” (800mm) or 40” (1016mm) wide, and 48” (1220mm) deep, including side panels and doors. Minimum depth is 46” (1168mm).

C. Doors and Panels.
1. Front Door. Provide a single locking, latched, hinged metal front door for the server cabinet with minimum 75% open perforated design for airflow.
2. Rear Door. Provide a locking, latched, hinged metal rear door for the server cabinet.
   a. If a vertical exhaust duct (VED, “chimney”) is specified for the server cabinet, the rear door shall be solid.
   b. If no VED is specified, the rear door shall be perforated with a minimum of 75% open design for airflow.
3. Side Panels. Provide removable, locking solid metal side panels. Side panels shall have cable pass-through cut-outs protected with brushed grommets on each side, aligned on each side to allow Rack PDU and communications cables to pass between enclosures to Zone PDUs.
   a. Cable management sidecars with front and rear doors may be used between network cabinets. If used, side panels between the cabinets are not necessary.
   b. Side panels are required on the exterior ends of strings of network cabinets.

D. Locks. All locks on a server cabinet shall be keyed the same. Provide two keys per cabinet.

E. Color. The cabinet and all components shall be white in color.

F. Equipment Mounting Rack. The cabinet shall provide an EIA-310-E compliant 19” racking system with front and rear rails using standard 3/8” x 3/8” square hole mounting.

G. Components. The cabinet shall be supplied with the following standard equipment:
1. Air dams for left and right of the front rails.
2. Bottom panel with brushed grommets.
3. Top panel with brushed grommets.
4. Toolless mounting brackets for vertical Rack PDUs.
5. 45U of 1RU blanking panels.
6. Cable management accessories as necessary to maintain cable bend radii, uniformity, and neatness (e.g. cable lashing managers, d-rings, spools, bend radius limiters, finger cable managers, waterfalls, etc.).

H. Vertical Exhaust Duct. Provide a vertical exhaust duct (VED, or “chimney”) matched to the height of the cabinet and facility horizontal return duct.

2.4 TELECOMMUNICATIONS ENCLOSURES (TE).

Telecommunications Enclosures (TEs) are swing-out wall-mounted enclosures.

A. Height. TEs shall provide 12 or 26 standard rack units (RU) of space for mounting equipment.

B. Dimensions. Nominal dimensions for server cabinets are 24” (610mm) or 48” (1220mm) tall, 24” (610mm) wide, and 30” (760mm) deep.

C. Doors and Panels.
1. Front Door. TEs shall have a single locking, latched, hinged metal front door with a tempered glass front.

2. Rear Panel. TEs shall have a latched, hinged metal rear door that mounts to the wall, allowing the body of the TE to be swung open for rear equipment access. If latched exterior to the body of the TE, the latch shall be locking.
   a. Cabling Cutouts. The top and bottom surfaces of the rear panel shall have cabling cutouts to accommodate telecommunications cabling entering the TE. Edge-protection grommets for the cabling cutouts shall be provided.
   b. Power Cutout. The rear panel shall have a cutout on the rear mounting surface allowing power to be installed internal to the TE.
3. Locks. All locks on a TE shall be keyed the same. Provide two keys per TE.

D. Load Rating. The TE shall support 300lb (136kg) of total weight.

E. Color. The cabinet and all components shall be white in color.

F. Equipment Mounting Rack. The cabinet shall provide an EIA-310-E compliant 19” racking system with front and rear rails using standard threaded #12-24 hole mounting.

G. Components. The cabinet shall be supplied with the following standard equipment:
1. 1U shelf (two per TE).
2. Vertical cable management kits (one per each full 12U of TE height).
3. Fan kit to evacuate heat generated by active equipment (two per TE).
4. Filter kit for fans (two per TE).

2.5 PATHWAY RACKS.

A. Height. Pathway racks shall provide a minimum of 5 standard rack units (RU) of space (5U) for mounting Equipment Distributor equipment.

B. Dimensions. Nominal dimensions for pathway racks are 12.6” tall, 23.6” wide, and 9” deep.

C. Mounting. Pathway racks shall mount to standard basket-style cable tray.

D. Color. Pathway racks shall be white in color.

E. Equipment Mounting Rack. The cabinet shall provide an EIA-310-E compliant 19” racking system with rails using EIA-tapped 10-32 holes.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Where to be installed in structures assigned to Seismic Design Category C, D, E, or F, seismic bracing equivalent to that for other storage racks per VA Master Specification 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS section 3.7 (“Install… to withstand earthquake forces and anchored to the floor or laterally braced from the top to the structural elements”) is required.

B. Casters on floor-mounted enclosures shall be retracted and the enclosures leveled and stabilized.

C. Floor-mounted enclosures shall be installed with their front edges aligned to present a clean and aesthetic appearance. Where a raised access floor system is present, the enclosures shall be aligned with the edges of the floor tiles.

D. Installations shall conform to the heat rejection methodology used in the telecommunications space. Where complete supply/return airstream separation is intended, the containment barrier between the supply and return sides of the enclosures shall be as airtight as reasonably possible.

3.2 OUTFITTING:

A. Patch panel and fiber distribution cabinet equipment is installed on the front side of Horizontal Distribution Area (HDA) and Main Distribution Area (MDA) enclosures in the data center

environment, and in racks in the distributed telecommunications space environments. Patch panel and fiber distribution equipment is installed on the rear side of server cabinets in the data center environment (the Equipment Distributors).

B. Relocate rack rails as necessary to provide clearance for (a) patch cord bend radii from angled patch panel equipment when enclosure doors are closed and (b) vertical Rack PDU mounting, where mounted interior to the enclosures.

C. Where a data center mechanical/heat rejection system uses vertical exhaust ducts to force return air upward into a return duct or plenum, (a) install Vertical Exhaust Duct (VED) equipment to mate to the return plenum system and (b) install solid rear doors on the enclosure.

D. Install 1RU blanking panels in every open RU on the front side of every cabinet in the data center environment.

E. Install 1RU of Horizontal Cable Management (HCM) sandwiching each network switch in the HDAs. The use of 2RU HCM between switches is acceptable.

F. Install front-side cable managers in front of core switches in the MDAs. Install rear-side cable managers behind IT equipment positions to manage power and patch cords.

G. Install lashing managers interior to cabinets in the data center environment to support distribution cabling.

H. Adjacent MDA cabinets require internal pathways to pass patch cabling between the cabinets, without exiting the enclosures. Install cabinet side panels with brushed grommet passages for this purpose. If solid side panels were provided, holes must be cut in these using a 4” knockout kit and brushed grommets installed through the sidewalls of both adjacent cabinets.

I. Install Rack PDU mounting brackets to allow Rack PDUs to be installed in a zero-U manner, not interfering with the use of rack rails to mount IT equipment. In the data center environment Rack PDU brackets may be installed in the rears of network enclosure sidecars. In the distributed telecommunications space environment Rack PDU brackets are to be installed in the rear Vertical Cable Managers of the racks.

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SECTION 27 11 19
COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies cable termination and management equipment to be mounted in information technology (IT) equipment cabinets and racks.

1.2 SUMMARY

A. Section includes:
1. Copper UTP Patch Panels.
2. Fiber Optic Distribution Cabinets.
3. Fiber Optic Distribution Cassettes.
4. Fiber Optic Splice Cassettes.
5. Horizontal Cable Managers.
6. Blanking Panels.

1.3 REFERENCES

A. VA Infrastructure Standard for Telecommunications Spaces.

1.4 RELATED WORK:

A. Server cabinets and network racks: Section 27 11 16, COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES.

B. Cable management equipment: Section 27 11 23, COMMUNICATIONS CABLE MANAGEMENT AND LADDER RACK.

C. Labeling and identification requirements: Section 27 05 53, IDENTIFICATION FOR COMMUNICATIONS SYSTEMS.

D. Copper UTP cabling: Section 27 13 13, COMMUNICATIONS COPPER BACKBONE CABLING.

E. Copper UTP cabling termination: Section 27 13 13.13, COMMUNICATIONS COPPER CABLE SPLICING AND TERMINATIONS.

F. Fiber optic cabling: Section 27 13 23, COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING.

G. Fiber optic cabling termination: Section 27 13 23.13, COMMUNICATIONS OPTICAL FIBER SPLICING AND TERMINATIONS.

1.5 SUBMITTALS:

A. Submit in accordance with Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS SYSTEMS.

PART 2 - PRODUCTS

2.1 COPPER (UTP) PATCH PANELS.

A. Form Factor. 1U, 19” rack-mountable. Default form factor for patch panels shall be angled to extend not less than 4” (104mm) forward from the mounting rail.

B. Capacity. 48 copper 8P8C ports in groupings of 6.

C. Interface. Copper (UTP) patch panels shall accept pre-terminated single 8P8C keystone jacks and 6-jack cassettes.

D. Accessories. Provide each patch panel installation with the following accessories.
   1. Angled panel cover. Specify angled panel covers at the top and bottom of each stack of angled patch panels. Covers shall mount to the same RU rail positions as the top and bottom patch panels.
   2. Rear cable manager tray. Specify one rear cable manager tray per patch panel. Trays shall mount to the same RU rail positions as the patch panel.

2.2 FIBER OPTIC DISTRIBUTION CABINETS.

A. Form Factor. 1U, 19” rack-mountable, angled to extend not less than 4” (104mm) forward from the mounting rail.

B. Capacity. 144 fibers in a variety of distribution and/or splice cassettes.

C. Door. Cabinets shall be supplied with a locking front cover.

D. Accessories. Provide each distribution cabinet with the following accessories.
   1. Rear cable manager. Specify one rear cable manager with fiber storage rings per distribution cabinet. Trays shall mount to the same RU rail positions as the distribution cabinet.
   2. 0RU patch cord managers. Specify one pair of patch cord managers per distribution cabinet. Managers shall mount to the same RU rail positions as the distribution cabinet and rear cable manager.

2.3 FIBER OPTIC DISTRIBUTION CASSETTES.

Fiber optic distribution cassettes are used in structured cabling in the computer room to connect Main Distribution Areas (MDAs), Horizontal Distribution Areas (HDAs), and Equipment Distributors (EDs) where pre-terminated cable is used.

A. Form Factor. Designed to install in rack-mounted fiber optic distribution cabinet.

B. Connections. The rear connection shall 24-strand multi-fiber push-on (MPO) connectors. Adapters on the front of the cassette shall accept 6 duplex Lucent connector (LC) fiber pairs or 3 sets of 8-strand multi-fiber push-on (MPO) connectors depending on the application per the ISTS.

C. Polarity. Provide type A polarity for pre-terminated MPO and type B universal polarity for LC cassettes.

2.4 FIBER OPTIC SPLICE CASSETTES.

Fiber optic splice cassettes are used in backbone structured cabling connecting the Entrance Rooms to the Main Distribution Areas (MDAs) in the computer room, and the MDAs to Telecommunications Rooms (TRs) where field-terminated (fusion spliced) cable is used.

A. Form Factor. Designed to install in rack-mounted fiber optic distribution cabinet.

B. Connections. Adapters on the front of the cassette shall accept 6 duplex Lucent connector (LC) fiber pairs or 3 sets of 8-strand multi-fiber push-on (MPO) depending on application per the ISTS.

C. Design. Splice cassette modules shall be self-contained to integrate fiber adapter bulkhead and splice holders. No additional splice trays shall be necessary. Each module shall provide 12 or 24 fiber splice connections.

D. Fiber Type. Provide multimode OM4 and single-mode OS2 splice cassettes as required by the quantity of each type of fiber installed.

2.5 HORIZONTAL CABLE MANAGERS.

A. Form Factor. 1U or 2U, 19” rack-mountable.

B. Door. Horizontal cable managers shall have a double-hinged front cover to protect installed cables.

C. Fingers. 6-port spacing (five fingers).

2.6 BLANKING PANELS.

A. Form Factor. 1U, 19” rack-mountable, flat or angled to extend 4” (104mm) forward from the mounting rail .

B. Transition. Blanking panel shall have a transition cover from angled front to flat front.

C. Quantity. Provide blanking panels to fill 75% of all RUs in all server cabinets and network cabinets.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Not used.

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SECTION 27 11 26

COMMUNICATIONS RACK MOUNTED POWER PROTECTION AND POWER STRIPS

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies power distribution equipment and interconnections supporting equipment deployed in telecommunications spaces (entrance rooms, computer rooms, and telecommunications rooms).

1.2 SUMMARY

A. Section includes:
1. Zone Power Distribution Units (zPDUs).
2. Rack-Mounted Uninterruptible Power Supply (UPS) Units.
3. Rack Power Distribution Units (rPDUs).
4. Equipment Power Cords.

1.3 REFERENCES

A. VA Infrastructure Standard for Telecommunications Spaces.

B. EDICT QA Job Aid: Rack Operations Preparation & Power Distribution Guidance.

1.4 RELATED WORK

A. General electrical requirements that are common to more than one section in Division 27: Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS.

B. IT equipment enclosures: Section 27 11 16, COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES.

1.5 SUBMITTALS

A. Submit in accordance with Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS.

B. For each type of product:
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for rack-mounted power protection and power strips.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

PART 2 - PRODUCTS

2.1 ZONE POWER DISTRIBUTION UNITS (ZONE PDU)

A. Provide components from a single manufacturer. eConnect intelligent PDUs combines remote rack-level (cabinet-level) power monitoring and control, environmental monitoring and access control via a single appliance, software and network Ethernet connection. eConnect Monitored PDU provides rack-level power monitoring. Monitored Pro PDU provides rack and device (outlet) level power monitoring. Switched provides rack level power monitoring and individual outlet control. Switched Pro provides rack level power monitoring, outlet level power monitoring and outlet level control.

B. 60 Amp Zone PDU:

1. Description: Zone PDU with A/B redundant 3-phase 60A input circuits and three (3) pairs of A/B redundant L21-20R outlets allowing each supported Standard Density (5kW) enclosure to operate at full density rating.
2. Input Connection: Dual 60A three-phase 208V hard-wired, with junction box and five-wire (L+L+L+N+G) DIN copper terminal blocks accommodating 4AWG conductors. Power cord 10' (3m) length.
3. Output Connection: Three (3) pairs of A/B (redundant) L21-20R outlets.
4. Power Capacity: 43.2kW (21.6kW redundant at full load); 5.7kW fully-rated at each L21-20R outlet.
5. Enclosure: Fully self-contained.
6. Mounting: 1" rack-mount.

C. 30 Amp Zone PDU:
1. Description: Zone PDU with A/B redundant 3-phase 30A input circuits and two (2) pairs of A/B redundant L21-20R outlets allowing each supported Standard Density (5kW) enclosure to operate at partial density rating.
2. Input Connection: Dual 30A three-phase 208V L21-30P. Power cord 10' (3m) length.
3. Output Connection: Two (2) pairs of A/B (redundant) L21-20P outlets.
4. Power Capacity: 21.6kW (10.8kW redundant at full load); combined 8.6kW rated output through each A/B pair of L21-20R outlets.
5. Enclosure: Fully self-contained.
6. Mounting: 1" rack-mount.

2.2 RACK-MOUNTED UNINTERRUPTIBLE POWER SUPPLY (UPS) UNITS

A. Provide components from a single manufacturer.

B. Description: 5kW three-phase 208V 20A rack-mounted UPS with L21-20 input and output connections.

C. Input Connection: Single input NEMA L21-20P plug (twistlock three-phase five wire L+L+L+N+G). Power cord minimum 3' (1m) length (twistlock three-phase five wire L+L+L+N+G). Power cord 10' (3m) length. (twistlock three-phase five wire L+L+L+N+G). Power cord 10' (3m) length. (twistlock three-phase five wire L+L+L+N+G). Power cord 10' (3m) length. (twistlock three-phase five wire L+L+L+N+G). Power cord 10' (3m) length (twistlock three-phase five wire L+L+L+N+G). Power cord 10' (3m) length.

D. Output Connection: Single output NEMA L21-20R receptacle.

E. Power Capacity: 5kW

F. Enclosure: Fully self-contained.

G. Mounting: 19" rack mount.

H. Battery Capacity: Ten minutes at 70% load (3.5kW).

I. Cooling: Fan-cooled, front air entry, rear exhaust.

J. Monitoring: RJ45 Ethernet port allows connection to an external monitoring system. Supports SNMP v3 with SSL Encryption.

2.3 RACK POWER DISTRIBUTION UNITS (RACK PDUS)

A. Provide components from a single manufacturer.

B. Description: Metered/monitored three-phase 208V 20A vertical Rack Power Distribution Unit (Rack PDU), 5.7kW, with IEC60320 outlets.

C. Input Connection: Single input NEMA L21-20P plug (twistlock three-phase five wire L+L+L+N+G). Power cord 10' (3m) length.

D. Output Connections.

1. For Computer Room applications: Minimum 30 each C13 and 6 each C19. Outlets grouped in phase-grouping banks (A-B, B-C, C-A) or alternating to assist with phase balancing. Outlets labelled with associated phase-grouping bank. Outlets lock to standard power cords and are capable of accepting Z-lock power cords.
2. For Telecommunications Room (TR) and entrance room applications: Minimum 30 each C13, 6 each C19, 2 each NEMA 5-15/20 or L5-20. Outlets grouped in phase-grouping banks (A-B, B-C, C-A) or alternating to assist with phase balancing. Outlets labelled with associated phase-grouping bank. Outlets are capable of accepting Z-lock power cords.

E. Power Capacity: 5.7kW rated.

F. Enclosure: Fully self-contained.

G. Mounting: Toolless mounting, orientation vertical at rear of enclosure, taking up zero RU spaces. Up to two Rack PDUs must be able to be installed on each side for High Density (10kW) enclosures.

H. Mounting Hardware: As required to connect to the specific enclosure make/model.

I. Number of RPDUs: 2 for Standard Density (up to 5kW) enclosures, 4 for High Density (10kW) enclosures.

J. Control Module: Field-replaceable, modular control module with metering and monitoring capabilities.
1. For Computer Room applications: A minimum of 12 control modules shall be able to be daisy-chained together to a single IP address output for network monitoring of all metered and monitored data.

K. Metering: Local display provides input line currents (Amperage). Additional metering items (voltage, power, energy, power factor) across the unit or at individual outlets, is acceptable.

L. Monitoring: RJ45 Ethernet port allows connection to an external monitoring system. Supports SNMP v3 with SSL Encryption.

2.4 EQUIPMENT POWER CORDS

A. Description: International Electrotechnical Commission (IEC) standard 60320 power cords that supply electrical power to IT equipment from Rack PDUs using standardized coupler and inlet connectors.

B. Voltage: UL-rated 208V (minimum).

C. Amperage: 10A (C13/C14 and C14/C15) and 15A or 16A (C19/C20).

D. Securement: Locking configuration to match Rack PDU. A-Lock may be used if Rack PDUs have integral locking. Z-lock required where Rack PDUs do not have integral locking.

E. Color: A-side power cord black. B-side power cord distinctly different color (white or gray preferred).

PART 3 - EXECUTION

3.1 INSTALLATION

A. DEFINITION: Sides (left/right) of the enclosure are as when viewed from the rear (hot aisle) of the enclosure for the purposes of this section.

B. Zone PDUs.
1. Install Zone PDUs only in enclosures that require them.
2. Zone PDUs shall not be installed in enclosures supported by busbar power distribution.

3. Install Zone PDUs beginning in RU position 1 or the first open RU position above any rack-mounted UPS unit, at the bottom of the 19” rack, on the rear rails of the enclosure.
4. Connect the Zone PDU power cords to the upstream branch circuit supporting the enclosures.

C. Rack-Mounted UPS Units.
1. Install rack-mounted UPS units only in enclosures that require them. Rack-mounted UPS units shall not be installed downstream of another UPS system (cascaded).
2. Where non-redundant UPS power is required to support the enclosure, install the rack-mounted UPS unit in the A side power distribution.
3. Install rack-mounted UPS units beginning in RU position 1, at the bottom of the 19” rack, with the exhaust ports facing the rear of the enclosure. No other equipment should be installed below the rack-mounted UPS units.
4. Connect the rack-mounted UPS unit power cord to the appropriate (A side) power receptacle on the upstream Zone PDU.

D. Rack PDUs.
1. Install Rack PDUs in matched A/B pairs only.
2. Install A side Rack PDUs on the left side of the enclosure and B side Rack PDUs on the right side of the enclosure, interior to the rear enclosure door.
3. Connect the Rack PDU power cord to the upstream rack-mounted UPS unit (where present) or the appropriate power receptacle on the upstream Zone PDU.

E. Equipment Power Cords.
1. Connect black power cord to A-side Rack PDU. Connect color-distinct power cord to B-side Rack PDU.
2. Connect both power cords to same power bank and outlet location on supporting Rack PDUs (mirrored).
3. Connect power cords to power banks to improve phase balancing on Rack PDUs.
4. Ensure power cords are securely locked into IT equipment inlets and Rack PDU receptacles.
5. Install power cords in a neat and organized manner. Lash power cords to horizontal and vertical cable management equipment with hook-and-loop connectors.

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SECTION 27 13 13
COMMUNICATIONS COPPER BACKBONE CABLING

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies requirements for telecommunications copper (UTP) backbone and horizontal cabling in structured cabling systems in computer rooms and on campuses.

1.2 SUMMARY

A. Section includes:
   1. Copper (Ethernet) Backbone Cables.
   2. Copper (Analog) Backbone Cables (Outside Plant).
   3. Copper (Analog) Backbone Cables (Inside Plant).

1.3 REFERENCES

A. VA Infrastructure Standard for Telecommunications Spaces.

1.4 RELATED WORK:

A. Computer room structured cabling: Section 27 10 00, STRUCTURED CABLING.

B. Termination equipment: Section 27 11 19, COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS.

C. Cable labeling requirements: Section 27 05 53, IDENTIFICATION FOR COMMUNICATIONS SYSTEMS.

1.5 SUBMITTALS:

A. Submit in accordance with Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS.

PART 2 - PRODUCTS

2.1 COPPER (ETHERNET) BACKBONE CABLES.

Copper (Ethernet) backbone and horizontal cables are used in computer room structured cabling to connect Main Distribution Areas (MDAs), Horizontal Distribution Areas (HDAs), and server cabinet Equipment Distributors (EDs).

A. Performance Category. Copper (Ethernet) backbone cables shall meet the Category 6A performance requirements. Category 6A connectors are required.

B. Performance Specifications. Meets or exceeds TIA-EIA-568-C.2-10 and TSB-155.

C. Limited Power (LP) Certification. UL Listed as x-LP (0.5A).

D. Termination. Factory pre-terminated TIA 568B.

E. Testing. Factory certified to meet performance category requirements per TIA 568-C.2.

F. Conductor Size. 22-24AWG, four pairs per cable.

G. Jacket Rating. Communications Multipurpose Cable, Plenum (CMP) shall be specified if any portion of the cable passes through an NEC-defined plenum. Communications Multipurpose Cable, Riser (CMR) shall be specified for all other applications. CMP may be used as a substitute for CMR.

H. Bundling and Construction. Copper (Ethernet) backbone cables shall be provided in 6-cable bundles with individual 8P8C media interface connectors (RJ-45 'jacks') or 6-jack cassettes designed to fit in copper (Ethernet) patch panels.

I. Color. A-side 8P8C media interface connectors (RJ-45) shall be blue. B-side 8P8C connectors shall be yellow.

J. Length. Backbone cabling used shall be procured to the specific length required by the design (horizontal and vertical paths) with no more than 2 feet of excess length.

2.2 COPPER (ANALOG) BACKBONE CABLES (OUTSIDE PLANT).

A. Copper (analog) backbone cables (outside plant) are used in campus structured cabling systems to connect Main Distribution Areas (MDAs) in the computer room to Telecommunications Rooms, Entrance Rooms, and Antenna Entrance Rooms.

B. Performance Category. Copper (analog) backbone cables shall meet the ANSI/TIA-568.2-D Category 5e performance requirements. Category 5e connectors are required. 1000BASE-T support required.

C. Performance Compliance. Compliant with UL, c(UL) Listed CM, NEC Article 800 (NFPA 70), UL® 444, ANSI-TIA-568.2-D, ANSI/ICEA S-90-661-2012, RoHS-compliant/RoHS 2-compliant.

D. Termination. Field terminated to rack-mounted 1RU 24-port flat patch panels on each end.

E. Testing. Not applicable.

F. Conductor Size. 21-24AWG solid annealed copper.

G. Jacket Rating. Indoor/outdoor-rated, non-halogen OSP grade jacket material. CM rated.

H. Bundling and Construction. 25 pairs of Unshielded Twisted Pair (UTP)

I. Color. Color-coded UTP pairs. 8P8C media interface connector (RJ-45) color not specified.

J. Length. Backbone cabling used shall be procured on continuous spools to the length required.

2.3 COPPER (ANALOG) BACKBONE CABLES (INSIDE PLANT).

A. Copper (analog) backbone cables (inside plant) are used in campus structured cabling systems to connect Main Distribution Areas (MDAs) in the computer room to Telecommunications Rooms, Entrance Rooms, and Antenna Entrance Rooms.

B. Performance Category. Copper (analog) backbone cables shall meet the ANSI/TIA-568.2-D Category 5e performance requirements. Category 5e connectors are required. 1000BASE-T support required. Supports Power over Ethernet (PoE) – IEEE 802.3bt Type 1 to 4.

C. Performance Compliance. Compliant with UL, c(UL) Listed CM, NEC Article 800 (NFPA 70), UL® 444, UL® 1666, NFPA 262, ANSI-TIA-568.2-D, ANSI/ICEA S-90-661-2012, RoHS-compliant/RoHS 2-compliant.

D. Termination. Field terminated to rack-mounted 1RU 24-port flat patch panels on each end.

E. Testing. Not applicable.

F. Conductor Size. 21-24AWG solid annealed copper.

G. Jacket Rating. Rated CMP.

H. Bundling and Construction. 25 pairs of Unshielded Twisted Pair (UTP)

I. Color. Color-coded UTP pairs. 8P8C media interface connector (RJ-45) color not specified.

PART 3 - EXECUTION

3.1 IMPLEMENTATION.

A. All cabling and equipment shall be labeled per the requirements of the VA Infrastructure Standard for Telecommunications Spaces.

B. Install first level backbone and horizontal structured cabling in the computer room in cable tray and fiber raceway systems following diverse path routing.

C. CM-rated cable used in vertical riser applications (floor to floor) must be installed in conduit with appropriate firestopping.

D. Cabling installed in or passing through a plenum space must be rated CMP, even if installed in conduit.

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SECTION 27 13 13.13
COMMUNICATIONS COPPER CABLE SPLICING AND TERMINATIONS

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies requirements for terminations of copper (UTP) cabling.

1.2 SUMMARY

A. Section includes:
   1. Termination Requirements.
   2. Splicing.

1.3 REFERENCES

A. VA Infrastructure Standard for Telecommunications Spaces.

1.4 RELATED WORK:

A. Termination equipment: Section 27 11 19, COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS.

B. Copper (UTP) cabling requirements: Section 27 13 13, COMMUNICATIONS COPPER BACKBONE CABLING.

C. Copper (UTP) cabling requirements: Section 27 15 13, COMMUNICATIONS COPPER HORIZONTAL CABLING.

1.5 SUBMITTALS:

A. Submit in accordance with Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS SYSTEMS.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 TERMINATION REQUIREMENTS.

A. Terminate copper (UTP) cabling used for data communications per TIA 568B.

B. Connections shall be made to equipment certified to performance category 6a.

C. Pre-terminated connections are preferred for computer room structured cabling applications. Field termination for non-computer room applications is acceptable.

3.2 SPLICING.

A. Splicing of copper (UTP) cabling is prohibited.

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SECTION 27 13 23
COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies requirements for telecommunications optical fiber backbone cabling.

1.2 SUMMARY

A. Section Includes:
   1. Multimode Optical Fiber Backbone Cables.
   2. Single Mode Optical Fiber Backbone Cables.
   3. Hybrid Optical Fiber Backbone Cables.
   4. Outside Plant (OSP) Fiber Backbone Cables.

This section does not cover air-blown fiber systems at the current time.

1.3 REFERENCES

A. VA Infrastructure Standard for Telecommunications Spaces.

1.4 RELATED WORK:

A. Computer room structured cabling: Section 27 10 00, STRUCTURED CABLING.

B. Termination equipment: Section 27 11 19, COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS.

C. Cable labeling requirements: Section 27 05 53, IDENTIFICATION FOR COMMUNICATIONS SYSTEMS.

1.5 SUBMITTALS:

A. Submit in accordance with Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS.

PART 2 - PRODUCTS

2.1 MULTIMODE OPTICAL FIBER BACKBONE CABLES.

Multimode fiber optic backbone cables are specified for inside plant use, for data center backbone use as well as for intrabuilding campus backbone.

A. Performance Category. Laser-optimized OM4 or OM5 cables are specified.

B. Testing. All fiber optic backbone media shall pass all Tier 1 requirements (attenuation with an Optical Loss Test Set or OLTS, verification of cable length and polarity) and all Tier 2 requirements (characterization by an Optical Time Domain Reflectometer or OTDR resulting in indication of the uniformity of cable attenuation and connector insertion loss).

C. Termination. For computer room first level backbone usage, factory pre-terminated cables with MPO connectors are required. Fiber will be field terminated (fusion spliced) when used to connect the computer room to Telecommunications Rooms (TRs) and other telecommunications spaces.
   1. Polarity. For pre-terminated MPO-MPO cables, the polarity of the cables shall be matched to the type of fiber optic distribution cassettes specified.

D. Jacket Color.
   1. OM4. Aqua.

2. OM5. Lime.

E. Jacket Rating. Communications Multipurpose Cable, Plenum (CMP) shall be specified if any portion of the cable passes through an NEC-defined plenum. Communications Multipurpose Cable, Riser (CMR) shall be specified for all other applications. CMP may be used as a substitute for CMR.

F. Bundling and Construction. Bundles consisting of multiples of sub-bundles (subunits) of 12 or 24 strands of fiber are specified. Cables shall be dielectric and tight-buffered. Construction shall match the rear entry requirements of the fiber optic distribution or splice cassette such that the sub-bundle (subunit) remains jacketed into the cassette.

G. Length. Backbone cabling for computer room first level backbone use (pre-terminated) shall be procured to the specific length required by the design (horizontal and vertical paths) with no more than 1 meter of excess length on each end.

2.2 SINGLE MODE OPTICAL FIBER BACKBONE CABLES.

Single mode fiber optic backbone cables are specified for inside plant (ISP) use as campus backbone.

A. Performance Category. OS1 and OS2 are specified for inside plant applications.

B. Testing. All fiber optic backbone media shall pass all Tier 1 requirements (attenuation with an Optical Loss Test Set or OLTS, verification of cable length and polarity) and all Tier 2 requirements (characterization by an Optical Time Domain Reflectometer or OTDR resulting in indication of the uniformity of cable attenuation and connector insertion loss).

C. Termination. Fiber will be field terminated (fusion spliced) when used to connect the computer room to Telecommunications Rooms (TRs) and other telecommunications spaces.

D. Jacket Color. Yellow.

E. Jacket Rating. Communications Multipurpose Cable, Plenum (CMP) shall be specified if any portion of the cable passes through an NEC-defined plenum. Communications Multipurpose Cable, Riser (CMR) shall be specified for all other applications. CMP may be used as a substitute for CMR.

F. Bundling and Construction. Bundles consisting of multiples of sub-bundles (subunits) of 12 or 24 strands of fiber are specified. Cables shall be dielectric and tight-buffered for OS1, and loose-tube for OS2.

2.3 HYBRID OPTICAL FIBER BACKBONE CABLES.

A. Hybrid cables containing multiple 12 or 24-strand bundles (subunits) of multimode and/or single mode fiber are acceptable.

2.4 OUTSIDE PLANT (OSP) FIBER BACKBONE CABLES.

Single mode fiber optic backbone cables are specified for outside plant (OSP) use as campus backbone.

A. Performance Category. Inside/outside rated OS2 is specified for applications where the pathway transits an outside plant path.

B. Performance Compliance. Compliant with UL-1666, NEC OFNR-LS or -LSZH, Telcordia GR-20, TIA-598, RoHS-compliant/RoHS 2-compliant.

C. Testing. All fiber optic backbone media shall pass all Tier 1 requirements (attenuation with an Optical Loss Test Set or OLTS, verification of cable length and polarity) and all Tier 2 requirements (characterization by an Optical Time Domain Reflectometer or OTDR resulting in indication of the uniformity of cable attenuation and connector insertion loss).

D. Termination. Fiber will be field terminated (fusion spliced) when used to connect the computer room to Telecommunications Rooms (TRs) and other telecommunications spaces.

E. Jacket Color. Not specified. Individual fibers colored in accordance with TIA-598.

F. Jacket Rating. Fiber backbone for OSP use shall be armored, rodent-resistant, and riser rated.

G. Construction. Bundles consisting of 12 or 24 strands of fiber are specified. Cables shall be dielectric and loose-tube (gel-free). Specific construction element materials are not specified.

H. Length. Backbone cabling used shall be procured on continuous spools to the length required. Fusion splicing in maintenance holes is acceptable.

PART 3 - EXECUTION

3.1 IMPLEMENTATION.

A. All cabling and equipment shall be labeled per the requirements of the VA Infrastructure Standard for Telecommunications Spaces.

B. Interior to telecommunications spaces, install fiber optic backbone cabling in overhead cable tray and fiber raceway systems.

C. Cable used in vertical riser applications (floor to floor) must be installed in conduit with appropriate firestopping.

D. Cabling installed in or passing through a plenum space must be rated CMP, even if installed in conduit.

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SECTION 27 15 00

COMMUNICATIONS STRUCTURED CABLING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies a complete and operating voice and digital structured cabling distribution system and associated equipment and hardware to be installed in VA here-in-after referred to as the “facility”.

1.2 RELATED WORK

A. Wiring devices: Section 26 27 26, WIRING DEVICES.

B. General electrical requirements that are common to more than one section in Division 27: Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

C. Requirements for personnel safety and to provide a low impedance path for possible ground fault currents: Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.

D. Conduits for cables and wiring: Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS.

E. Low voltage cabling system infrastructure: Section 27 10 00, CONTROL, COMMUNICATION AND SIGNAL WIRING.

1.3 SUBMITTALS

A. In addition to requirements of Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS provide:
   1. Pictorial layout drawing of each main computer room showing termination cabinets, each distribution cabinet and rack, as each is expected to be installed and configured.
   2. List of test equipment as per 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

B. Certifications:
   1. Submit written certification from OEM indicating that proposed supervisor of installation and proposed provider of contract maintenance are authorized representatives of OEM. Include individual's legal name and address and OEM warranty credentials in the certification.
   2. Pre-acceptance Certification: Submit in accordance with test procedures.
   3. Test system cables and certify to COR before proof of performance testing can be conducted. Identify each cable as labeled on as-installed drawings.
   4. Provide current and qualified test equipment OEM training certificates and product OEM installation certification for contractor installation, maintenance, and supervisory personnel.

C. Closeout Submittal: Provide document from OEM certifying that each item of equipment installed conforms to OEM published specifications.

1.4 WARRANTY

A. Work subject to terms of Article "Warranty of Construction," FAR clause 52.246-21.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

A. Provide complete system including “punch down” and cross-connector blocks voice and data distribution sub-systems, and associated hardware including telecommunications outlets (TCO); copper and fiber optic distribution cables, connectors, “patch” cables, “break out” devices and equipment cabinets, interface cabinets, and radio relay equipment rack.

B. Industry Standards:
   1. Cable distribution systems provided under this section are connected to systems identified as critical care performing life support functions.
   2. Conform to National and Local Life Safety Codes (whichever are more stringent), NFPA, NEC, this section, Joint Commission Life Safety Accreditation requirements, and OEM recommendations, instructions, and guidelines.
   3. Provide supplies and materials listed by a nationally recognized testing laboratory where such standards are established for supplies, materials or equipment.
   4. Refer to industry standards and minimum requirements of Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS and guidelines listed.
   5. Active and passive equipment required by system design and approved technical submittal; must conform to each UL standard in effect for equipment, when technical submittal was reviewed and approved by Government or date when COR accepted system equipment to be replaced. Where a UL standard is in existence for equipment to be used in completion of this contract, equipment must bear approved NRTL label.

C. System Performance: Provide complete system to meet or exceed TIA Category 6a or on a case by case basis Category 6A for specialized powered systems’ requirements.

D. Provide continuous inter- and/or intra-facility voice, data, and analog service.
   1. Provide voice and data cable distribution system based on a physical “Star" topology.
   2. Provide separate cable distribution system for emergency, safety and protection systems (i.e. emergency bypass phones; police emergency voice communications from parking lots and stairwells personal protection, duress alarms and annunciation systems; etc.)
   3. Contact SMCS 005OP2H3 (202-462-5310) for specific technical assistance and approvals.

E. Specific Subsystem Requirements: Provide products necessary for a complete and functional voice, data, analog and videotele communications cabling system, including backbone cabling system, patch panels and cross-connections, horizontal cabling systems, jacks, faceplates, and patch cords.

F. Coordinate size and type of conduit, pathways and firestopping for maximum 40 percent cable fill with subcontractors.

G. Terminate all interconnecting twisted pair, fiber-optic or coaxial cables on patch panels or punch blocks. Terminate unused or spare conductors and fiber strands. Do not leave unused or spare twisted pair wire, fiber-optic or coaxial cable unterminated, unconnected, loose or unsecured.

H. Color code distribution wiring to conform to ANSI/TIA 606-B and construction documents, whichever is more stringent. Label all equipment, conduit, enclosures, jacks, and cables on record drawings, to facilitate installation and maintenance.

I. In addition to requirements in Section 27 05 11, REQUIREMENTS FOR COMMUNICATION INSTALLATIONS, provide stainless steel faceplates with plastic covers over labels.

2.2 EQUIPMENT AND MATERIALS

A. Cable Systems - Twisted Pair, Fiber optic, Coaxial and Analog:
   1. General:

a. Provide cable (i.e. backbone, outside plant, and horizontal cabling) conforming to accepted industry standards with regards to size, color code, and insulation.
b. Some areas can be considered “plenum”. Comply with all codes pertaining to plenum environments. It is contractor’s responsibility to review the VA’s cable requirements with COR and OI&T Service prior to installation to confirm type of environment present at each location.
c. Provide proper test equipment to confirm that cable pairs meet each OEM’s standard transmission requirements, and ensure cable carries data transmissions at required speeds, frequencies, and fully loaded bandwidth.

2. Telecommunications Rooms (TR):
   a. In TR’s served with UTP and STP fiber optic, coaxial and analog backbone cables, terminate UTP and STP cable on RJ-45, 8-pin connectors of separate 48-port modular patch panels, 110A or equivalent type punch down blocks that are dedicated to voice and data applications.
   b. Provide 24 port fiber optic modular patch panels with “LC” or OEM specified couplers dedicated for voice, data and FMS applications.
   c. Provide connecting cables required to extend backbone cables (i.e. patch cords, twenty-five pair, etc.), to ensure complete and operational distribution systems.
   d. In TR’s, which are only served by a UTP and STP backbone cable, terminate cable on separate modular connecting devices, Type 110A punch down blocks (or equivalent), dedicated to data applications.
3. Backbone Copper Cables:
   a. Riser Cable:
      1) Provide communication riser cables listed in NEC Table 800, 154(a) for the purpose and suited for electrical connection to a communication network.
      2) Provide STP or Unshielded Twisted Pair (UTP), minimum 24 American Wire Gauge (AWG) solid, thermoplastic insulated conductors for communication (analog RF coaxial cable is not to be provided in riser systems) riser cables with a thermoplastic outer jacket.
      3) Label and test complete riser cabling system.
4. Horizontal Cable: Installed from TCO jack to the TR patch panel.
   a. Tested to ANSI/TIA-568-C.2 Category 6a requirements including NEXT, ELFEXT (Pair-to-Pair and Power Sum), Insertion Loss (attenuation), Return Loss, and Delay Skew.
   b. Minimum Transmission Parameters: 500 MHz.
   c. Provide four pair 0.205 mm2 (24 AWG) cable
   d. Terminate all four pairs on same port at patch panel in TR.
   e. Terminate all four pairs on same jack, at work area Telecommunication Outlets (TCO):
      1) Jacks: Minimum three eight-pin RJ-45 ANSI/TIA-568-C.2 Category 6 Type jacks at TCO.
         a) Top Port: RJ-45 jack compatible with RJ-11 plug for voice.
         b) Bottom Two Ports: Unkeyed RJ-45 jacks for data.
5. Patient Bedside Prefabricated Units (PBPU):
   a. Provide stainless steel face plate approved for use by PBPU OEM and COR.
6. Fiber Optics Backbone Cable:
   a. Provide 50/125 micron OM4 multi-mode cable, containing at minimum 18 strands of fiber, unless otherwise specified.
   b. Provide loose tube cable, which separates individual fibers from the environment, or indoor/outdoor cables, for outdoor runs or any area that includes an outdoor run.
   c. Provide tight buffered fiber cable or indoor/outdoor cables for indoor runs.
   d. Terminate multimode fibers at both ends with LC type female connectors installed in an appropriate patch or breakout panel and secured with a cable management system. Provide minimum 610 mm (2 ft.) cable loop at each end.
   e. Provide single mode fiber optic cable 8.3 mm containing at minimum 12 strands of fiber, unless otherwise specified. Terminate single mode fibers at both ends with

LC type female connectors installed in an appropriate patch or breakout panel and secured with a cable management system. Provide minimum 610 mm (2 feet) cable loop at each end to allow for future movement.

f. Install fiber optic cables in TR's, Voice (Telephone) Switch Room, and Main Computer Room, in rack mounted fiber optic patch panels. Provide female LC couplers in appropriate panel for termination of each strand.

g. Test all fiber optic strands' cable transmission performance in accordance with TIA standards. Measure attenuation in accordance with fiber optic test procedures TIA-455-C ('-61', or -53). Provide written results to COR for review and approval.

B. Cross-Connect Systems (CCS):
1. Copper Cables: Provide copper CCS sized to connect cables at TR and allow for a minimum of 50 percent anticipated growth.
2. Maximum DC Resistance per Cable Pair: 28.6 Ohms per 305 m (1,000 feet).
3. Fiber Optic Cables:
   a. Provide fiber CCS sized to connect cables at TR and allow for a minimum of 50 percent anticipated growth.
   b. Install fiber optic cable slack in protective enclosures.

C. Telecommunication Room (TR):
1. Terminate backbone and horizontal, copper, fiber optic, coaxial and analog cables on appropriate cross-connection systems (CCS) containing patch panels, punch blocks, and breakout devices provided in enclosures and tested, regardless of installation method, mounting, termination, or cross-connecting used. Provide cable management system as a part of each CCS.
2. Coordinate location in TR with FMS equipment (i.e. fire alarm, nurse call, code blue, video, public address, radio entertainment, intercom, and radio paging equipment).

D. Coaxial and Analog Cables: Bond equipment to ground per TIA standards, such that all grounding systems comply with all applicable National, Regional, and Local Building and Electrical codes.
1. Provide current arrester for each copper or coaxial cable that enters from outside of a building regardless if cable is installed underground or aerial.
2. Provide a gas surge protector/module and bond to earth ground.

E. Main Cross-connection Subsystem (MCCS): MCCS is common point of distribution for inter- and intra-building copper and fiber optic backbone system cables, and connections to the voice (telephone) and data cable systems.

F. Voice (or Telephone) Cable Cross-Connection Subsystem:
1. Provide Insulation Displacement Connection (IDC) hardware.
2. Provide the following for each Category 6a (or on a case by case basis Category 6 for specialized powered systems technically accepted by SMCS 005OP2H3, (202) 461-5310, OI&T and FMS Services and COR) Cabling System termination; cross-connection wires, RJ-45 patch cord connector to RJ-45 patch cord connector , hybrid modular cord to IDC patch cord connector.
   a. Provide terminations to be accessible without need for disassembly of IDC wafer. Provide IDC wafers removable from their mounts to facilitate testing on either side of connector.
   b. Provide removable designation strips or labels to allow for inspection of terminations.
   c. Provide cable management system as a part of IDC.
3. Provide IDC connectors capable of re-terminations, without damage, a minimum of 200 IDC insertions or withdrawals on either side of connector panel.
4. Install using only non-impact terminating tool having both a tactile and an audible feedback to indicate proper termination.

5. Provide inputs from PBX, FTS, Local Voice (Telephone) System, or diverse routed voice distribution systems on left side of IDC (110A blocks with RJ45 connections are acceptable alternates to IDC) of MCCS.
6. Provide system outputs from MCCS to voice backbone cable distribution system on the right side of same IDC (or 110A blocks) of MCCS.
7. Do not split pairs within cables between different jacks or connections.
8. Provide UTP cross connect wire to connect each pair of terminals plus an additional 50 percent spare.

G. Data Cross-Connection Subsystems:
1. Provide patch panels with modular RJ45 female to 110 connectors for cross-connection of copper data cable terminations and system ground with cable management system.
2. Provide patch panels conforming to EIA/ECA 310-E dimensions and suitable for mounting in standard equipment racks, with 48 RJ45 jacks aligned in two horizontal rows per panel. Provide RJ45 jacks of modular design and capable of accepting and functioning with other modular (i.e. RJ11) plugs without damaging jack.
   a. Provide system inputs from servers, data LAN, bridge, or interface distribution systems on top row of jacks of appropriate patch panel.
   b. Provide backbone cable connections on bottom row of jacks of same patch panel.
   c. Provide patch cords for each system pair of connection jacks with modular RJ45 connectors provided on each end to match panel's modular RJ45 female jack's being provided.

H. Fiber-Optic Cross-Connection Subsystems: Provide rack mounted patch or distribution panels installed inside a lockable cabinet or "breakout enclosure" that accommodate minimum 12 strands multimode fiber and 12 strand single mode fiber - these counts do not include 50 percent spare requirement. Provide cable management system for each panel.
1. Provide panels for minimum 24 female LC connectors, able to accommodate splices and field mountable connectors and have capacity for additional connectors to be added up to OEM's maximum standard panel size for this type of use. Protect patch panel sides, including front and back, by a cabinet or enclosure.
2. Provide panels that conform to EIA/ECA 310-E dimensions suitable for installation in standard racks, cabinets, and enclosures. Provide panels for system grounding where armored cables are installed.
3. Provide patch panels with highest OEM approved density of fiber LC termination's (maximum of 72 each), while maintaining a high level of manageability. Provide proper LC couplers installed for each pair of fiber optic cable LC connectors.
   a. Provide system inputs from interface equipment or distribution systems on top row of connectors of appropriate patch panel.
   b. Provide backbone cable connections on bottom row of connectors of same patch panel.
   c. Provide patch cords for each pair of fiber optic strands with connector to match couplers.
4. Provide field installable connectors that are pre-polished.
   a. Terminate every fiber cable with appropriate connector, and test to ensure compliance to specifications and industry standards for fiber optic LC female connector terminated with a fiber optic cable.
   b. Install a terminating cap for each unused LC connector.

I. Copper Outside Plant Cable: Minimum of STP or UTP, 22 AWG solid conductors, solid PVC insulation, and filled core (flex gel - waterproof Rural Electric Association (REA) listed PE 39 code) between outer armor or jacket and inner conductors protective lining.
1. Provide copper cable system as a Star Topology.

J. Horizontal Cabling (HC):
1. Horizontal cable length to farthest system outlet to be maximum of 90 m (295 ft).
2. Splitting of pairs within a cable between different jacks is not permitted.

K. Air Blown Fiber: Alternative fiber optic cable installation method.
1. Air blown fiber installation process (also referred to as air blown cable, air assisted cable, high pressure air blowing, cable jetting, and referred to as air blown fiber herein) typically uses separate optical fiber cables along with separate flexible protective microducts installed where optical fiber cables can be blown in using specific equipment, trained installation personnel and practices.
2. Indoor Microducts:
   a. Provide empty bundled microducts comprising an inner layer of microducts optimized for air blown fiber system and an outer jacket layer of plenum riser rated material with product identification and sequential length marking on outer layer at minimum one-meter (three feet) intervals.
   b. Provide microduct allowing multiple fibers to be installed simultaneously into each microduct using air blown fiber installation technique and fibers to also be removed from microduct using same technique.
   c. Size each microduct for 50 percent unoccupied microducts after initial fiber bundle installation.
   d. Furnish microducts that maintain minimum bend radius of 20 times cable diameter.
   e. Provide quantity of plugs or end-caps so all unoccupied microducts are plugged on both ends per manufacturer's specifications. Provide plugs or end-caps that can be easily installed or removed from duct connectors as needed over the lifetime of the installation.
3. Outside Microducts:
   a. Provide outdoor-rated bundled microducts consisting of a number of empty microducts comprising an inner layer of microducts optimized for air blown fiber system and covered by a rated jacketing material with product identification and sequential length marking on outer layer at one-meter (three feet) minimum intervals.
   b. Provide microducts with rodent protection at direct buried applications.
   c. Protect outdoor-rated bundled microducts either by utilizing a moisture barrier and an outer jacket outerlayer of jacketed, galvanized steel armored (underground), direct buried, or outdoor tray or rack locations UV resistant for aerial, outdoor rack or tray applications jacketed, galvanized steel armored for aerial, outdoor rack or tray locations or by utilizing an HDPE jacket (with optional steel-tape wrapped between outer jacket and inner microducts) that has been treated with rodent deterent.
   d. Water-blocking must be accomplished by utilizing a moisture barrier within the bundled microduct assembly or by utilizing water-blocked fiber cable.
   e. Provide microduct allowing multiple fibers to be installed simultaneously into each microduct using air blown fiber installation technique and fibers to also be removed from microduct using same technique.
   f. For future capacity, size each microduct provided for 50 percent unoccupied microducts after initial fiber bundle installation.
   g. Furnish microducts to maintain minimum bend radius twenty times cable diameter.
   h. Provide quantity of plugs or end-caps so unoccupied microducts are plugged on both ends per manufacturer's specifications, to prevent ingress of contaminants including water.
4. Microduct Couplers: Provide plastic-bodied pneumatic connector to join microducts of same size.
   a. Provide straight connectors constructed of a transparent plastic material permitting a visual verification of fiber population.
   b. Provide tee connectors with additional port allowing for gas-blocking in internal/external situations, or provide gas-blocking couplers as needed to protect and isolate classified areas from non-classified areas or provide close-down connectors if needed for midspan assisted blows in long runs
5. Microduct Distribution Units: Provide NEMA-rated enclosure, suited for site environmental conditions provided for microduct distribution, routing, and termination.

a. Provide unit capable of wall mounting to provide proper geometry for distribution wherever several microducts enter same location or where microduct type transitions take place.
b. Size based on number of microducts to enter unit.

6. Outdoor Enclosure/Splice Case: Provide outdoor NEMA-rated enclosure, or splice case suitable for site environmental conditions of outside plant microduct distribution and routing.
   a. Splice Cases: Water-tight, and air-tight re-enterable splice cases that do not require re-entry kits.
   b. Material: Stainless steel.
   c. Select enclosure/splice case hardware to meet site conditions.
      1) Provide NEMA-4 and 4X enclosures or splice cases in areas where hosing and splashing environmental conditions exist.
      2) Provide NEMA-6 and 6P enclosures splice cases in areas where temporary or long term flooded environmental conditions exist.
7. Fiber Termination Units: Provide at locations where fiber is to be terminated.
   a. Provide for strain relief of incoming microducts.
   b. Provide connector panels and connector couplings adequate to accommodate the number of fibers to be terminated.
   c. Incorporate radius control mechanisms to limit bending of fibers to manufacturer's recommended minimum or 76 mm (3 inches), whichever is larger.
   d. Where rack-mount fiber termination hardware is required, provide wall-mount microduct distribution unit near rack and provide individual microducts to route and connect fiber bundle passing through microduct distribution units to fiber termination hardware.
   e. Provide LC connectors mounted on a coupler panel that snaps into patch panel housing assembly.
8. Fiber Bundles or Cables:
   a. Provide fiber bundles or cables designed and manufactured to facilitate:
      1) Rapid installation of fiber using air blown fiber installation process without risk or damage to fibers.
      2) Re-installation without degradation of the optical specifications and performance of fiber.
      3) Transition points from indoor to outdoor environments without splices.
   b. Provide jacketed optical fibers manufactured so that the jacketed fiber strands meet GR409 and meet either UL 1666 for riser rated cables or UL 910 for plenum rated cables and are specific to the purpose of being blown throughout the bundled microduct system.
   c. Provide fiber designed to be stripped and terminated with standard tools.
   d. Provide fiber designed to be terminated with standard fiber optic connectors.
   e. Provide maximum 72 strands of fiber to be blown within each microduct; if fiber counts higher than 72 strands are required, provide microcore fiber with counts to 432 strands in larger size microducts.

2.3 DISTRIBUTION EQUIPMENT AND SYSTEMS

A. Telecommunication Outlet:
   1. TCO consists of minimum one voice (telephone) RJ45 jack and two data RJ45 jacks, and one single mode fiber optic, and one multimode fiber optic jacks mounted in a separate steel outlet box 100 mm (4 inches) x 100 mm (4 inches) x 63 mm (2-1/2 inches) minimum with a labeled stainless steel faceplate. Where shown on drawings, provide a second steel outlet box minimum 100 mm (4 inches) x 100 mm (4 inches) x 63 mm (2-1/2 inches), with a labeled faceplate, adjacent to first box to ensure system connections and expandability requirements are met.
   2. Provide RJ-45/11 compatible female type voice (telephone) multi-pin connections. Provide RJ-45 female type data multi-pin connections. Provide LC stainless steel ferrule female type fiber optic connectors.

3. Provide wall outlet with a stainless steel face plate and sufficient ports to fit voice (telephone) multi-pin jack, data multi- pin jacks, fiber optic jacks, analog jacks and plastic covers for labels when mounted on outlet box provided (minimum 100mm (4 inches) x 100mm (4 inches) for single and 100mm (4 inches) x 200mm (8 inches) for dual outlet box applications. Install stainless steel face plate, for prefabricated bedside patient unit installations.

B. Backbone Distribution Cables:
1. Meet TIA transmission performance requirements of Voice Grade Category 6.
2. Provide cable listed for environments where it is installed.
3. Technical Characteristics:
   a. Length: As required, in minimum 1 kilometer (3,000 ft.) reels.
   b. Size:
      1) Minimum 0.326 mm2 (22 AWG) outside plant installation.
      2) Minimum 0.205 mm2 (24 AWG) interior installations.
   c. Color Coding: American Telephone and Telegraph Company Standard; Bell System Practices Outside Plant Construction and Maintenance Section G50.607.3, Issue 2 February, 1959.
   d. Minimum Bend Radius: 10X cable outside diameter.
   e. Impedance: 120 Ohms + 15 percent.
   f. DC Resistance: Maximum 8.00 ohms/100 m
   g. Shield Coverage: As required by drawing notes single shield tape design.
   h. Maximum attenuation for 100m at 20° C:

Frequency (MHz)	Category 3 (dB)	Category 5e (dB)	Category 6 (dB)	Category 6A (dB)
.772	2.2	-	-	-
1	2.6	2.0	2.0	2.1
4	5.6	4.1	3.8	3.8
8	8.5	5.8	5.3	5.3
10	9.7	6.5	6.0	5.9
16	13.1	8.2	7.6	7.5
20		9.3	8.5	8.4
25		10.4	9.5	9.4
31.25		11.7	10.7	10.5
62.5		17.0	15.4	15.0
100		22.0	19.8	19.1
200			29.0	27.6
250			32.8	31.1
300				34.3
400				40.1

Frequency (MHz)	Category 3 (dB)	Category 5e (dB)	Category 6 (dB)	Category 6A (dB)
500				45.3

4. Data Multi-Conductor:
   a. Unshielded F/UTP cable with solid conductors.
   b. Able to handle the power and voltage used over the distance required.
   c. Meets TIA transmission performance requirements of Category 6.
   d. Technical Characteristics:
      1) 0.205 mm2 (24 AWG) - 0.326 mm2 (22 AWG) cable
      2) Working Shield: 350 V.
      3) Bend Radius: 10 times cable outside diameter.
      4) Impedance: 100 Ohms + 15%, BAL.
      5) Bandwidth: 500 MHz.
      6) DC Resistance: Maximum 9.38 Ohms/100m (328 ft.) at 20 degrees C.
      7) Maximum Mutual Capacitance: 5.6 nF per 100 m (328 ft.).
      8) Shield Coverage:
         a) Overall Outside (if OEM specified): 100 percent.
         b) Individual Pairs (if OEM specified): 100 percent.
      9) Maximum attenuation for 100m (328 ft.) at 20° C:

Frequency (MHz)	Category 5e (dB)	Category 6 (dB)	Category 6A (dB)
1	2.0	2.0	2.1
4	4.1	3.8	3.8
8	5.8	5.3	5.3
10	6.5	6.0	5.9
16	8.2	7.6	7.5
20	9.3	8.5	8.4
25	10.4	9.5	9.4
31.25	11.7	10.7	10.5
62.5	17.0	15.4	15.0
100	22.0	19.8	19.1
200		29.0	27.6
250		32.8	31.1
300			34.3
400			40.1
500			45.3

5. Fiber Optic:
   a. Multimode Fiber:

1) Provide OM4 Type general purpose multimode fiber optic cable installed in conduit for system locations with load-bearing support braid surrounding inner tube for strength during cable installation.
2) Technical Characteristics:
a) Bend Radius: Minimum 152 mm (6 inches); outer jacket as required.
b) Fiber Diameter: 50 microns.
c) Cladding: 125 microns.
d) Attenuation:
1) 850 nanometer: Maximum 4.0 dB per kilometer.
2) 1,300 nanometer: Maximum 2.0 dB per kilometer.
e) Bandwidth:
3) 850 nanometer: Minimum 160 MHz.
4) 1,300 nanometer: Minimum 500 MHz.
f) Connectors: Stainless steel.

b. Single mode Fiber:
1) Provide OS1 Type general purpose single mode fiber optic cable installed in conduit for all system locations with load-bearing support braid surrounding inner tube for strength during cable installation.
2) Technical Characteristics:
a) Bend Radius: Minimum 100 mm (4 inches).
b) Outer Jacket: PVC.
c) Fiber Diameter: 8.7 microns.
d) Cladding: 125 microns.
e) Attenuation at 850 nanometer: 1.0 dBm per kilometer.
f) Connectors: Ceramic.

C. Outlet Connection Cables:
1. Voice (Telephone):
a. Provide a connection cable for each TCO voice (telephone) jack in system with 10 percent spares able to connect voice (telephone) connection cable from voice (telephone) instrument to TCO voice (telephone) jack. Do not provide voice (telephone) instruments or equipment.
b. Technical Characteristics:
1) Length: Minimum 1.8 m (6 feet).
2) Cable: Voice Grade.
3) Connector: RJ-11/45 compatible male on each end.
4) Size: Minimum 24 AWG.
5) Color Coding: Required, telephone industry standard.
2. Data:
a. Provide a connection cable for each TCO data jack in system with 10 percent spares to connect a data instrument to TCO data jack. Do not provide data terminals/equipment.
b. Technical Characteristics:
1) Length: Minimum 1.8 m (6 feet).
2) Cable: Data grade Category 6a or on a case-by-case basis Category 6 for specialized powered systems accepted by SMCS 005OP2H3 (202) 461-5310, IT and FMS Services and COR.
3) Connector: RJ-45 male on each end.
4) Color Coding: Required, data industry standard.
5) Size: Minimum 24 AWG.
3. Fiber Optic:
a. Provide a connection cable for each TCO fiber optic connector in system with 10 percent spares. Provide data connection cable to connect a fiber optic instrument to TCO fiber optic jack. Do not provide fiber optic instruments/equipment.

b. Technical Characteristics:
1) Length: Minimum 1.8 m (6 feet).
2) Cable: Flexible single conductor with jacket.
3) Connector: LC male on each end.
4) Size: To fit OM1 single mode or OM4 multimode cable.

D. System Connectors:
1. Modular (RJ-45/11 and RJ-45): Provide voice and high speed data transmission applications type modular plugs compatible with voice (telephone) instruments, computer terminals, and other type devices requiring linking through modular telecommunications outlet to the system compatible with UTP F/UTP cables.
a. Technical Characteristics:
1) Number of Pins:
a) RJ-45: Eight.
b) RJ-11/45: Compatible with RJ-45.
2) Dielectric: Surge.
3) Voltage: Minimum 1,000V RMS, 60 Hz at one minute.
4) Current: 2.2A RMS at 30 minutes or 7.0A RMS at 5.0 seconds.
5) Leakage: Maximum 100 µA.
6) Connections:
a) Initial contact resistance: Maximum 20 milli-Ohms.
b) Insulation displacement: Maximum 10 milli-Ohms.
c) Interface: Must interface with modular jacks from a variety of OEMs. RJ-11/45 plugs provide connection when used in RJ-45 jacks.
d) Durability: Minimum 200 insertions/withdrawals.

E. Fiber Optic Terminators:
1. Pre-polished crimp on type that has proper ferrule to terminate fiber optic cable.
2. Technical Characteristics:
a. Frequency: Light wave.
b. Power Blocking: As required.
c. Return Loss: 25 dB.
d. Connectors: LC.
e. Construction: Ceramic.

F. Conduit and Signal Ducts:
1. Conduit:
a. Provide conduit or sleeves for cables penetrating walls, ceilings, floors, interstitial space, fire barriers, etc.
b. Minimum Conduit Size: 19 mm (3/4 inch).
c. Provide separate conduit and signal ducts for each cable type installation.
d. When metal (plastic covered, flexible cable protective armor, etc.) systems are authorized to be provided for use in system, follow installation guidelines and standard specified in Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS and NEC.
e. Maximum 40 percent conduit fill for cable installation.
2. Signal Duct, Cable Duct, or Cable Tray: Use existing signal duct, cable duct, and cable tray, when identified and accepted by COR.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install for ease of operation, maintenance, and testing.

B. Install system to comply with NFPA 70 National Electrical Code, NFPA 99 Health Care Facilities, NFPA 101 Life Safety Code, Joint Commission Manual for Health Care Facilities, and original equipment manufacturers' (OEM) installation instructions.

C. Cable Systems Installation:
   1. Install system cables in cable duct, cable tray, cable runway, conduit or when specifically approved, flexible NEC Article 800 communications raceway. Confirm drawings show sufficient quantity and size of cable pathways. If flexible communications raceway is used, install in same manner as conduit.
   2. Coordinate outside plant and backbone cables to furnish number of cable pairs for system requirements and obtain approval of COR and IT Service prior to installation.
   3. Bond to ground metallic cable sheaths, etc. (i.e. risers, underground, horizontal, etc.).
   4. Install temporary cable to not present a pedestrian safety hazard and be responsible for all work associated with removal. Temporary cable installations are not required to meet Industry Standards; but, must be reviewed and accepted by COR, IT Service, FMS and SMCS 005OP2H3 (202-461-5310) prior to installation.

D. Patient Bedside Prefabricated Units (PBPU) Installation:
   1. Under no circumstances, proceed with installing PBPU without written approval of PBPU OEM and specific instructions regarding attachment to or modifying of PBPU.
   2. Maintain UL integrity of each PBPU. If installation violates UL integrity, obtain on site UL re-certification of violated PBPU at the direction of COR.

E. Labeling:
   1. Industry Standard: Provide labeling in accordance with ANSI/TIA-606-B.
   2. Print lettering of labels with laser printers handwritten labels are not acceptable.
   3. Label both ends of all cables in accordance with industry standard. Provide permanent Labels in contrasting colors and identify according to system “Record Wiring Diagrams”.
   4. Termination Hardware: Label workstation outlets and patch panel connections using color coded labels with identifiers in accordance with industry standard and record on“Record Wiring Diagrams”.

3.2 FIELD QUALITY CONTROL

A. Interim Inspection:
   1. Verify that equipment provided adheres to installation requirements of this section. Interim inspection must be conducted by a factory-certified representative and witnessed by COR.
   2. Check each item of installed equipment to ensure appropriate NRTL label.
   3. Verify cabling terminations in telecommunications rooms and at workstations adhere to color code for T568B pin assignments and cabling connections comply with TIA standards.
   4. Visually confirm marking of cables, faceplates, patch panel connectors and patch cords.
   5. Perform fiber optical field inspection tests via attenuation measurements on factory reels and provide results along with manufacturer certification for factory reel tests. Remove failed cable reels from project site upon attenuation test failure.
   6. Notify COR of the estimated date the contractor expects to be ready for interim inspection, at least 20 working days before requested inspection date, so interim inspection does not affect systems’ completion date.
   7. Provide results of interim inspection to COR. If major or multiple deficiencies are discovered, COR can require a second interim inspection before permitting contractor to continue with system installation.
   8. Do not proceed with installation until COR determines if an additional inspection is required. In either case, re-inspection of deficiencies noted during interim inspections must be part of the proof of performance test.

B. Pretesting:
   1. Pretest entire system upon completion of system installation.
   2. Verify during system pretest, utilizing the accepted equipment, that system is fully operational and meets system performance requirements of this section.
   3. Provide COR four copies of recorded system pretest measurements and the written certification that system is ready for formal acceptance test.

C. Microduct Tests:
   1. Furnish COR, obstruction and pressure test data for each microduct installed. Complete pressure and obstruction tests per manufacturer's recommended procedures prior to installing fiber, and ensure 100 percent of all microducts are compliant with manufacturer.
   2. Complete microduct pressure testing before proceeding with end-to-end microduct obstruction testing.
   3. Notify COR at least one week in advance of test date so that Government and design professional may be present to witness testing.
   4. Maintain close contact with chosen and technically-approved OEM and SMCS 005OP2H3 throughout installation, testing and certification process.

D. Acceptance Test:
   1. After system has been pretested and the contractor has submitted pretest results and certification to COR, then schedule an acceptance test date and give COR 30 days' written notice prior to date acceptance test is expected to begin.
   2. Test only in presence of a COR.
   3. Test utilizing approved test equipment to certify proof of performance.
   4. Verify that total system meets the requirements of this section.
   5. Include expected duration oftest time, with notification of the acceptance test.

E. Verification Tests:
   1. Test UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors, and between conductors and shield, if cable has an overall shield. Test cables after termination and prior to cross-connection.
   2. Multi-mode Fiber Optic Cable: Perform end-to-end attenuation tests in accordance with TIA-568-B.3 and TIA-526-14A using Method A, Optical Power Meter and Light Source and Method B, OTDR. Perform verification acceptance test.
   3. Single mode Fiber Optic Cable: Perform end-to-end attenuation tests in accordance with TIA-568-B.3 and TIA-526-7 using Method A, Optical Power Meter and Light Source and Method B, OTDR. Perform verification acceptance test.

F. Performance Testing:
   1. Perform Category 6a (or on a case by case basis Category 6 for specialized powered systems accepted by SMCS 005OP2H3, (202) 461-5310, IT and FMS Services and COR) tests in accordance with TIA-568-B.1 and TIA-568-B.2. Include the following tests - wire map, length, insertion loss, return loss, NEXT, PSNEXT, ELFEXT, PSELFEXT, propagation delay and delay skew.
   2. Fiber Optic Links: Perform end-to-end fiber optic cable link tests in accordance with TIA-568-B.3.

G. Total System Acceptance Test: Perform verification tests for UTP copper cabling systems and multi-mode and single mode fiber optic cabling systems after complete telecommunication distribution system and workstation outlet are installed.

3.3 MAINTENANCE

A. Accomplish the following minimum requirements during one year warranty period:
   1. Respond and correct on-site trouble calls, during standard work week:
      a. A routine trouble call within one working day of its report. A routine trouble is considered a trouble which causes a system outlet, station, or patch cord to be inoperable.
      b. Standard work week is considered 8:00 A.M. to 5:00 P.M., Monday through Friday exclusive of Federal holidays.
   2. Respond to an emergency trouble call within six hours of its report. An emergency trouble is considered a trouble which causes a subsystem or distribution point to be inoperable at any time.
   3. Respond on-site to a catastrophic trouble call within four hours of its report. A catastrophic trouble call is considered total system failure.

a. If a system failure cannot be corrected within four hours (exclusive of standard work time limits), provide alternate equipment, or cables within four hours after four hour trouble shooting time.
b. Routine or emergency trouble calls in critical emergency health care facilities (i.e., cardiac arrest, intensive care units, etc.) are also be deemed as a catastrophic trouble.

4. Provide COR written report itemizing each deficiency found and the corrective action performed during each official reported trouble call. Provide COR with sample copies of reports for review and approval at beginning of total system acceptance test.

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SECTION 27 15 13
COMMUNICATIONS COPPER HORIZONTAL CABLING

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies requirements for telecommunications copper (UTP) horizontal distribution cabling outside of the computer room. For copper (UTP) horizontal cabling in structured cabling systems in the computer room, see Section 27 13 13 Communications Copper Backbone Cabling.

1.2 SUMMARY

A. Section Includes:
   1. Copper (UTP) Horizontal Cables.

1.3 REFERENCES

A. VA Infrastructure Standard for Telecommunications Spaces.

1.4 RELATED WORK:

A. Computer room structured cabling: Section 27 10 00, STRUCTURED CABLING.

B. Termination equipment: Section 27 11 19, COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS.

C. Cable labeling requirements: Section 27 05 53, IDENTIFICATION FOR COMMUNICATIONS SYSTEMS.

1.5 SUBMITTALS:

A. Submit in accordance with Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS SYSTEMS.

PART 2 - PRODUCTS

2.1 COPPER (UTP) HORIZONTAL CABLES.

Copper (UTP) horizontal cables connect the Telecommunications Room (TR) to each end-user Work Area Outlet (WAO) (horizontal distribution).

A. Performance Category. Copper (UTP) horizontal cables shall meet the Category 6A performance requirements. Category 6A connectors are required.

B. Performance Specifications. Meets or exceeds TIA-EIA-568-C.2-10 and TSB-155.

C. Limited Power (LP) Certification. UL Listed as x-LP (0.5A).

D. Termination. Field terminated TIA 568B.

E. Testing. Following installation, each cable shall be field certified to meet performance category requirements per TIA 568-C.2.

F. Conductor Size. 22-24AWG.

G. Jacket Rating. Communications Multipurpose Cable, Plenum (CMP) shall be specified if any portion of the cable passes through an NEC-defined plenum. Communications Multipurpose Cable, Riser (CMR) shall be specified for all other applications. CMP may be used as a substitute for CMR.

H. Construction. Copper Clad Aluminum (CCA) cable is not permitted.

I. Length. The maximum distance for UTP horizontal cables is limited to 295 feet.

PART 3 - EXECUTION

3.1 IMPLEMENTATION.

A. All cabling and equipment shall be labeled per the requirements of the VA Infrastructure Standard for Telecommunications Spaces.

B. Interior to the TR, install horizontal copper (UTP) structured cabling in overhead cable tray.

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SECTION 27 15 13.13
COMMUNICATIONS OPTICAL FIBER SPLICING AND TERMINATIONS

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies requirements for terminations of fiber optic cabling.

1.2 SUMMARY

A. Section Includes:
1. Termination Requirements.

1.3 REFERENCES

A. VA Infrastructure Standard for Telecommunications Spaces.

1.4 RELATED WORK:

A. Termination equipment: Section 27 11 19, COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS.

B. Fiber optic cabling requirements: Section 27 13 23, COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING.

1.5 SUBMITTALS:

A. Submit in accordance with Section 27 05 11, COMMON WORK RESULTS FOR COMMUNICATIONS SYSTEMS.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 TERMINATION REQUIREMENTS.

A. Terminate fiber optic cabling with duplex Lucent connector (LC) adapters or 12-fiber multi-fiber push on (MPO) connectors/24-fiber multi-fiber push on (MPO) connectors as required for the application.

B. Pre-terminated connections are preferred for computer room structured cabling applications. Field termination (fusion splicing) for non-computer room applications where cable lengths cannot be determined in advance is acceptable.

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SECTION 27 16 19
COMMUNICATIONS PATCH CORDS, STATION CORDS, AND CROSS CONNECT WIRE

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies requirements for telecommunications patch cords.

1.2 SUMMARY

A. Section Includes:
   1. Copper (UTP) Patch Cables.
   2. Fiber Optic Patch Cables.

1.3 REFERENCES

A. VA Infrastructure Standard for Telecommunications Spaces.

1.4 RELATED WORK:

A. Termination equipment: Section 27 11 19, COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS.

B. Cable labeling requirements: Section 27 05 53, IDENTIFICATION FOR COMMUNICATIONS SYSTEMS.

1.5 SUBMITTALS:

A. Submit in accordance with Section 27 05 00, COMMON WORK RESULTS FOR COMMUNICATIONS SYSTEMS.

PART 2 - PRODUCTS

2.1 COPPER (UTP) PATCH CABLES.

A. Performance Category. Patch cables shall meet the Category 6A performance requirements. Category 6A connectors are required.

B. Termination Method. Factory pre-terminated TIA 568B.

C. Conductor Size. 22-28AWG. Where 28AWG patch cords are specified, the overall horizontal channel distance is reduced.

D. Length. Patch cords of the shortest appropriate length shall be used.

2.2 FIBER OPTIC PATCH CABLES.

A. Construction. Fiber patch cords shall be constructed of pairs (2-strands) of multimode laser-enhanced 50/125µm or single mode laser-optimized 9/125µm fiber depending on the application.

B. Performance Category. Multimode patch cords shall meet the OM4 performance requirements.

C. Connectors. Duplex Lucent connector (LC) connectors are required. Where polarity requirements are not known, reversible polarity duplex LC connectors are specified on one end.

D. Termination Method. Factory pre-terminated.

E. Length. Patch cords of the shortest appropriate length shall be used.

PART 3 - EXECUTION

3.1 IMPLEMENTATION.

A. Patch cords shall not be used to connect equipment in different server cabinets.

B. Patch cords shall be neatly installed using cable management equipment and following cable management principles.

C. Upon installation patch cords shall be labeled in accordance with the requirements of the VA Infrastructure Standard for Telecommunications Spaces.

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SECTION 27 51 16

PUBLIC ADDRESS AND MASS NOTIFICATION SYSTEMS

PART 1 - GENERAL

1.1 SECTION SUMMARY

A. Work covered by this document includes design, engineering, labor, material and products, equipment warranty and system warranty, training and services for, and incidental to, the complete installation of new and fully operating National Fire Protection Association (NFPA) – Life Safety Code 101.3-2 (a) Labeled and (b) Listed Emergency Service Public Address System (PAS) and associated equipment (here-in-after referred to as the System) in approved locations indicated on the contract drawings. These items shall be tested and certified capable of receiving, distributing, interconnecting and supporting PAS communications signals generated local and remotely as detailed herein.

B. Work shall be complete, Occupational Safety and Health Administration (OSHA), National Recognized Testing Laboratory (NRTL – i.e. Underwriters Laboratory [UL]) Listed and Labeled; and VA Central Office (VACO), Telecommunications Voice Engineering (TVE 005OP3B) tested, certified and ready for operation.

C. The System shall be delivered free of engineering, manufacturing, installation, and functional defects. It shall be designed, engineered and installed for ease of operation, maintenance, and testing.

D. The term “provide”, as used herein, shall be defined as: designed, engineered, furnished, installed, certified, and tested, by the Contractor.

E. Specification Order of Precedence: In the event of a conflict between the text of this document and the Project’s Contract Drawings outlined and/or cited herein; THE TEXT OF THIS DOCUMENT TAKES PRECEDENCE. HOWEVER, NOTHING IN THIS DOCUMENT WILL SUPERSEDE APPLICABLE EMERGENCY LAWS AND REGULATIONS, SPECIFICALLY NATIONAL AND/OR LOCAL LIFE AND PUBLIC SAFETY CODES. The Local Fire Marshall and/or VA Public Safety Officer are the only authorities that may modify this document’s EMERGENCY CODE COMPLIANCE REQUIREMENTS, on a case by case basis, in writing and confirmed by VA’s PM, RE and TVE-005OP3B. The VA PM is the only approving authority for other amendments to this document that may be granted, on a case by case basis, in writhing with technical concurrencies by VA’s RE, TVE-005OP3B and identified Facility Project Personnel.

F. The Original Equipment Manufacturer (OEM) and Contractor shall ensure that all management, sales, engineering and installation personnel have read and understand the requirements of this specification before the system is designed, engineered, delivered and provided. The Contractor shall furnish a written statement attesting this requirement as a part of the technical submittal that includes each name and certification, including the OEMs.

1.2 RELATED SECTIONS

A. 01 33 23 – Shop Drawings, Product Data and Samples.

B. 07 84 00 – Firestopping.

C. 26 05 19 – Low – Voltage Electrical Power Conductors and Cables (600 Volts and Below).

D. 27 05 11 – Requirements for Communications Installations.

E. 27 05 26 – Grounding and Bonding for Communications Systems.

F. 27 05 33 – Raceways and Boxes for Communications Systems.

G. 27 10 00 – Control, Communication and Signal Wiring.

H. 27 11 00 – Communications Cabling Interface and Equipment Rooms Fittings.

I. 27 15 00 – Horizontal and Vertical Communications Cabling Equipment and Systems.

1.3 DEFINITIONS

A. Provide: Design, engineer, furnish, install, connect complete, test, certify and warranty.

B. Work: Materials furnished and completely installed.

C. Review of contract drawings: A service by the engineer to reduce the possibility of materials being ordered which do not comply with contract documents. The engineer's review shall not relieve the Contractor of responsibility for dimensions or compliance with the contract documents. The reviewer's failure to detect an error does not constitute permission for the Contractor to proceed in error.

D. Headquarters Technical Review, for National and VA communications and security, codes, frequency licensing, standards, guidelines compliance:
   a) Office of Telecommunications
   b) Special Communications Team (005OP2B)
   c) 1335 East West Highway – 3rd Floor
   d) Silver Spring, Maryland 20910
   e) (O) 301-734-0350, (F) 301-734-0360

E. Contractor: Radio Contractor; you; successful bidder

1.4 REFERENCES

A. The installation shall comply fully with all governing authorities, laws and ordinances, regulations, codes and standards, including, but not limited to:
   1. United States Federal Law:
      a. Departments of:
         1) Commerce, Consolidated Federal Regulations (CFR), Title 15 – Under the Information Technology Management Reform Act (Public Law 104-106), the Secretary of Commerce approves standards and guidelines that are developed by the:
            a) Chapter II, National Institute of Standards Technology (NIST – formerly the National Bureau of Standards). Under Section 5131 of the Information Technology Management Reform Act of 1996 and the Federal Information Security Management Act of 2002 (Public Law 107-347), NIST develops – Federal Information Processing Standards Publication (FIPS) 140-2—Security Requirements for Cryptographic Modules.
            b) Chapter XXIII, National Telecommunications and Information Administration (NTIA – aka ‘Red Book’) Chapter 7.8 / 9; CFR, Title 47 Federal communications Commission (FCC) Part 15, Radio Frequency Restriction of Use and Compliance in “Safety of Life” Functions & Locations
         2) FCC - Communications Act of 1934, as amended, CFR, Title 47 – Telecommunications, in addition to Part 15 – Restrictions of use for Part 15 listed Radio Equipment in Safety of Life / Emergency Functions / Equipment/ Locations (also see CFR, Title 15 – Department of Commerce, Chapter XXIII – NTIA):
            a) Part 15 – Restrictions of use for Part 15 listed Radio Equipment in Safety of Life / Emergency Functions / Equipment/Locations.
            b) Part 58 – Television Broadcast Service.
            c) Part 90 – Rules and Regulations, Appendix C.
            d) Form 854 – Antenna Structure Registration.
         3) Health, (Public Law 96-88), CFR, Title 42, Chapter IV Health & Human Services, CFR, Title 46, Subpart 1395(a)(b) JCAHO “a hospital that meets

JCAHO accreditation is deemed to meet the Medicare conditions of Participation by meeting Federal Directives:"

a) All guidelines for Life, Personal and Public Safety; and, Essential and Emergency Communications.

4) Labor, CFR, Title 29, Part 1910, Chapter XVII - Occupational Safety and Health Administration (OSHA), Occupational Safety and Health Standard:
   a) Subpart 7 - Definition and requirements (for a NRTL – 15 c's, for complete list, contact (**http://www.osha.gov/dts/otpca/nrtl/faq_nrtl.html**):
      i. UL:
         i) 44-02 – Standard for Thermoset-Insulated Wires and Cables.
         ii) 65 – Standard for Wired Cabinets.
         iii) 83-03 – Standard for Thermoplastic-Insulated Wires and Cables.
         iv) 467-01 – Standard for Electrical Grounding and Bonding Equipment
         v) 468 – Standard for Grounding and Bonding Equipment.
         vi) 486A-01 – Standard for Wire Connectors and Soldering Lugs for Use with Copper Conductors
         vii) 486C-02 – Standard for Splicing Wire Connectors.
         viii) 486D-02 – Standard for Insulated Wire Connector Systems for Underground Use or in Damp or Wet Locations.
         ix) 486E-00 – Standard for Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors.
         x) 493-01 – Standard for Thermoplastic-Insulated Underground Feeder and Branch Circuit Cable.
         xi) 514B-02 – Standard for Fittings for Cable and Conduit.
         xii) 1069 – Hospital Signaling and Nurse Call Equipment.
         xiii) 1333 – Vertical (Riser) Fire Rating.
         xiv) 1449 – Standard for Transient Voltage Surge Suppressors.
         xv) o) 1479-03 – Standard for Fire Tests of Through-Penetration Fire Stops.
         xvi) 1863 – Standard for Safety, Communications Circuits Accessories.
         xvii) 2024 – Standard for Optical Fiber Raceways.
         xviii) 60950-1/2 – Information Technology Equipment – Safety.
      ii. Canadian Standards Association (CSA): same tests as for UL.
      iii. Communications Certifications Laboratory (CCL): same tests as for UL.
      iv. Intertek Testing Services NA, Inc. (ITSNA formerly Edison Testing Laboratory [ETL]): same tests as for UL.
   b) Subpart 35 – Compliance with NFPA 101 – Life Safety Code.
   c) Subpart 36 - Design and construction requirements for exit routes.
   d) Subpart 268 - Telecommunications.
   e) Subpart 305 - Wiring methods, components, and equipment for general use.
5) Department of Transportation, CFR, Title 49 (Public Law 89-670), Part 1, Subpart C – Federal Aviation Administration (FAA):
   a) Standards AC 110/460-ID & AC 707 / 460-2E – Advisory Circulars for Construction of Antenna Towers.
   b) Forms 7450 and 7460-2 – Antenna Construction Registration.
6) Veterans Affairs (Public Law No. 100-527), CFR, Title 38, Volumes I & II:

a) Office of Telecommunications:
   i. Handbook 6100 – Telecommunications.
      i) Spectrum Management FCC & NTIA Radio Frequency Compliance and Licensing Program.
      ii) Special Communications Proof of Performance Testing, VACO Compliance and Life Safety Certification(s).
b) Office of Cyber and Information Security (OCIS):
   i. Handbook 6500 - Information Security Program.
   ii. Wireless and Handheld Device Security Guideline Version 3.2, August 15, 2005.
c) VA's National Center for Patient Safety – Veterans Health Administration Warning System, Failure of Medical Alarm Systems using Paging Technology to Notify Clinical Staff, July 2004.
d) VA's Center for Engineering Occupational Safety and Health, concurrence with warning identified in VA Directive 7700.
e) Office of Construction and Facilities Management (CFM):
   i. Master Construction Specifications (PG-18-1).
   ii. Standard Detail and CAD Standards (PG-18-4).
   iii. Equipment Guide List (PG-18-5.
   iv. Electrical Design Manual for VA Facilities (PG 18-10), Articles 7 & 8.
   v. Minimum Requirements of A/E Submissions (PG 18-15):
   vi. Volume B, Major New Facilities, Major Additions; and Major Renovations, Article VI, Paragraph B.
   vii. Volume C - Minor and NRM Projects, Article III, Paragraph S.
   viii. Volume E - Request for Proposals Design/Build Projects, Article II, Paragraph F.
   ix. Mission Critical Facilities Design Manual 2015.
   x. Life Safety Protected Design Manual 2015.
   xi. Solicitation for Offerors (SFO) for Lease Based Clinics – (05-2009).

b. Federal Specifications (Fed. Specs.):
   1) A-A-59544-00 - Cable and Wire, Electrical (Power, Fixed Installation).

2. United States National Codes:
   a. American Institute of Architects (AIA): Guidelines for Healthcare Facilities.
   b. American National Standards Institute/Electronic Industries Association/Telecommunications Industry Association (ANSI/EIA/TIA):
      1) 568-B - Commercial Building Telecommunications Wiring Standards:
         a) B-1 – General Requirements.
         b) B-2 – Balanced twisted-pair cable systems.
         c) B-3 - Fiber optic cable systems.
      2) 569 - Commercial Building Standard for Telecommunications Pathways and Spaces.
      3) 606 – Administration Standard for the Telecommunications Infrastructure of Communications Buildings.
      4) 607 – Commercial Building Grounding and Bonding Requirements for Telecommunications.
      5) REC 127-49 – Power Supplies.
      6) RS 160-51 – Sound systems.
      7) RS 270 – Tools, Crimping, Solderless Wiring Devices, Recommended Procedures for User Certification.
      8) SE 101-A49 – Amplifier for Sound Equipment
      9) SE 103-49 – Speakers for Sound Equipment
   c. cAmerican Society of Mechanical Engineers (ASME):
      1) Standard 17.4 – Guide for Emergency Personnel.

2) Standard 17.5 – Elevator & Escalator Equipment (prohibition of installing non-elevator equipment in Elevator Equipment Room / Mechanical Penthouse).

d. American Society of Testing Material (ASTM):
1) D2301-04 - Standard Specification for Vinyl Chloride Plastic Pressure Sensitive Electrical Insulating Tape.

e. Building Industries Communications Services Installation (BICSI):
1) All standards for smart building wiring, connections and devices for commercial and medical facilities.
2) Structured Building Cable Topologies.
3) In consort with ANSI/EIA/TIA.

f. Institute of Electrical and Electronics Engineers (IEEE):
1) SO/TR 21730:2007 - Use of mobile wireless communication and computing technology in healthcare facilities - Recommendations for electromagnetic compatibility (management of unintentional electromagnetic interference) with medical devices.
2) 0739-5175/08/©2008 IEEE – Medical Grade – Mission Critical – Wireless Networks.
3) C62.41 – Surge Voltages in Low-Voltage AC Power Circuits.

g. NFPA:
1) 70 - National Electrical Code (current date of issue) – Articles 517, 645 & 800.
2) 75 - Standard for Protection of Electronic Computer Data-Processing Equipment.
3) 77 – Recommended Practice on Static Electricity.
4) 99 - Healthcare Facilities.
5) 101 - Life Safety Code.
6) 1600 – Disaster Management, Chapter 5.9 – Communications and Warning

3. State Hospital Code(s).
4. Local Town, City and/or County Codes.
5. Accreditation Organization(s):
a. Joint Commission on Accreditation of Hospitals Organization (JCAHO) – Section VI, Part 3a – Operating Features.

1.5 QUALIFICATIONS

A. The OEM shall have had experience with three (3) or more installations of systems of comparable size and complexity with regards to type and design as specified herein. Each of these installations shall have performed satisfactorily for at least one (1) year after final acceptance by the user. Include the names, locations and point of contact for these installations as a part of the submittal.

B. The Contractor shall submit certified documentation that they have been an authorized distributor and service organization for the OEM for a minimum of three (3) years. The Contractor shall be authorized by the OEM to pass thru the OEM's warranty of the installed equipment to VA. In addition, the OEM and Contractor shall accept complete responsibility for the design, installation, certification, operation, and physical support for the System. This documentation, along with the System Contractor and OEM certifications must be provided in writing as part of the Contractor's Technical submittal.

C. The Contractor's Communications Technicians assigned to the System shall be fully trained, qualified, and certified by the OEM on the engineering, installation, operation, and testing of the System. The Contractor shall provide formal written evidence of current OEM certification(s) for the installer(s) as a part of the submittal or to the RE before being allowed to commence work on the System.

D. The Contractor shall display all applicable national, state and local licenses.

E. The Contractor shall submit copy (s) of Certificate of successful completion of OEM's installation/training school for installing technicians of the System's PA equipment being proposed.

1.6 CODES AND PERMITS

A. Provide all necessary permits and schedule all inspections as identified in the contract's milestone chart, so that the system is proof of performance tested and ready for operation on a date directed by the Owner.

B. The contractor is responsible to adhere to all codes described herein and associated contractual, state and local codes.

C. The Contractor shall display all applicable national, state and local licenses and permits.

1.7 SCHEDULING

A. After the award of contract, the Contractor shall prepare a detailed schedule (aka milestone chart) using "Microsoft Project" software or equivalent. The Contractor Project Schedule (CPS) shall indicate detailed activities for the projected life of the project. The CPS shall consist of detailed activities and their restraining relationships. It will also detail manpower usage throughout the project.

B. It is the responsibility of the Contractor to coordinate all work with the other trades for scheduling, rough-in, and finishing all work specified. The owner will not be liable for any additional costs due to missed dates or poor coordination of the supplying contractor with other trades.

1.8 REVIEW OF CONTRACT DRAWINGS AND EQUIPMENT DATA SUBMITTALS

A. (Note: The Contractor is encouraged, but not required, to submit separate technical submittal(s) outlining alternate technical approach(s) to the system requirements stated here-in as long as each alternate technical document(s) is complete, separate, and submitted in precisely the same manner as outlined herein. VA will review and rate each received alternate submittal, which follows this requirement, in exactly the same procedure as outlined herein. Partial, add-on, or addenda type alternates will not be accepted or reviewed.)

B. Submit at one time within 10 days of contract awarding, drawings and product data on all proposed equipment and system. Check for compliance with contract documents and certify compliance with Contractor's "APPROVED" stamp and signature.

C. Support all submittals with descriptive materials, i.e., catalog sheets, product data sheets, diagrams, and charts published by the manufacturer. These materials shall show conformance to specification and drawing requirements.

D. Where multiple products are listed on a single cut-sheet, circle or highlight the one that you propose to use. Provide a complete and through equipment list of equipment expected to be installed in the system, with spares, as a part of the submittal. Special Communications (TVE-005OP3B) will not review any submittal that does not have this list.

E. Provide four (4) copies to the PM for technical review. The PM will provide a copy to the offices identified in Paragraph 1.3.C & D, at a minimum for compliance review as described herein where each responsible individual(s) shall respond to the PM within 10 days of receipt of their acceptance or rejection of the submittal(s).

F. Provide interconnection methods, conduit (where not already installed), junction boxes (J-Boxes), cable, interface fixtures and equipment lists for the: ENR(s) (aka DMARC), TER, TCR, MCR, MCOR, PCR, ECR, Stacked Telecommunications Rooms (STR), Nurses Stations (NS), Head End Room (HER), Head End Cabinet (HEC), Head End Interface Cabinet (HEIC) and approved TCO locations Telecommunications Infrastructure Plant (TIP) interface distribution layout drawing, as they are to be installed and interconnected to teach other (REFER TO APPENDIX B – SUGGESTED TELECOMMUNICATIONS ONE LINE TOPOLOGY pull-out drawing).

G. Headend and each interface distribution cabinet layout drawing, as they are expected to be installed.

H. Equipment OEM technical literature detailing the electrical and technical characteristics of each item of equipment to be furnished.

I. Engineering drawings of the System, showing calculated of expected signal levels at the headend input and output, each input and output distribution point, and signal level at each telecommunications outlet.

J. Surveys Required as a Part of The Technical Submittal:
1. The Contractor shall provide the following System survey(s) that depict various system features and capacities required in addition to the on-site survey requirements described herein. Each survey shall be in writing and contain the following information (the formats are suggestions and may be used for the initial Technical Submittal Survey requirements), as a minimum:
   a. PA Cable System Design Plan:
      1) An OEM and contractor designed functioning PA System cable plan to populate the entire TIP empty conduit/pathway distribution systems provided as a part of Specification 27 11 00 shall be provided as a part of the technical proposal. A specific functioning PA: cable, interfaces, J-boxes and back boxes shall coincide with the total growth items as described herein. It is the Contractor's responsibility to provide the Systems' entire PA cable and accessory requirements and engineer a functioning PA distribution system and equipment requirement plan of the following paragraph(s), at a minimum:
      2) The required PA Equipment Locations:

EQUIPPED ITEM	**CAPACITY**	**GROWTH**
Master Control Stations		
Telephone Operators Room		
Police Control Room		
Other		
Zone Amplifiers		
All Call (complete Zone 1)		
Admissions (Zone 2)		
Entrance (Zone 2a)		
Pharmacy Dispensing (Zone 2a)		
Agent Cashier (Zone 2a)		
Other (Zone 2a)		
Labs (Zone 3)		
Blood (Zone 3a)		
Dissecting (Zone 3a)		
Other (Zone 3a)		
Clinics (Zone 4)		
Dental (Zone 4a)		
Radiology (Zone 4a)		

EQUIPPED ITEM	CAPACITY	GROWTH
Oncology (Zone 4a)		
Other (Zone 4a)		
Supervisory Panel(s)		
Trouble Panel(s)		
Locations		
Speakers		
Overhead		
Locations		
Other		
Other		
Outside		
Locations		
Other		
Horn		
Locations		
Other		
Power Supply(s)		
Location		
Other		
UPS(s)		
Location		
Other		
Radio Paging Access **(when pre-approved by TVE-005OP3B)**		
Wireless Access **(when pre-approved by TVE-005OP3B)**		
Maintenance/Programming Console		
Location(s)		
Other		

3) The required PA Cable Plant/Connections:
4) The Contractor shall clearly and fully indicate this category for each item identified herein as a part of the technical submittal. For this purpose, the following definitions and sample connections are provided to detail the system's capability:

EQUIPPED ITEM	CAPACITY	GROWTH
Central Control Cabinet/Equipment		
Location		
Power Supply(s)		
UPS(s)		
Essential Electrical Power Panel(s)		
Other		
Cable Plant		
Supply to Locations Identified herein		
Speaker Locations		
Remote Locations		
Telephone Operator Room		
Police Control Room		
Other		
Maintenance/Program Console		
Location(s)		
Other		
LAN (Local Facility) Access/Equipment/Location **(when pre-approved by TVE-005OP3B)**		
Wireless Access/Equipment/Location **(when pre-approved by TVE-005OP3B)**		
Other		

1.9 PROJECT RECORD DOCUMENTS (AS BUILTS)

A. Throughout progress of the Work, maintain an accurate record of changes in Contract Documents. Upon completion of Work, transfer recorded changes to a set of Project Record Documents.

B. The floor plans shall be marked in pen to include the following:
1. All device locations with UL labels affixed.
2. Conduit locations.
3. Head-end equipment and specific location.
4. Each interface and equipment specific location.
5. Facility Entrance (aka DEMARC) Room(s) interface equipment and location(s).
6. Telephone Equipment Room (TER) interface equipment and specific location.
7. Main Computer Room (MCR) interface equipment and specific location.
8. Police Control Room (PCR) interface equipment and specific location.
9. Engineering Control Room (ECR) interface equipment and specific location
10. Telecommunication Outlet (s –TCO) equipment and specific location
11. TIP Wiring diagram(s).
12. Warranty certificate.
13. System test results.
14. System Completion Document(s) or MOU.

1.10 WARRANTIES

A. The Contractor shall warrant the installation to be free from defect in material and workmanship for a period of two (2) years from the date of acceptance of the project by the owner. The Contractor shall agree to remedy covered defects within four (4) hours of notification of major failures or within twenty-four (24) hours of notification for individual station related problems.

1.11 USE OF THE SITE

A. Use of the site shall be at the GC's direction.

B. Coordinate with the GC for lay-down areas for product storage and administration areas.

C. Coordinate work with the GC and their sub-contractors.

D. Access to buildings wherein the work is performed shall be directed by the GC.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft.

B. Store products in original containers.

C. Coordinate with the GC for product storage. There may be little or no storage space available on site. Plan to potentially store materials off site.

D. Do not install damaged products. Remove damaged products from the site and replaced with new product at no cost to the Owner.

1.13 PROJECT CLOSE-OUT

A. Prior to final inspection and acceptance of the work, remove all debris, rubbish, waste material, tools, construction equipment, machinery and surplus materials from the project site and thoroughly clean your work area.

B. Before the project closeout date, the Contractor shall submit:
   1. Warranty certificate.
   2. Evidence of compliance with requirements of governing authorities such as the Low Voltage Certificate of Inspection.
   3. Project record documents.
   4. Instruction manuals and software that is a part of the system.

C. Contractor shall submit written notice that:
   1. Contract Documents have been reviewed.
   2. Project has been inspected for compliance with contract.
   3. Work has been completed in accordance with the contract.

PART 2 - PRODUCTS / FUNCTIONAL REQUIREMENTS

2.1 GENERAL REQUIREMENTS FOR EQUIPMENT AND MATERIALS

A. Furnish and install a complete and fully functional and operable Nurse Call System for each location shown on the contract drawings and TCOs WHOSE EMPTY CONDUIT SYSTEM WAS PROVIDED AS A PART OF SPECIFICATION 27 11 00.

B. The specific location for each PA: Central Control Cabinet is IT Room, Power Supply is IT Room, Electrical Supervisor Panel is IT Room, UPS is IT Room, Main Equipment Cabinet is IT Room.

C. Coordinate features and select interface components to form an integrated PA system. Match components and interconnections between the systems for optimum performance of specified functions.

D. Expansion Capability: The PA equipment interfaces and cables shall be able to increase number of enunciation points in the future by a minimum of 50 percent (%) above those indicated without adding any internal or external components or main trunk cable conductors.

E. Equipment: Active electronic type shall use solid-state components, fully rated for continuous duty unless otherwise indicated. Select equipment for normal operation on input power usually supplied between 110 to 130 VAC, 60 Hz.

F. Meet all FCC requirements regarding low radiation and/or interference of RF signal(s). The system shall be designed to prevent direct pickup of signals from within and outside the building structure.

G. Weather/Water Proof Equipment: Listed and labeled by an OSHA certified National Recognized Testing Laboratory (NRTL – i.e. UL) for duty outdoors or in damp locations.

H. Deliver a fully functioning and operable PA in the specific locations shown on the drawings.

2.2 SYSTEM DESCRIPTION

A. Furnish and install a complete and fully functional and operable HF Radio System. Provide additional require conduit(s) according to Specification 27 11 00.

B. The Contractor is responsible for interfacing the MATV, RED, Patient Bed Service Walls, systems with the System and shall be the interface points for connection of the radio interface cabling from the interface unit(s). The interface unit(s) shall be provided by the Contractor.

C. The Contractor shall continually employ interfacing methods that are approved by the OEM and VA. At a minimum, an acceptable interfacing method requires not only a physical and mechanical connection, but also a matching of signal, voltage, and processing levels with regard to signal quality and impedance. The total PA system shall be configured and installed so that the combination of equipment actually employed does not produce any undesirable visual or aural effects such as signal distortions, noise pulses, glitches, hum, transients, images, etc. The interface points must adhere to all standards described herein for the full separation of Critical Care and Life Safety systems.

D. It is not acceptable to utilize the telephone cable system for the control of radio signals and equipment. The System Contractor shall connect the Telephone System Remote Control System to the Radio System Paging Control Unit ensuring that all NFPA and UL Critical Care and Life Safety Circuit and System separation guidelines are satisfied. The System Contractor is not allowed to make any connections to the Telephone System. The Owner shall arrange for the interconnection between the PA and Telephone Systems with the appropriate responsible parties.

E. System hardware shall consist of a standalone (separate) PA communications network comprised of amplifiers, mixers, speakers, volume controls, test sets, telephone private branch exchange (PBX) interface equipment, equipment cabinets/racks, wiring and other options such as, sub zoning in addition to “all call” functions, computer interfaces, printer interfaces and wireless network interfaces, (when specifically approved by 005OP3B and VA Headquarters Spectrum Management 005OP2B – herein after referred to as 005OP2B) as shown on drawings. All necessary equipment required to meet the intent of these specifications, whether or not enumerated within these specifications, shall be supplied and installed to provide a complete and operating nurse/patient communications network.

F. Systems firmware shall be the product of a reputable firmware OEM of record with a proven history of product reliability and sole control over all source code. Manufacturer shall provide, free of charge, product firmware/software upgrades for a period of two (2) years from date of acceptance by VA for any product feature enhancements. System configuration programming changes shall not require any exchange of parts and shall be capable of being executed remotely via a modem connection (when specifically approved first by 005OP3B).

G. The PA Head End Equipment shall be located in Telecommunications PBX/Telephone Room. The PA shall cover floor(s) Expansion areas. The PA shall provide zoned, one-way voice

paging through distributed, ceiling mounted loudspeakers. Voice input into the PA shall be by zone using the telephone system. The Nurse Call / Code Blue System may interface the PA system when specifically approved by VA Headquarters 005OP3B during the project approval process prior to contract bidding.

H. The System shall utilize microprocessor components for all signaling and programming circuits and functions. Self contained or on board system program memory shall be non-volatile and protected from erasure from power outages for a minimum of 24 hours.

I. Provide a backup battery or a UPS for the System (including each distribution cabinet/point, CRT, LCD and Monitor) to allow normal operation and function (as if there was no AC power failure) in the event of an AC power failure or during input power fluctuations for a minimum of two (2) Hours.

J. The System is defined as Emergency Service and the Code Blue functions is defined as Life Safety/Support by NFPA (re Part 1.1.A) and so evaluated by JCAHCO. Therefore, the system shall have a minimum of two (2) additional remote enunciation points in order to satisfy NFPA's Life Safety Code 101 where each enunciation point shall fully function independent of the Facility's PBX.
   1. These two (2) additional remote locations shall be fully manned:
      a. 24/7/365 for certified Hospital.
      b. As long as other identified VA Medical / Servicing Facilities are open for servicing patients.
      c. The minimum remote enunciation locations shall be:
         1) The Telephone / PBX Operator Room.
         2) The Police Control / Operations Room.
         3) Other location(s) that is specifically approved by VA Headquarters TVE - 005OP3B DURING THE PROJECT DEVELOPMENT STAGES AND PRIOR TO EQUIPMENT PURCHASE.
      d. One (1) global (aka "all call") hard wired zone shall be provided that connects to every system speaker.
      e. There shall be hard-wired sub-zones designated as follows:
         1) Department A.
         2) Department B.
         3) Department C.
         4) Department D.
         5) Department E.
         6) Each zone shall be capable of be programmed.
         7) The System shall have a minimum of three (3), unused zones.
   2. The System shall allow voice pages to be made within a single zone, across programmed multiple zones or a global page (all zones) by using preset codes entered into the keypad of any telephone instrument attached to the PBX.

K. The System shall interface with the Facility's existing PAS so that a global page (aka "all call" page) is communicated to the existing PAS and the new System of this project. Arrangements for interconnection of the System and the telephone system(s) shall be coordinated with the owner and the PBX provider.

L. The system shall be designed to provide continuous electrical supervision of the complete and entire system (i.e. light bulbs, wires, contact switch connections, master control stations, wall stations, circuit boards, data, audio, and communication busses, main and UPS power, etc.). All alarm initiating and signaling circuits shall be supervised for open circuits, short circuits, and system grounds. Main and UPS power circuits shall be supervised for a change in state (i.e. primary to backup, low battery, UPS on line, etc.). When an open, short or ground occurs in any system circuit, an audible and visual fault alarm signal shall be initiated at the main supervisory panel, nurse control station and all remote amplifier locations.

M. When the System is approved to connect to a separate communications system (i.e. LAN, WAN, Telephone, Nurse Call, radio raging, wireless systems, etc) the connection point shall be

at one location and shall meet the following minimum requirements for each hard wired connection (note each wireless system connection MUST BE APPROVED PRIOR TO CONTRACT BID BY VA HEADQUARTERS 005OP3B AND 005OP2B):
1. UL 60950-1/2.
2. FIPS 142.
3. FCC Part 15 Listed Radio Equipment is not allowed.

N. All passive distribution equipment shall meet or exceed -80 dB radiation shielding (aka RFI) shielding specifications and be provided with screw type audio connectors.

O. All equipment face plates utilized in the system shall be stainless steel, anodized aluminum or UL approved cycolac plastic for the areas where provided.

P. All trunk, branch, and interconnecting cables and unused equipment ports or taps shall be terminated with proper terminating resistors designed for RF, audio and digital cable systems without adapters.

Q. Noise filters and surge protectors shall be provided for each equipment interface cabinet, headend cabinet, control console and local and remote amplifier locations to insure protection from input primary AC power surges and to insure noise glitches are not induced into low voltage data circuits.

R. Plug-in connectors shall be provided to connect all equipment, except coaxial cables and RF transmission line interface points. Coaxial cable distribution points and RF transmission lines shall use coaxial cable connections recommended by the cable OEM and approved by the system OEM. Base band cable systems shall utilize barrier terminal screw type connectors, at a minimum. As an alternate, crimp type connectors installed with a ratchet type installation tool are acceptable provided the cable dress, pairs, shielding, grounding, connections and labeling are the same as the barrier terminal strip connectors. Tape of any type, wire nuts or solder type connections are unacceptable and will not be approved.

S. Audio Level Processing: The control equipment shall consist of audio mixer(s), volume limiter(s) and/or compressor(s), and power amplifier(s) to process, adjust, equalize, isolate, filter, and amplify each audio channel for each sub-zone in the system and distribute them into the System's RF interfacing distribution trunks and amplification circuits. It is acceptable to use identified Telephone System cable pairs designated for Two-Way Radio interface and control use or identified as spare telephone cable pairs by the Facility's Telephone System Contractor. The use of telephone cable to distribute RF signals, carrying system or sub-system AC or DC voltage is not acceptable and will not be approved. Additionally, each control location shall be provided with the equipment required to insure the system can produce its designed audio channel capacity at each speaker identified on the contract drawings. The Contractor shall provide: a spare set of telephone paging modules as recommended by the OEM (as a minimum provide one spare module for each installed module); one spare audio power amplifier, one spare audio mixer, one spare audio volume limiter and/or compressor, and one spare audio automatic gain adjusting device, and minimum RF equipment recommended by the OEM.

T. Contractor is responsible for pricing all accessories and miscellaneous equipment required to form a complete and operating system. Unless otherwise noted in this Part, equipment quantities shall be as indicated on the drawings.

2.3 SYSTEM PERFORMANCE:

A. At a minimum, each distribution, interconnection, interface, terminating point and TCO shall be capable of supporting the Facility's PA system voice and data service as follows:
1. Shall be compliant with and not degrade the operating parameters of the Public Switched Telephone Network (PSTN) and the Federal Telecommunications System (FTS) at each PSTN and FTS interface, interconnection and terminating locations in the TERs.
2. Audio Input: The signal level of each audio input channel at each input point shall be a MINIMUM of zero decibels measured (dBm), +0.10 dBm across 150 Ohms, balanced.

3. Audio Output: The audio signal level at each speaker shall be a MINIMUM of +0.25 Watt (W) and a maximum of +20 W, 600 Ohms balanced impedance, on a 70.7 V audio distribution line Contractor to determine and set each speaker's proper audio signal level (top) based on speaker location and the ambient noise level in speaker coverage area.
4. The system shall meet the following MINIMUM parameters at each speaker:
   a. Cross Modulation: -46 dB
   b. Hum Modulation: -55 dB
   c. Isolation (outlet-outlet): 24 dB
   d. Impedance:
      1) Distribution: 600 Ohm balanced @ 70.7 V audio line level.
      2) Speaker: Selectable, as required.
   e. Audio Gain: 10 dB minimum @ mid-range measured with a sound pressure level meter (SPL)
   f. Signal to noise (S/N) ratio: 35 dB, minimum

B. Audio Level Processing: The head-end equipment shall consist of audio mixer(s), volume limiter(s) and/or compressor(s), and power amplifier(s) to process, adjust, equalize, isolate, filter, and amplify each audio channel for each zone or sub-zone in the system and distribute them into the system's distribution trunks. It is acceptable to use identified telephone system cable pairs designated for PA use or identified as spare telephone cable pairs by the Facility's Telephone System Contractor.
   1. THE USE OF TELEPHONE CABLE TO DISTRIBUTE PA SIGNALS CARRYING AC OR DC VOLTAGE IS NOT ACCEPTABLE AND WILL NOT BE APPROVED.
   2. Additionally, each remote location shall be provided with the equipment required to ensure the system supervision and designed audio channel capacity at each speaker identified on the contract drawings.

2.4 MANUFACTURERS

A. The products specified shall be new, FCC and UL Listed, labeled and produced by OEM of record. An OEM of record shall be defined as a company whose main occupation is the manufacture for sale of the items of equipment supplied and which:
   1. Maintains a stock of replacement parts for the item submitted,
   2. Maintains engineering drawings, specifications, and operating manuals for the items submitted, and
   3. Has published and distributed descriptive literature and equipment specifications on the items of equipment submitted at least 30 days prior to the Invitation for Bid (IFB).

B. Specifications contained herein as set forth in this document detail the salient operating and performance characteristics of equipment in order for VA to distinguish acceptable items of equipment from unacceptable items of equipment. When an item of equipment is offered or furnished for which there is a specification contained herein, the item of equipment offered or furnished shall meet or exceed the specification for that item of equipment.

C. Equipment Standards and Testing:
   1. The System has been defined herein as connected to systems identified as an Emergency performing Public Safety Support Functions. Therefore, at a minimum, the system shall conform to all aforementioned National and/or Local Public and Life Safety Codes (which ever are the more stringent), NFPA, NEC, this specification, JCAHCO Life Safety Accreditation requirements, and the OEM recommendations, instructions, and guidelines.
   2. All supplies and materials shall be listed, labeled or certified by UL or a nationally recognized testing laboratory (NRTL) where such standards have been established for the supplies, materials or equipment.
   3. The provided equipment required by the System design and approved technical submittal must conform with each UL standard in effect for the equipment, as of the date of the technical submittal (or the date when the RE approved system equipment necessary to be replaced) was technically reviewed and approved by VA. Where a UL standard is in

existence for equipment to be used in completion of this contract, the equipment must bear the approved UL seal.

4. Each item of electronic equipment to be provided under this contract must bear the approved UL seal or the seal of the testing laboratory that warrants the equipment has been tested in accordance with, and conforms to the specified standards. The placement of the UL Seal shall be a permanent part of the electronic equipment that is not capable of being transportable from one equipment item to another.

2.5 PRODUCTS

A. General.

1. Contractor is responsible for pricing all accessories and miscellaneous equipment required to form a complete and operating system. The equipment quantities provided herein shall be as indicated on the drawings with the exception of the indicated spare equipment.
2. Each cabinet shall be provided with internal and external items to maintain a neat and orderly system of equipment, wire, cable and conduit connections and routing.
3. Contractor Furnished Equipment List (CFEs):
   a. The Contractor is required to provide a list of the CFE equipment to be furnished. The quantity, make and model number of each item is required. Select the required equipment items quantities that will satisfy the needs of the system as described herein and with the OEM's concurrence applied to the list(s), in writing.
   b. The following equipment items are the minimum requirements of VA to provide an acceptable system described herein:

Item	Quantity	Unit
1.	As required	Interface Panel(s)
1.a	As required	Electrical Supervision Trouble Enunciator
1.a.1.	As required	Equipment Back Box(s)
1.a.2.	As required	Telephone Access Equipment
1.a.3.	As required	Radio Paging Access Equipment
1.a.3.a.	As required	Radio Pager Equipment
1.a.4.	As required	Wireless Access Equipment
1.a.5.	As required	Personal Communicator Equipment
2.	As required	Lightning Arrestor
3.	As required	Head End Equipment Locations
3.a	As required	Cabinet(s)
3.a.1.	As required	AC Power Conditioner & Filter
3.a.2.	As required	AC Power Strip
3.a.3.	As required	UPS
3.a.3.a	As required	Main Power Amplifiers
3.a.3.b	As required	Remote Power Amplifiers
3.a.3.c	As required	Distributed Amplifiers (When Approved)
3.a.4.	As required	Interconnecting wire Cable(s)
3.a.4.a	As required	Wire Cable Connector(s)
3.a.4.b	As required	Wire Cable Terminator(s)
3.a.4.c	As required	Wire Management System
3.b.	As required	Head End Function(s)
4.	As required	Distribution System(s)
4.a	As required	Equipment Back Box(s)
4.a.1.	As required	Speakers
4.a.1.a	As required	Overhead
4.a.1.b	As required	Horn
4.a.1.c	As required	Outside

4.a.1.d	As required	Speaker w/ Microphone
5.	2 (MIN)	Remote Station(s)
5.a.	As required	Spare Items

B. ENT (aka DEMARC) Room(s):
1. Refer to CFM Physical Security Manual (07-2007) for VA Facilities, Chapters 9.3 & 1) and PG 18-10, EDM, Chapters 7- Table 7-1, 8 & Appendix B, Telecommunications One Line Topology for specific Room and TIP Connection Requirements.

C. TER, TCR, TR, SCC, PCR, STR, HER Rooms and Equipment:
1. Refer to CFM Physical Security Manual (07-2007) for VA Facilities, Chapters 9.3 & 1) and PG 18-10, EDM, Chapters 7- Table 7-1, 8 & Appendix B, Telecommunications One Line Topology for specific Room and TIP Connection Requirements.
2. Interface Equipment:
   a. TER:
      1) Paging adaptor:
         a) The Contractor shall coordinate the installation of the paging adapter(s) designed for use with the Facility's telephone system with the Facility Telephone Contractor or local telephone company.
         b) The Contractor shall provide and install a paging adapter(s) for each zone and sub zone. The paging adapter(s) shall be accessible by dialing a telephone number provided by the Facility's Telephone Contractor. The Paging Adapter shall:
            i. Monitor each audio input and output on the unit.
            ii. Be provided with an electrical supervision panel to provide both audio and visual trouble alarms.
            iii. Be provided as part of the head end equipment and shall be located in the Telephone Switch Room
            iv. Be provided with Executive (aka emergency) Paging Override of all routine paging calls in progress or being accessed to allow system "all call" (aka global) and radio paging calls designated as (Code One Blue) functions.
            v. Be capable of internal time out capability.
            vi. Function completely with the interface module.
            vii. Provide one spare adapter.
         c) Time Out Device: A time out device/capability shall be provided to prevent system "hang-up" due to an off-hook telephone. The device shall be able to be preset from 30 seconds to two (2) minutes. Its function shall not interfere with or override the required "all call" (aka global) operational capability.
            i. Central Processor Module:
            ii. Controls system operations and holds all programmed parameters.
            iii. Data link connection to additional CPU modules.
         d) Power Module: Provides 12V DC @ 800mA to Central Processor Module.
         e) Minimum three (3) Zone Module:
            i. Provides a minimum of three (3) paging zone outputs at 70V audio sound level.
            ii. Background Music inhibit switch for each zone.
      2) Audio Monitor Panel:
         a) The panel shall be EIA/TIA standard for 483 mm (19") cabinet mounting.
         b) It shall be provided in the upper portion of the head-end equipment cabinet.
         c) Provide one (1) spare panel.
      3) Trouble Annunciator Panel:

a) A trouble annunciator panel shall be provided in the head-end cabinet, and at locations as designated on the contract drawings. The panel(s) shall be compatible with or generate electrical and/or electronic supervising signals to continuously monitor the operating condition for the System head-end audio power amplifier(s), remote power amplifier(s), microphone consoles and interconnecting trunks. The panels shall generate an audible and visual signal when the System's supervising system detects an amplifier or trunk-line is malfunctioning.
b) Provide one (1) spare panel.

4) Head-End Equipment
   a) Provide all required power supplies, communications hubs, network switches, intelligent controllers and other devices necessary to form a complete system listed herein. Head-end components may be rack mounted or wall mounted in a metal enclosure.
   b) Provide the head end equipment in the closed telecommunications closet where the PA system is installed to include the minimum equipment listed herein.
   c) Provide minimum of 30 minute battery back-up to system components.

5) Equipment Cabinet: Comply with TIA/EIA-310-D. Lockable, ventilated metal cabinet houses terminal strips, power supplies, amplifiers, system volume control, and other switching and control devices required for conversation channels and control functions
   a) Vertical Equipment Rack, Wall Mounted (to be included inside of the Equipment Cabinet):
   b) 74" (48RU) rack space, Welded Steel construction, Minimum 20" usable depth, Adjustable front mounting rails.
      i. Install the following products in rack provided by same manufacturer or as specified:
      ii. Security screws w/ nylon isolation bushings.
      iii. Textured blank panels.
      iv. Custom mounts for components without rack mount kits.
      v. Security covers.
      vi. Copper Bus Bar.
      vii. Power Sequencer rack mounted power conditioner and (provide as needed) delayed sequencer(s) with two (2) inswitched outlets each and contact closure control inputs.
      viii. Rack mounting: Provide rack mount kit.

6) Amplifier Equipment:
   a) Paging (aka zone):
      i. Inputs for 600-ohm balanced telephone line, LO-Z balanced microphone, and background music.
      ii. Input Sensitivity: Compatible with master stations and central equipment so amplifier delivers full rated output with sound-pressure level of less than 10 dynes/sq. cm impinging on master stations speaker microphones, or handset transmitters
      iii. Automatic Level Control (ALC) for pages, adjustable background music muting level during page, wall or rack mountable.
      iv. 16-ohm, 25V, 25V center tapped (CT), and 70V outputs. Amplifier quantity and size (output power) as needed. Continuous amplifier power rating shall exceed loudspeaker load on amplifier by at least 25%.
      v. Output Power: 70-V balanced line. 80 percent of the sum of wattage settings of connected for each station and speaker

connected in all-call mode of operation, plus an allowance for future stations.

vi. Total Harmonic Distortion: Less than 5 percent at rated output power with load equivalent to quantity of stations connected in all-call mode of operation.

vii. Minimum Signal-to-Noise Ratio: 45 dB, at rated output.

viii. Frequency Response: Within plus or minus 3 dB from 70 to 12,000 Hz.

b) Output Regulation: Maintains output level within 2 dB from full to no load.

c) Amplifier Protection: Prevents damage from shorted or open output.

d) Be provided with electronic supervision function(s).

e) Provide one spare amplifier.

b. TCR:

1) Microphone Paging Console:

a) A console shall be provided in the TCR and PCR's as shown on the drawings.

b) The console shall contain visual enunciators for each connection to the telephone system's Public Address Paging Adapter. The visual enunciators shall display all the System connections to the telephone system being used.

c) The console shall be fully independent of the Facility's telephone system so if the telephone system has a catastrophic failure (aka partial, multiple or total system failure) the microphone console will function normally as if the Facility's telephone system was operating normally. The restoration of the Facility's telephone system shall not affect the System.

d) Each microphone console shall:

i. Be Mounted: Flush unless otherwise indicated, and

ii. suitable for mounting conditions indicated.

iii. Have a Faceplate: Stainless steel or anodized aluminum with tamperproof mounting screws.

iv. Have a system interface Back Box: Minimum Two-gang galvanized steel with 2-1/2 inch minimum depth.

v. Have an Internal Speaker: 3 inches, 2.3 oz. minimum; permanent magnet.

vi. Have a Call Switch: Mount on faceplate. Permits calls to The system.

vii. When approved - in lieu of a standalone microphone, provide a Handset with Hook Switch: Have a Handset with Hook Switch: Telephone type with 24-inch-long, permanently coiled cord. Arrange to disconnect speaker when handset is lifted.

viii. Be provided with an electrical supervision panel to provide both audio and visual trouble alarms to the Nurse Call /Code Blue electrical supervision system.

ix. Be capable of internal time out capability.

x. Be completely compatible with the Telephone Interface unit(s)

2) Electrical Supervision Trouble Annunciator Panel:

a) The Electrical Supervision Trouble Annunciation Panel shall be located in the TCR and PCR's.

b) The panel(s) shall be compatible with the generated electrical and/or electronic supervising signals to continuously monitor the operating condition for the PA system head-end processing equipment, local/remote control consoles, audio power amplifier(s), UPS, power supplies, dome lights and interconnecting trunks. The panels shall

generate an audible and visual signal when the System's supervising system detects a system trouble or trunk-line is malfunctioning.

c) TRs: Locate the PA floor distribution equipment within each TR as required by system design and OEM direction. Provide secured and lockable cabinet/rack(s) as required.

i. General Equipment: Provide all required power supplies, communications hubs, network switches, intelligent controllers and other devices necessary to form a complete system listed herein. Equipment components may be rack mounted or wall mounted in a metal enclosure.

3) Amplifiers:

a) Panging Amplifier Equipment:

b) Refer to the Amplifier characteristics described herein Paragraph 2.4.G.f.

c) Provide one (1) spare amplifier in addition to the spare Head End Amplifier.

4) Distributed Amplifier:

a) Provide the type and number of the amplifier(S) required to meet the system design. Provide this unit as complete and separate technical submittal during the IFB review portion of the project.

b) Provide one spare amplifier for each 20% (or portion thereof) of amplifiers used in the system.

5) Provide the equipment in the nearest TER where the System is installed to include the minimum equipment listed herein.

6) Provide minimum of 30 minute battery (UPS) back-up to system components.

7) Equipment Cabinet: Comply with cabinet requirements as aforementioned.

8) Trouble Annunciator Panel: Comply with the panel characteristics identified herein.

c. SCC, PCR, STR, HER: Refer to PG-18-10, Article 7 for specific required equipment and use minimum aforementioned specifications for population.

D. TIP DISTRIBUTION SYSTEM:

1. System Speakers:

a. Ceiling Cone-Type:

1) Minimum Axial Sensitivity: 91 dB at one meter, with 1-W input.

2) Frequency Response: Within plus or minus 3 dB from 70 to 15,000 Hz.

3) Minimum Dispersion Angle: 100 degrees.

4) Line Transformer: Maximum insertion loss of 0.5 dB, power rating equal to speaker's, and at least four level taps.

5) Enclosures: Steel housings or back boxes, acoustically dampened, with front face of at least 0.0478-inch steel and whole assembly rust proofed and factory primed; complete with mounting assembly and suitable for surface ceiling, flush ceiling, pendant or wall mounting; with relief of back pressure.

6) Baffle: For flush speakers, minimum thickness of 0.032-inch aluminum with textured white finish. Completely fill the baffle with fiberglass.

7) Vandal-Proof, High-Strength Baffle: For flush-mounted speakers, self-aging cast aluminum with tensile strength of 44,000 psi, 0.025-inch minimum thickness; countersunk heat-treated alloy mounting screws; and textured white epoxy finish.

8) Size: 8 inches with 1-inch voice coil and minimum 5-oz. ceramic magnet.

9) Have a minimum of two (2) safety wires installed to a solid surface or use a flexible conduit from ceiling / wall back box to the speaker back box.

10) The speakers and mounting shall be self contained and wall mounted with flush back box at a minimum of 10 meter intervals and shall match (or contrast with, at the direction of the RE) the color of the adjacent surfaces.

11) Provide one spare speaker, mount, and back box for each 50 speakers or portion thereof.

b. Wall Mounted Horne-Type:
1) Each horn speaker shall be provided with a means of adjusting the output level over the rated horn speaker range to an appropriate audio level in the area installed.
2) Provide horn speakers in equipment rooms, mechanical room, supply warehouse areas, loading dock, entrance and exit areas, and at other areas as indicated on the drawings.
3) Speakers shall be all-metal, weatherproof construction; complete with universal mounting brackets.
4) Frequency Response: Within plus or minus 3 dB from 275 to 14,000 Hz.
5) Minimum Power Rating of Driver: 15 W, continuous.
6) Minimum Dispersion Angle: 110 degrees.
7) Line Transformer: Maximum insertion loss of 0.5 dB, power rating equal to speaker's, and at least four level taps.
8) Provide one spare speaker, mount, and back box for each 20 speakers or portion thereof.

c. System Cables: In addition to the TIP provided under Specification Section 27 15 00 – TIP Horizontal and Vertical Communications Cabling, provide the following additional TIP installation and testing requirements, provide the following minimum System TIP cables & interconnections:
1) Line Level Audio and Microphone Cable:
a) Line level audio and microphone cable for inside racks and conduit.
b) Shielded, twisted pair Minimum 22 American Wire Gauge (AWG), stranded conductors and 24 AWG drain wire with overall jacket.
2) Speaker Level (Audio 70.7Volt [V]) Cable, Riser Rated:
a) For use with 70.7 V audio speaker circuits.
b) 18 AWG stranded pair, minimum.
c) UL-1333 listed.
3) Speaker Level Audio Cable, Plenum Rated (70.7V):
a) For use with 70.7 V audio speaker circuits.
b) 18 AWG stranded pair, minimum.
4) All cabling shall be plenum rated.
5) Provide one (1) spare 1,000 foot roll of approved System (not microphone) cable only.

2. Raceways, Back Boxes and conduit:
a. Raceways:
1) In addition to the Raceways, Equipment Room Fittings provided under Specification Sections 27 15 00 TIP Communication Room Fittings and 27 15 00 – TIP Communications Horizontal and Vertical Cabling, provide the following additional TIP raceway and fittings:
2) Each raceway that is open top, shall be: UL certified for telecommunications systems, partitioned with metal partitions in order to comply with NEC Parts 517 & 800 to “mechanically separate telecommunications systems of different service, protect the installed cables from falling out when vertically mounted and allow junction boxes to be attached to the side to interface “drop” type conduit cable feeds.
3) Intercommunication System cable infrastructure: EMT above accessible ceilings, 24 inches on center.
4) Junction boxes shall be not less than 2-1/2 inches deep and 6 inches wide by 6 inches long.
5) Flexible metal conduit is prohibited unless specifically approved by 005OP3B.

b. System Conduit:

1) The PA system is NFPA listed as Emergency / Public Safety Communication System which requires the entire system to be installed in a separate conduit system.
2) The use of centralized mechanically partitioned wireways may be used to augment main distribution conduit on a case by case basis when specifically approved by VA Headquarters (005OP3B).
3) Conduit Sleeves:
   a) The AE has made a good effort to identify where conduit sleeves through full-height and fire rated walls on the drawings, and has instructed the electrician to provide the sleeves as shown on the drawings.
   b) While the sleeves shown on the drawings will be provided by others, the contractor is responsible for installing conduit sleeves and fire-proofing where necessary. It is often the case, that due to field conditions, the nurse-call cable may have to be installed through an alternate route. Any conduit sleeves required due to field conditions or those omitted by the engineer shall be provided by the cabling contractor.

3. Device Back Boxes:
   a. Furnish to the electrical contractor all back boxes required for the PA system devices.
   b. The electrical contractor shall install the back boxes as well as the system conduit. Coordinate the delivery of the back boxes with the construction schedule.
4. Telecommunication Outlets (TCO): Populate each TCO that is required to perform system operations in the locations that were provided and cabled as a part of Specifications Sections 27 11 00 and 27 15 00. Provide additional TCO equipment, interfaces and connections as required by System design. Provide secured pathway(s) and TCOs as required.
5. UPS:
   a. Provide a backup battery or a UPS for the System to allow normal operation and function (as if there was no AC power failure) in the event of an AC power failure or during input power fluctuations for a minimum of four (4) hours.
   b. As an alternate solution, the telephone system UPS may be utilized to meet this requirement at the headend location, as long as this function is specifically approved by the Telephone Contractor and the RE.
   c. The PA Contractor shall not make any attachments or connection to the telephone system until specifically directed to do so, in writing, by the RE.
   d. Provide UPS for all active system components including but not limited to:
      1) System Amplifiers.
      2) Microphone Consoles.
      3) Telephone Interface Units.
      4) TER, TR & Headend Equipment Rack(s).

E. Patient Bedside Prefabricated Units (PBPU):
1. Where PBPU's exist in the Facility; the Contractor shall identify the "gang box" location on the PBPU designated for installation of the telephone jack. This location shall here-in-after be identified as the unit's TCO. The Contractor shall be responsible for obtaining written approval and specific instructions from the PBPU OEM regarding the necessary disassembly and reassembly of each PBPU to the extent necessary to pull wire from above the TIP ceiling junction box to the PBPU's reserved gang box for the unit's TCO. A Contractor provided stainless steel cover plate approved for use by the PBPU OEM and Facility IRM Chief shall finish out the jack installation.
2. Under no circumstances shall the Contractor proceed with the PBPU installations without the written approval of the PBPU OEM and the specific instructions regarding the attachment to or modifying of the PBPU. The RE shall be available to assist the

Contractor in obtaining approvals and instructions in a timely manner as related to the project's time constraints.

3. It is the responsibility of the Contractor to maintain the UL integrity of each PBPU. If the Contractor violates that integrity, it shall be the responsibility of the Contractor to obtain on site UL re-certification of the violated PBPU at the direction of the RE and at the Contractor's expense.

F. Installation Kit:

1. General: The kit shall be provided that, at a minimum, includes all connectors and terminals, labeling systems, audio spade lugs, barrier strips, punch blocks or wire wrap terminals, heat shrink tubing, cable ties, solder, hangers, clamps, bolts, conduit, cable duct, and/or cable tray, etc., required to accomplish a neat and secure installation. All wires shall terminate in a spade lug and barrier strip, wire wrap terminal or punch block. Unfinished or unlabeled wire connections shall not be allowed. Turn over to the RE all unused and partially opened installation kit boxes, coaxial, fiberoptic, and twisted pair cable reels, conduit, cable tray, and/or cable duct bundles, wire rolls, physical installation hardware. The following are the minimum required installation sub-kits:
2. System Grounding:
   a. The grounding kit shall include all cable and installation hardware required. All radio equipment shall be connected to earth ground via internal building wiring, according to the NEC.
   b. This includes, but is not limited to:
      1) Coaxial Cable Shields.
      2) Control Cable Shields.
      3) Data Cable Shields.
      4) Equipment Racks.
      5) Equipment Cabinets.
      6) Conduits.
      7) Duct.
      8) Cable Trays.
      9) Power Panels.
      10) Connector Panels.
      11) Grounding Blocks.
3. Coaxial Cable: The coaxial cable kit shall include all coaxial connectors, cable tying straps, heat shrink tabbing, hangers, clamps, etc., required to accomplish a neat and secure installation.
4. Wire and Cable: The wire and cable kit shall include all connectors and terminals, audio spade lugs, barrier straps, punch blocks, wire wrap strips, heat shrink tubing, tie wraps, solder, hangers, clamps, labels etc., required to accomplish a neat and orderly installation.
5. Conduit, Cable Duct, and Cable Tray: The kit shall include all conduit, duct, trays, junction boxes, back boxes, cover plates, feed through nipples, hangers, clamps, other hardware required to accomplish a neat and secure conduit, cable duct, and/or cable tray installation in accordance with the NEC and this document.
6. 6. Equipment Interface: The equipment kit shall include any item or quantity of equipment, cable, mounting hardware and materials needed to interface the systems with the identified sub-system(s) according to the OEM requirements and this document.
7. 7. Labels: The labeling kit shall include any item or quantity of labels, tools, stencils, and materials needed to completely and correctly label each subsystem according to the OEM requirements, as-installed drawings, and this document.
8. 8. Documentation: The documentation kit shall include any item or quantity of items, computer discs, as installed drawings, equipment, maintenance, and operation manuals, and OEM materials needed to completely and correctly provide the system documentation as required by this document and explained herein.

PART 3 - EXECUTION

3.1 PROJECT MANAGEMENT

A. Assign a single project manager to this project who will serve as the point of contact for the Owner, the General Contractor, and the Engineer.

B. The Contractor shall be proactive in scheduling work at the hospital, specifically the Contractor will initiate and maintain discussion with the general contractor regarding the schedule for ceiling cover up and install cables to meet that schedule.

C. Contact the Office of Telecommunications, Special Communications Team (005OP3B) at (301) 734-0350 to have a VA Certified Telecommunications COTR assigned to the project for telecommunications review, equipment and system approval and co-ordination with VA's Spectrum Management and OCIS Teams.

3.2 COORDINATION WITH OTHER TRADES

A. Coordinate with the cabling contractor the location of the PA system faceplate and the faceplate opening for the PA system back boxes.

B. Coordinate with the cabling contractor the location of TIP equipment in the TER, TCR, PA, PCR, SCC, ECR, STRs, NSs, HER and TCOs in order to connect to the TIP cable network that was installed as a part of Section Specification 27 11 00. Contact the RE immediately, in writing, if additional location(s) are discovered to be activated that was not previously provided.

C. Before beginning work, verify the location, quantity, size and access for the following:
   1. Isolated ground AC power circuits provided for systems.
   2. Junction boxes, wall boxes, wire troughs, conduit stubs and other related infrastructure for the systems.
   3. System components installed by others.
   4. Overhead supports and rigging hardware installed by others.

D. Immediately notify the Owner, GC and Consultant(s) in writing of any discrepancies

3.3 NEEDS ASSESSMENT

A. Provide a one-on-one meeting with the particular manager of each unit affected by the installation of the new PA system. Review the floor plan drawing, educate the nursing manager with the functions of the equipment that is being provided and gather details specific to the individual units; coverage and priorities of calls; staffing patterns; and other pertinent details that will affect system programming and training.

3.4 INSTALLATION

A. General
   1. Execute work in accordance with National, State and local codes, regulations and ordinances.
   2. Install work neatly, plumb and square and in a manner consistent with standard industry practice. Carefully protect work from dust, paint and moisture as dictated by site conditions. The Contractor will be fully responsible for protection of his work during the construction phase up until final acceptance by the Owner.
   3. Install equipment according to OEM's recommendations. Provide any hardware, adaptors, brackets, rack mount kits or other accessories recommended by OEM for correct assembly and installation.
   4. Secure equipment firmly in place, including receptacles, speakers, equipment racks, system cables, etc.
      a. All supports, mounts, fasteners, attachments and attachment points shall support their loads with a safety factor of at least 5:1.
      b. Do not impose the weight of equipment or fixtures on supports provided for other trades or systems.

c. Any suspended equipment or associated hardware must be certified by the OEM for overhead suspension.
d. The Contractor is responsible for means and methods in the design, fabrication, installation and certification of any supports, mounts, fasteners and attachments.

5. Locate overhead ceiling-mounted loudspeakers as shown on drawings, with minor changes not to exceed 12” in any direction.
   a. Mount transformers securely to speaker brackets or enclosures using screws. Adjust torsion springs as needed to securely support speaker assembly.
   b. Speaker back boxes shall be completely filled with fiberglass insulation.
   c. Seal cone speakers to their enclosures to prevent air passing from one side of the speaker to the other.
6. Finishes for any exposed work such as plates, racks, panels, speakers, etc. shall be approved by the Architect, Owner and 005OP3B.
7. Coordinate cover plates with field conditions. Size and install cover plates as necessary to hide joints between back boxes and surrounding wall. Where cover plates are not fitted with connectors, provide grommeted holes in size and quantity required. Do not allow cable to leave or enter boxes without cover plates installed.
8. Active electronic component equipment shall consist of solid state components, be rated for continuous duty service, comply with the requirements of FCC standards for telephone and data equipment, systems, and service.
9. Color code all distribution wiring to conform to the PA Industry Standard, EIA/TIA, and this document, whichever is the more stringent. At a minimum, all equipment, cable duct and/or conduit, enclosures, wiring, terminals, and cables shall be clearly and permanently labeled according to and using the provided record drawings, to facilitate installation and maintenance.
10. Connect the System’s primary input AC power to the Facility’ Critical Branch of the Emergency AC power distribution system as shown on the plans or if not shown on the plans consult with RE regarding a suitable circuit location prior to bidding.
11. Product Delivery, Storage and Handling:
    a. Delivery: Deliver materials to the job site in OEM's original unopened containers, clearly labeled with the OEM's name and equipment catalog numbers, model and serial identification numbers. The RE may inventory the cable, patch panels, and related equipment.
    b. Storage and Handling: Store and protect equipment in a manner, which will preclude damage as directed by the RE.
12. Where TCOs are installed adjacent to each other, install one outlet for each instrument.
13. Equipment installed outdoors shall be weatherproof or installed in weatherproof enclosures with hinged doors and locks with two keys.

B. Equipment Racks:
   1. Fill unused equipment mounting spaces with blank panels or vent panels. Match color to equipment racks.
   2. Provide security covers for all devices not requiring routine operator control.
   3. Provide vent panels and cooling fans as required for the operation of equipment within the OEM' specified temperature limits. Provide adequate ventilation space between equipment for cooling. Follow manufacturer’s recommendations regarding ventilation space between amplifiers.
   4. Provide insulated connections of the electrical raceway to equipment racks.
   5. Provide continuous raceway/conduit with no more than 40% fill between wire troughs and equipment racks for all non-plenum-rated cable. Ensure each system is mechanically separated from each other in the wireway.
   6. Ensure a minimum of 36 inches around each cabinet and/or rack to comply with OSHA Safety Standards. Cabinets and/or Racks installed side by side – the 36” rule applies to around the entire assembly

C. Distribution Frames.

1. A new stand-alone (i.e., self supporting, free standing) PA rack/frame may be provided in each TR to interconnect the PA, TER, TCR, PCR, SCC, STRs & ECRs. Rack/frames shall be wired in accordance with industry standards and shall employ "latest state-of-the-art" modular cross-connect devices. The PA riser cable shall be sized to satisfy all voice/digital requirements plus not less than 50% spare (growth) capacity in each TR which includes a fiber optic backbone.
2. The frames/racks shall be connected to the TER/MCR system ground.

D. Wiring Practice - in addition to the MANDATORY infrastructure requirements outlined in VA Construction Specifications 27 10 00 – TIP Structured Communications Cabling, 27 11 00 – TIP Communications Rooms Fittings and 27 15 00 – TIP Horizontal and Vertical Communicators Cabling, the following additional practices shall be adhered too:
1. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway and Boxes for Electrical Systems."
2. Execute all wiring in strict adherence to the National Electrical Code, applicable local building codes and standard industry practices.
3. Wiring shall be classified according to the following low voltage signal types:
   a. Balanced microphone level audio (below -20dBm) or Balanced line level audio (-20dBm to +30dBm)
   b. 70V audio speaker level audio.
   c. Low voltage DC control or power (less than 48VDC)
4. Where raceway is to be EMT (conduit), wiring of differing classifications shall be run in separate conduit. Where raceway is to be an enclosure (rack, tray, wire trough, utility box) wiring of differing classifications which share the same enclosure shall be mechanically partitioned and separated by at least four (4) inches. Where Wiring of differing classifications must cross, they shall cross perpendicular to one another.
5. Do not splice wiring anywhere along the entire length of the run. Make sure cables are fully insulated and shielded from each other and from the raceway for the entire length of the run.
6. Do not pull wire through any enclosure where a change of raceway alignment or direction occurs. Do not bend wires to less than radius recommended by manufacturer.
7. Replace the entire length of the run of any wire or cable that is damaged or abraided during installation. There are no acceptable methods of repairing damaged or abraided wiring.
8. Use wire pulling lubricants and pulling tensions as recommended by the OEM.
9. Use grommets around cut-outs and knock-outs where conduit or chase nipples are not installed.
10. Do not use tape-based or glue-based cable anchors.
11. Ground shields and drain wires to the Facility's signal ground system as indicated by the drawings.
12. Field wiring entering equipment racks shall be terminated as follows:
    a. Provide ample service loops at harness break-outs and at plates, panels and equipment. Loops should be sufficient to allow plates, panels and equipment to be removed for service and inspection.
    b. Line level and speaker level wiring may be terminated inside the equipment rack using specified terminal blocks (see "Products.") Provide 15% spare terminals inside each rack. Microphone level wiring may only be terminated at the equipment served.
    c. If specified terminal blocks are not designed for rack mounting, utilize ¾" plywood or 1/8" thick aluminum plates/blank panels as a mounting surface. Do not mount on the bottom of the rack.
    d. Employ permanent strain relief for any cable with an outside diameter of 1" or greater.
13. Use only balanced audio circuits unless noted otherwise
14. Make all connections as follows:

a. Make all connections using rosin-core solder or mechanical connectors appropriate to the application.
b. For crimp-type connections, use only tools that are specified by the manufacturer for the application.
c. Use only insulated spade lugs on screw terminals. Spade lugs shall be sized to fit the wire gauge. Do not exceed two lugs per terminal.
d. Wire nuts, electrical tape or “Scotch Lock” connections are not acceptable for any application.

15. Make all connections as follows:
    a. Make all connections using rosin-core solder or mechanical connectors appropriate to the application.
    b. For crimp-type connections, use only tools that are specified by the manufacturer for the application.
    c. Use only insulated spade lugs on screw terminals. Spade lugs shall be sized to fit the wire gauge. Do not exceed two lugs per terminal.
    d. Wire nuts, electrical tape or “Scotch Lock” connections are not acceptable for any application.
16. Noise filters and surge protectors shall be provided for each equipment interface cabinet, switch equipment cabinet, control console, local, and remote active equipment locations to ensure protection from input primary AC power surges and noise glitches are not induced into low Voltage data circuits.
17. Wires or cables previously approved to be installed outside of conduit, cable trays, wireways, cable duct, etc:
    a. Only when specifically authorized as described herein, will wires or cables be identified and approved to be installed outside of conduit. The wire or cable runs shall be UL rated plenum and OEM certified for use in air plenums.
    b. Wires and cables shall be hidden, protected, fastened and tied at 600 mm (24 in.) intervals, maximum, as described herein to building structure.
    c. Closer wire or cable fastening intervals may be required to prevents sagging, maintain clearance above suspended ceilings, remove unsightly wiring and cabling from view and discourage tampering and vandalism. Wire or cable runs, not provided in conduit, that penetrate outside building walls, supporting walls, and two hour fire barriers shall be sleeved and sealed with an approved fire retardant sealant.
    d. Wire or cable runs to system components installed in walls (i.e.: volume attenuators, circuit controllers, signal, or data outlets, etc.) may, when specifically authorized by the RE, be fished through hollow spaces in walls and shall be certified for use in air plenum areas.
    e. Completely test all of the cables after installation and replace any defective cables.
    f. Wires or cables that are installed outside of buildings shall be in conduit, secured to solid building structures. If specifically approved, on a case by case basis, to be run outside of conduit, the wires or cables shall be installed, as described herein. The bundled wires or cables must: Be tied at not less than 460 mm (18 in.) intervals to a solid building structure; have ultra violet protection and be totally waterproof (including all connections). The laying of wires or cables directly on roof tops, ladders, drooping down walls, walkways, floors, etc. is not allowed and will not be approved.

E. Cable Installation - In addition to the MANDATORY infrastructure requirements outlined in VA Construction Specifications 27 10 00 – Structured TIP Communications Cabling, 27 11 00 – TIP Communications Rooms and Fittings and 27 15 00 – TIP Communications Horizontal and Vertical Cabling and the following additional practices shall be adhered too:
1. Support cable on maximum 2’-0” centers. Acceptable means of cable support are cable trays. Velcro wrap cable bundles loosely to the means of support with plenum rated Velcro straps. Plastic tie wraps are not acceptable as a means to bundle cables.
2. Run cables parallel to walls.

3. Install maximum of 10 cables in a single row. Provide necessary rows as required by the number of cables.
4. Do not lay cables on top of light fixtures, ceiling tiles, mechanical equipment, or ductwork. Maintain at least 2'-0" clearance from all shielded electrical apparatus.
5. All cables shall be tested after the total installation is fully complete. All test results are to be documented. All cables shall pass acceptable test requirements and levels. Contractor shall remedy any cabling problems or defects in order to pass or comply with testing. This includes the re-pull of new cable as required at no additional cost to the Owner.
6. Ends of cables shall be properly terminated on both ends per industry and OEM's recommendations.
7. Provide proper temporary protection of cable after pulling is complete before final dressing and terminations are complete. Do not leave cable lying on floor. Bundle and tie wrap up off of the floor until you are ready to terminate.
8. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at outlets and terminals.
9. Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Cables may not be spliced.
10. Bundle, lace, and train conductors to terminal points without exceeding OEM's limitations on bending radii. Install lacing bars and distribution spools.
11. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used.
12. Cable shall not be run through structural members or be in contact with pipes, ducts, or other potentially damaging items.
13. Separation of Wires: (REFER TO RACEWAY INSTALLATION) Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate raceways or, where exposed or in same enclosure, separate conductors at least 12 inches apart for speaker microphones and adjacent parallel power and telephone wiring. Separate other intercommunication equipment conductors as recommended by equipment manufacturer.
14. Serve all cables as follows:
    a. Cover the end of the overall jacket with a 1" (minimum) length of transparent heat-shrink tubing. Cut unused insulated conductors 2" (minimum) past the heat-shrink, fold back over jacket and secure with cable-tie. Cut unused shield/drain wires 2" (minimum) past the Heatshrink and serve as indicated below.
    b. Cover shield/drain wires with heat-shrink tubing extending back to the overall jacket. Extend tubing ¼" past the end of unused wires, fold back over jacket and secure with cable tie.
    c. For each solder-type connection, cover the bare wire and solder connection with heat-shrink tubing.

F. Labeling: Provide labeling in accordance with ANSI/EIA/TIA-606-A. All lettering for PA circuits shall be stenciled using thermal ink transfer process.
1. Cable and Wires (Hereinafter referred to as "Cable"): Cables shall be labeled at both ends in accordance with ANSI/EIA/TIA-606-A. Labels shall be permanent in contrasting colors. Cables shall be identified according to the System "Record Wiring Diagrams."
2. Equipment: System equipment shall be permanently labeled with contrasting plastic laminate or Bakelite material. System equipment shall be labeled on the face of the unit corresponding to its source.
    a. Clearly, consistently, logically and permanently mark switches, connectors, jacks, relays, receptacles and electronic and other equipment.
    b. Engrave and paint fill all receptacle panels using 1/8" (minimum) high lettering and contrasting paint.
    c. For rack-mounted equipment, use engraved Lamacoid labels with white 1/8" (minimum) high lettering on black background. Label the front and back of all rack-mounted equipment.

3. Conduit, Cable Duct, and/or Cable Tray: The Contractor shall label all conduit, duct and tray, including utilized GFE, with permanent marking devices or spray painted stenciling a minimum of 3 meters (10 ft.) identifying it as the System. In addition, each enclosure shall be labeled according to this standard.
4. Termination Hardware: The Contractor shall label TCOs and patch panel connections using color coded labels with identifiers in accordance with ANSI/EIA/TIA-606-A and the "Record Wiring Diagrams."
5. Where multiple pieces of equipment reside in the same rack group, clearly and logically label each indicating to which room, channel, receptacle location, etc. they correspond.
6. Permanently label cables at each end, including intra-rack connections. Labels shall be covered by the same, transparent heat-shrink tubing covering the end of the overall jacket. Alternatively, computer generated labels of the type which include a clear protective wrap may be used.
7. Contractor's name shall appear no more than once on each continuous set of racks. The Contractor's name shall not appear on wall plates or portable equipment.
8. Ensure each OEM supplied item of equipment has appropriate UL Labels / Marks for the service the equipment is performed permanently attached / marked. SYSTEM EQUIPMENT INSTALLED NOT BEARING THESE UL MARKS WILL NOT BE ALLOWED TO BE A PART OF THE SYSTEM. THE CONTRACTOR SHALL BEAR ALL COSTS REQUIRED TO PROVIDE REPLACEMENT EQUIPMENT WITH APPROVED UL MARKS.

G. Conduit and Signal Ducts: When the Contractor and/or OEM determines additional system conduits and/or signal ducts are required in order to meet the system minimum performance standards outlined herein, the contractor shall provide these items as follows:
1. Conduit:
   a. The Contractor shall employ the latest installation practices and materials. The Contractor shall provide conduit, junction boxes, connectors, sleeves, weather heads, pitch pockets, and associated sealing materials not specifically identified in this document as GFE. Conduit penetrations of walls, ceilings, floors, interstitial space, fire barriers, etc., shall be sleeved and sealed.
   b. All cables shall be installed in separate conduit and/or signal ducts (exception from the separate conduit requirement to allow PA cables to be installed in partitioned cable tray with voice cables may be granted in writing by the RE if requested). Conduits shall be provided in accordance with Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and NEC Articles 517 for Critical Care and 800 for Communications systems, at a minimum.
   c. When metal, plastic covered, etc., flexible cable protective armor or systems are specifically authorized to be provided for use in the System, their installation guidelines and standards shall be as specified herein, Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and the NEC.
   d. When "interduct" flexible cable protective systems is specifically authorized to be provided for use in the System, it's installation guidelines and standards shall be as the specified herein, Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and the NEC.
   e. Conduit fill (including GFE approved to be used in the system) shall not exceed 40%. Each conduit end shall be equipped with a protective insulator or sleeve to cover the conduit end, connection nut or clamp, to protect the wire or cable during installation and remaining in the conduit. Electrical power conduit shall be installed in accordance with the NEC. AC power conduit shall be run separate from signal conduit.
   f. Ensure that Critical Care PA Systems (as identified by NEC Section 517) are completely separated and protected from all other systems.
2. Signal Duct, Cable Duct, or Cable Tray:
   a. The Contractor shall use GFE signal duct, cable duct, and/or cable tray, when identified and approved by the RE.

b. Approved signal and/or cable duct shall be a minimum size of 100 mm x 100 mm (4 in. X 4 in.) inside diameter with removable tops or sides, as appropriate. Protective sleeves, guides or barriers are required on all sharp corners, openings, anchors, bolts or screw ends, junction, interface and connection points.

c. Approved cable tray shall be fully covered, mechanically and physically partitioned for multiple electronic circuit use, and be UL certified and labeled for use with telecommunication circuits and/or systems. The RE shall approve width and height dimensions.

d. All cable junctions and taps shall be accessible. Provide an 8” X 8” X 4” (minimum) junction box attached to the cable duct or raceway for installation of distribution system passive equipment. Ensure all equipment and tap junctions are accessible

3.5 PROTECTION OF NETWORK DEVICES

A. Contractor shall protect network devices during unpacking and installation by wearing manufacturer approved electrostatic discharge (ESD) wrist straps tied to chassis ground. The wrist strap shall meet OSHA requirements for prevention of electrical shock, should technician come in contact with high voltage.

3.6 CUTTING, CLEANING AND PATCHING

A. It shall be the responsibility of the contractor to keep their work area clear of debris and clean area daily at completion of work.

B. It shall be the responsibility of the contractor to patch and paint any wall or surface that has been disturbed by the execution of this work.

C. The Contractor shall be responsible for providing any additional cutting, drilling, fitting or patching required that is not indicated as provided by others to complete the Work or to make its parts fit together properly.

D. The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate Contractor the Contractor’s consent to cutting or otherwise altering the Work.

E. Where coring of existing (previously installed) concrete is specified or required, including coring indicated under unit prices, the location of such coring shall be clearly identified in the field and the location shall be approved by the Project Manager prior to commencement of coring work.

3.7 FIREPROOFING

A. Where PA wires, cables and conduit penetrate fire rated walls, floors and ceilings, fireproof the opening.

B. Provide conduit sleeves (if not already provided by electrical contractor) for cables that penetrate fire rated walls and Telecommunications Rooms floors and ceilings. After the cabling installation is complete, install fire proofing material in and around all conduit sleeves and openings. Install fire proofing material thoroughly and neatly. Seal all floor and ceiling penetrations.

C. Use only materials and methods that preserve the integrity of the fire stopping system and its rating.

D. Install fireproofing where low voltage cables are installed in the same manholes with high voltage cables; also cover the low voltage cables with arc proof and fireproof tape.

E. Use approved fireproofing tape of the same type as used for the high voltage cables, and apply the tape in a single layer, one-half lapped or as recommended by the manufacturer. Install the

tape with the coated side towards the cable and extend it not less than 25 mm (one inch) into each duct.

F. Secure the tape in place by a random wrap of glass cloth tape.

3.8 GROUNDING

A. Ground PA cable shields and equipment to eliminate shock hazard and to minimize ground loops, common mode returns, noise pickup, cross talk, and other impairments as specified in CFM Division 27, Section 27 05 26 – Grounding and Bonding for Communications Systems.

B. Facility Signal Ground Terminal: Locate at main room or area signal ground within the room (i.e. head end and telecommunications rooms) or area(s) and indicate each signal ground location on the drawings.

C. Extend the signal ground to inside each equipment cabinet and/or rack. Ensure each cabinet and/or rack installed item of equipment is connected to the extended signal ground. Isolate the signal ground from power and major equipment grounding systems.

D. When required, install grounding electrodes as specified in CFM Division 26, Section 26 05 26 – Grounding and Bonding for Electrical Systems.

E. Do not use "3rd or 4th" wire internal electrical system conductors for communications signal ground.

F. Do not connect the signal ground to the building's external lightning protection system.

G. Do Not "mix grounds" of different systems.

H. Insure grounds of different systems are installed as to not violate OSHA Safety and NEC installation requirements for protection of personnel.

PART 4 - TESTING / GUARANTY / TRAINING

4.1 SYSTEM LISTING

A. The PA System is NFPA listed as an "Emergency / Public Safety" Communications system. Where Code Blue signals are transmitted, that listing is elevated to "Life Support/Safety." Therefore, the following testing and guaranty provisions are the minimum to be performed and provided by the contractor and OEM.

4.2 PROOF OF PERFORMANCE TESTING

A. Intermediate Testing:
   1. After completion of 25 – 30% the installation of a head end cabinet(s) and equipment, one microphone console, local and remote enunciation stations, two (2) zones, two (2) sub zones prior to any further work, this portion of the system must be pretested, inspected, and certified. Each item of installed equipment shall be checked to ensure appropriate UL Listing and Certification Labels are affixed as required by NFPA -Life Safety Code 101-3.2 (a) & (b) and JCHCO evaluation guidelines, and proper installation practices are followed. The intermediate test shall include a full operational test.
   2. All inspections and tests shall be conducted by an OEM-certified contractor representative and witnessed by TVE-005OP3B if there is no local Government Representative that processes OEM and VA approved Credentials to inspect and certify the system. The results of the inspection will be officially recorded by the Government Representative and maintained on file by the RE, until completion of the entire project. The results will be compared to the Acceptance Test results. An identical inspection may be conducted between the 65 - 75% of the system construction phase, at the direction of the RE.

B. Pretesting:

1. Upon completing installation of the PA System, the Contractor shall align, balance, and completely pretest the entire system under full operating conditions.
2. Pretesting Procedure:
   a. During the System Pretest the Contractor shall verify (utilizing approved test equipment) that the System is fully operational and meets all the System performance requirements of this standard.
   b. The Contractor shall pretest and verify that all PA System functions and specification requirements are met and operational, no unwanted aural effects, such as signal distortion, noise pulses, glitches, audio hum, poling noise, etc. are present. At a minimum, each of the following locations shall be fully pretested:
      1) Central Control Cabinets.
      2) Local Control Stations.
      3) Zone Equipment/Systems.
      4) Sub-Zone Equipment/Systems.
      5) Remote Control Panels.
         a) TCR.
         b) PCR/SCC.
      6) All Networked locations.
      7) System interface locations (i.e. TELCO, two way radio, etc.).
      8) System trouble reporting.
      9) System Electrical Supervision.
      10) UPS operation.
      11) STRs.
      12) NSs
      13) TCOs.
3. The Contractor shall provide four (4) copies of the recorded system pretest measurements and the written certification that the System is ready for the formal acceptance test shall be submitted to the RE.

C. Acceptance Test:
1. After the PA System has been pretested and the Contractor has submitted the pretest results and certification to the RE, then the Contractor shall schedule an acceptance test date and give the RE 30 day's written notice prior to the date the acceptance test is expected to begin. The System shall be tested in the presence of TVE 005OP3B and an OEM certified representatives. The System shall be tested utilizing the approved test equipment to certify proof of performance and Emergency / Public Safety compliance. The tests shall verify that the total System meets all the requirements of this specification. The notification of the acceptance test shall include the expected length (in time) of the test.
2. The acceptance test shall be performed on a "go-no-go" basis. Only those operator adjustments required to show proof of performance shall be allowed. The test shall demonstrate and verify that the installed System does comply with all requirements of this specification under operating conditions. The System shall be rated as either acceptable or unacceptable at the conclusion of the test. Failure of any part of the System that precludes completion of system testing, and which cannot be repaired in four (4) hours, shall be cause for terminating the acceptance test of the System. Repeated failures that result in a cumulative time of eight (8) hours to affect repairs shall cause the entire System to be declared unacceptable. Retesting of the entire System shall be rescheduled at the convenience of the Government.
3. Retesting of the entire System shall be rescheduled at the convenience of the Government and costs borne by the Contractor at the direction of the SRE.

D. Acceptance Test Procedure:
1. Physical and Mechanical Inspection:
   a. The TVE 005OP3B Representative will tour all areas where the PA system and all sub-systems are completely and properly installed to insure they are operationally

ready for proof of performance testing. A system inventory including available spare parts will be taken at this time. Each item of installed equipment shall be checked to ensure appropriate UL certification labels are affixed.

b. The System diagrams, record drawings, equipment manuals, TIP Auto CAD Disks, intermediate, and pretest results shall be formally inventoried and reviewed.

c. Failure of the System to meet the installation requirements of this specification shall be grounds for terminating all testing.

2. Operational Test:

a. After the Physical and Mechanical Inspection, the system head end equipment shall be checked to verify that it meets all performance requirements outlined herein. A spectrum analyzer and sound level meter may be utilized to accomplish this requirement.

b. Following the head end equipment test, each speaker (or on board speaker) shall be inspected to ensure there are no signal distortions such as intermodulation, data noise, popping sounds, erratic system functions, on any function.

c. The distribution system shall be checked at each interface, junction, and distribution point, first, middle, and last speaker in each leg to verify the PA distribution system meets all system performance standards.

d. If the RED system is a part of the system, each volume stepper switches shall be checked to insure proper operation of the pillow speaker, the volume stepper and the RED system (if installed).

e. Additionally, each installed head end equipment, microphone console; amplifier, mixer, distributed speaker/amplifier, monitor speaker, telephone interface, power supply and remote amplifiers shall be checked insuring they meet the requirements of this specification.

f. Once these tests have been completed, each installed sub-system function shall be tested as a unified, functioning and fully operating system. The typical functions are: “all call,” three sub-zoned, minimum of 15 minutes of UPS operation, electrical supervision, trouble panel, corridor speakers and audio paging.

g. Individual Item Test: The TVE 005OP3B Representative will select individual items of equipment for detailed proof of performance testing until 100% of the System has been tested and found to meet the contents of this specification. Each item shall meet or exceed the minimum requirements of this document.

3. Test Conclusion:

a. At the conclusion of the Acceptance Test, using the generated punch list (or discrepancy list) the VA and the Contractor shall jointly agree to the results of the test, and reschedule testing on deficiencies and shortages with the RE. Any retesting to comply with these specifications will be done at the Contractor's expense.

b. If the System is declared unacceptable without conditions, all rescheduled testing expenses will be borne by the Contractor.

E. Acceptable Test Equipment: The test equipment shall furnished by the Contractor shall have a calibration tag of an acceptable calibration service dated not more than 12 months prior to the test. As part of the submittal, a test equipment list shall be furnished that includes the make and model number of the following type of equipment as a minimum:

1. Spectrum Analyzer.
2. Signal Level Meter.
3. Volt-Ohm Meter.
4. Sound Pressure Level (SPL) Meter.
5. Oscilloscope.
6. Random Noise Generator.
7. Audio Amplifier with External Speaker.

4.3 WARRANTY

A. Comply with FAR 52.246-21, except that warranty shall be as follows:

B. Contractor's Responsibility:
1. The Contractor shall warranty that all provided material and equipment will be free from defects, workmanship and will remain so for a period of two (2) years from date of final acceptance of the System by the VA. The Contractor shall provide OEM's equipment warranty documents, to the RE (or Facility Contracting Officer if the Facility has taken procession of the building), that certifies each item of equipment installed conforms to OEM published specifications.
2. The Contractor's maintenance personnel shall have the ability to contact the Contractor and OEM for emergency maintenance and logistic assistance, remote diagnostic testing, and assistance in resolving technical problems at any time. This contact capability shall be provided by the Contractor and OEM at no additional cost to the VA.
3. All Contractor maintenance and supervisor personnel shall be fully qualified by the OEM and must provide two (2) copies of current and qualified OEM training certificates and OEM certification upon request.
4. Additionally, the Contractor shall accomplish the following minimum requirements during the two year guaranty period:
   a. Response Time During the Two Year Guaranty Period:
      1) The RE (or Facility Contracting Officer if the system has been turned over to the Facility) is the Contractor's ONLY OFFICIAL reporting and contact official for nurse call system trouble calls, during the guaranty period.
      2) A standard work week is considered 8:00 A.M. to 5:00 P.M. or as designated by the RE (or Facility Contracting Officer), Monday through Friday exclusive of Federal Holidays.
      3) The Contractor shall respond and correct on-site trouble calls, during the standard work week to:
         a) A routine trouble call within one (1) working day of its report. A routine trouble is considered a trouble which causes a power supply; one (1) master System control station, microphone console or amplifier to be inoperable.
         b) Routine trouble calls in critical emergency health care facilities (i.e., cardiac arrest, intensive care units, etc.) shall also be deemed as an emergency trouble call. The RE (or Facility Contracting Officer) shall notify the Contractor of this type of trouble call.
         c) An emergency trouble call within four (4) hours of its report. An emergency trouble is considered a trouble which causes a sub-zone, zone, distribution point, terminal cabinet, or all call system to be inoperable at anytime.
      4) If a PA System component failure cannot be corrected within four (4) hours (exclusive of the standard work time limits), the Contractor shall be responsible for providing alternate System equipment. The alternate equipment/system shall be operational within a maximum of 12 hours after the four (4) hour trouble shooting time and restore the effected location operation to meet the System performance standards. If any sub-system or major system trouble cannot be corrected within one working day, the Contractor shall furnish and install compatible substitute equipment returning the System or sub-system to full operational capability, as described herein, until repairs are complete.
   b. Required On-Site Visits During the Two Year Guaranty Period
      1) The Contractor shall visit, on-site, for a minimum of eight (8) hours, once every 12 weeks, during the guaranty period, to perform system preventive maintenance, equipment cleaning, and operational adjustments to maintain the System according the descriptions identified in this document.
      2) The Contractor shall arrange all Facility visits with the RE (or Facility Contracting Officer) prior to performing the required maintenance visits.
      3) Preventive maintenance procedure(s)shall be performed by the Contractor in accordance with the OEM's recommended practice and service intervals

during non-busy time agreed to by the RE (or Facility Contracting Officer) and Contractor.

4) The preventive maintenance schedule, functions and reports shall be provided to and approved by the RE (or Facility Contracting Officer).

5) The Contractor shall provide the RE (or Facility Contracting Officer) a type written report itemizing each deficiency found and the corrective action performed during each required visit or official reported trouble call. The Contractor shall provide the RE with sample copies of these reports for review and approval at the beginning of the Acceptance Test. The following reports are the minimum required:
   a) The Contractor shall provide a monthly summary all equipment and sub-systems serviced during this warranty period to RE (or Facility Contracting Officer) by the fifth (5th) working day after the end of each month. The report shall clearly and concisely describe the services rendered, parts replaced and repairs performed. The report shall prescribe anticipated future needs of the equipment and systems for preventive and predictive maintenance.
   b) The Contractor shall maintain a separate log entry for each item of equipment and each sub-system of the System. The log shall list dates and times of all scheduled, routine, and emergency calls. Each emergency call shall be described with details of the nature and causes of emergency steps taken to rectify the situation and specific recommendations to avoid such conditions in the future.

6) The RE (or Facility Contracting Officer) shall convey to the Facility Engineering Officer, two (2) copies of actual reports for evaluation.
   a) The RE (or Facility Contracting Officer) shall ensure a copy of these reports is entered into the System's official acquisition documents.
   b) The Facility Chief Engineer shall ensure a copy of these reports is entered into the System's official technical record documents.

C. Work Not Included: Maintenance and repair service shall not include the performance of any work due to improper use; accidents; other vendor, contractor, or owner tampering or negligence, for which the Contractor is not directly responsible and does not control. The Contractor shall immediately notify the RE or Facility Contracting Officer in writing upon the discovery of these incidents. The RE or Facility Contracting Officer will investigate all reported incidents and render an official opinion in writing concerning the supplied information.

4.4 TRAINING

A. Provide thorough training of all biomed engineering and electronic technical staff assigned to those nursing units receiving new networked nurse/patient communications equipment. This training shall be developed and implemented to address two different types of staff. Floor nurses/staff shall receive training from their perspective, and likewise, unit secretaries (or any person whose specific responsibilities include answering patient calls and dispatching staff) shall receive operational training from their perspective. A separate training room will be set up that allows this type of individualized training utilizing in-service training unit, prior to cut over of the new system.

B. Provide the following minimum training times and durations:
   1. 48 hours prior to opening for BME / Electronic Staff (in 8-hour increments) – split evenly over 3 weeks and day and night shifts. Coordinate schedule with Owner.
   2. 32 hours during the opening week for Telephone Staff – both day and night shifts.
   3. 24 hours for supervisors and system administrators.

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SECTION 27 51 23

INTERCOMMUNICATIONS AND PROGRAM SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies a new and fully operating Intercom (IC) System. The system shall provide a large 7-inch (180 mm) touch screen monitor for clear visitor identification and easy operation control. The system shall be installed at a maximum of 8 door locations and connected to a maximum of 8 inside locations with internal communication between stations. Connection to and integration of CCTV cameras for surveillance capabilities shall be available.

1. The system shall be hard wired and constructed with a Cat 6E communication system for the door stations and for the video locations system.
2. Hearing Assistance: Provide T-Coil connection for hearing aids.

B. Conform to VAAR 852.236.91 and intent of the construction documents, recognizing that it may be impracticable to detail all items because of variances in manufacturers to achieve indicated intent.

1.2 RELATED WORK

A. Connection to Electronic Access Control at doors: Section 28 13 00, PHYSICAL ACCESS CONTROL SYSTEM.

B. Door hardware and operation of doors: 08 71 00 DOOR HARDWARE

C. Conduit and boxes: Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS.

D. Electrical conductors and cables: Section 27 10 00, CONTROL, COMMUNICATION AND SIGNAL WIRING.

E. Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents: Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.

F. Requirements for interfacing with Facility's SMS: Section 28 31 00, PHYSICAL ACCESS CONTROL SYSTEM.

1.3 SUBMITTALS

A. In addition to requirements of SECTION 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS, submit:

1. Written certification from OEM proposed provider of contract maintenance is an authorized representative of OEM. Include provider's legal name, address, and OEM credentials.
2. Submit names, locations and point of contact for three installations employing proposed OEM IC Systems of comparable size and complexity performing for at least one year after final acceptance by user.

B. Certifications:

1. Submit documentation that supplier has been an authorized distributor and service organization for OEM for a minimum of three years and is authorized by OEM to pass thru OEM's warranty of installed equipment to Government.
2. Submit certificate of successful completion of OEM's installation and training program for each installing technician of equipment being proposed. Provide current OEM certifications for installers to be approved by COR before being allowed to commence work on system.

3. Provide current OEM certification documenting maintenance and supervisory personnel are authorized by OEM to service installed equipment during warranty.
4. Furnish copies of applicable national, state and local licenses.

C. Warranty: Submit OEM warranty.

D. Needs Assessment Report: Provide a summary report of the needs assessment meeting conducted with nursing manager of each unit, as required by this section.

E. Maintenance Material Submission:
1. Provide one spare 304 m (1,000 foot) roll of accepted system (not microphone) cable.

1.4 QUALITY ASSURANCE

A. Assign only technicians trained, qualified, and certified by OEM on engineering, installation, operation and testing of system.

B. Provide system firmware from OEM with a proven history of product reliability and sole control over all source code.

1.5 WARRANTY

A. Comply with FAR clause 52.246-21, except that warranty must be as follows:
1. Manufacturer shall warranty their equipment and certified installation for a minimum of two years from date of installation and final acceptance by the Government.
2. Provide, free of charge, product firmware and software upgrades for a period of one year from date of final acceptance by Government for any product feature enhancements.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide voice and video communication between wall-mounted intercom stations and desk or wall-mounted master stations.

B. Provide accessories and miscellaneous appurtenances required for a complete and operating communications system and network.

C. Coordinate features and select components to form an integrated IC system. Match components and interconnections for optimum performance of specified functions.

D. Expansion Capability: Increase number of Room Speaker-Microphone stations in future by 25 percent above those indicated without adding any internal or external components or trunk cable conductors.

E. Equipment: Modular type, continuous duty rated.

F. Weather-Resistant Equipment: Listed by a National Recognized Testing Laboratory (NRTL) for operation in wet, damp or outdoor locations.

G. Install IC head end equipment in room 105 and connect doors 100, 101C, 103, 122, 165, and CLCB. Provide zoned, one-way voice & video paging through distributed, wall-mounted units. Interconnect so voice input into IC is by zone from main console at Info Desk in Foyer .

2.2 PERFORMANCE CRITERIA

A. In addition to requirements of Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS, the minimum requirements for each system are:
1. Wired IC systems approved to connect to separate communications system (i.e. SMS, WAN, LAN includes: Telephone, Nurse Call, radio paging, wireless systems) minimum requirements:
   a. NIST FIPS Pub 140/2.
   b. UL 60950-1, edition 2.
2. IEC 62368-1 ed 2: 2014.

3. Code of Federal Regulations, Title 47, Part 15 (or FCC Part 15) Listed Radio Equipment is not permitted.

B. Provide system with configuration programming capable of being executed remotely via a remote connection (when specifically accepted by Spectrum Management and COMSEC Services (SMCS 0050P2H3) without any exchange of parts.

2.3 EQUIPMENT ITEMS

A. Microprocessor-Switched System:
1. Master Station Features:
2. The Master Station shall accommodate up to 8 Door Stations and 8 Master Stations in a single system.
3. Provide icon driven One Touch Hands Free operation. Touch the screen to communicate with visitors using the built-in microphone and speaker or use the handset at any time during conversation for privacy.
4. Operation: From Master Station. Provide the following.
   a. Room Call: Touch screen icon to call a single sub master station or all sub master stations simultaneously.
   b. Play: Touch screen icon to play recorded images from door stations.
   c. Settings: Touch screen icon to program settings and adjustments.
   d. Security: Touch screen icon to activate the security mode or to change security settings.
   e. Monitor: Touch screen icon to monitor a door station or sub master station.
   f. Option: Touch screen icon to activate the connected external device(s).
5. Available Functions During Monitoring: Provide the following.
   a. Pan-Tilt-Zoom/Wide camera control.
   b. When monitoring is started, an image shall be shown in wide mode. Pan & Tilt and adjusting images shall be possible from the Master Station.
   c. Door release shall be possible from the Master Station.
   d. Volume control shall be possible from the Master Station.
   e. Manual recording shall be possible from the Master Station.
6. Physical Characteristics:
   a. Power supply: DC 24V (from power supply).
   b. Current Consumption: 390 mA.
   c. Communication: Handset - Simultaneous communication.
   d. Communication: Hands-free - Auto-voice actuation.
   e. Ambient Temperature 32 degree F to 104 degree F (0 to 40 degrees C).
   f. Monitor: 7 inches (180 mm) color LCD monitor.
   g. Mounting: Wall mount.
   h. Electrical box: 3-gang box
   i. Material: Flame resistant ABS resin.
   j. Color: White.
   k. Dimensions: 5-11/16 inches H x 10-1/16 inches W x 1-7/8 inches D (145 mm by 255 mm by 48 mm).
   l. Weight: Approx. 1.74 lbs (790 g).

B. Room Station (Sub Master Station):
1. Provide icon driven One Touch Hands Free operation. Touch the screen to communicate using the built-in microphone and speaker or use the handset at any time during conversation for privacy.
2. Physical Characteristics:
   a. Power supply: DC 24V (from power supply).
   b. Current Consumption: 200 mA.
   c. Communication: Handset - Simultaneous communication.
   d. Communication: Hands-free - Auto-voice actuation.
   e. Ambient Temperature: 32 degree F to 104 degrees F (0 to 40 degrees C).

f. Monitor: 7 inch color LCD monitor.
g. Electrical box: 3-gang box.
h. Material: Flame resistant ABS resin.
i. Color: White.
j. Dimensions: 5-11/16 inches H x 10-1/16 inches W x 1-7/8 inches D (145 mm by 255 mm by 48 mm).
k. Weight: Approx. 1.74 lbs (790 g).

C. Door/Entrance Station:
1. The Door Entrance Station shall automatically record images. Recording starts approximately 2 seconds after receiving a call.
2. 170 degree wide angle and 100 degree vertical angle camera to minimize blind spots, ensuring a clear view of the door station area.
3. Zoom for Clarity/ Pantilt for Control:
a. Video door stations feature a wide angle camera to observe more activity behind the door. In addition, digital PanTilt and Zoom can focus on an area for greater detail.
b. Oversized buttons and intuitive icons allow for quick navigation and control. Conventional push buttons shall not be permitted.
c. Equipped with an advanced light adjustment feature to compensate for varying light levels. If a picture is too dark, increase of the brightness level at the door station shall be controlled at the master station.
4. Record Images of Visitors:
a. After a call is placed, the Door Entrance Station records 6 images per call to internal memory.
b. Provide an SD / SDHC card (not included) as the primary storage location, with which recording frequency increases to 4 pictures per second for up to 10 seconds per call.
c. Provide documentation of outside disturbances by manually recording them at any time.
5. Physical Characteristics:
a. Operating Temperature: 14 degrees F to 140 degrees F (-10 to 60 degrees C).
b. Dimensions:
1) JP-DA 5-1/8 inches x 3-7/8 inches x 1-9/16 inches (131 x 99 x 40 mm).
2) JP-DV 6-13/16 inches x 3-7/8 inches x 1 inch (173 x 98 x 25 mm).
3) JP-DVF 8-1/4 inches x 5-5/16 inches x 7/32 inch (209 x 135 x 5.5 mm).
4) JP-DVF back box 7-3/32 inches x 4-3/8 inches x 1-25/32 inches (180 x 110 x 45 mm)
c. Power Supply: DC 24V (from master station).
d. Current Consumption: 90 mA.
e. Mounting:
1) Surface mount to 2x4 electrical box.
2) Surface mount direct to surface.
3) Flush mount with included back box.
f. Weight:
1) 1.3 lbs (550g).
2) Back Box: 0.95 lbs (430g).

D. Power Supply: PS-2420UL, 24V DC Power supply.

E. Distribution Adaptor: JP-8Z.
1. Power Supply: DC 24V (from power supply)
2. Current Consumption: 90 mA
3. Operating Temperature: 32 degree F to 104 degrees F (0 to 40 degrees C).
4. Mounting: Wall-mount.
5. Weight: Approx. 7.5 oz (210 g).

2.4 HEAD END EQUIPMENT

A. Provide required power supplies, communications hubs, network switches, intelligent controllers and other devices necessary to form a complete system.

B. Head end components can be rack mounted or wall mounted in a metal enclosure.

C. Provide head end equipment in telecommunications room where IC system is installed.

D. Provide minimum 30 minute battery back-up (or UPS) to system components.

2.5 SYSTEM CABLES

A. Comply with SECTION 27 10 00, CONTROL, COMMUNICATION AND SIGNAL WIRING for specific installation and testing requirements.

B. Conductors: Jacketed, twisted pair and twisted multipair, untinned solid copper; sizes as recommended by system manufacturer, but no smaller than No. 22 AWG.

C. Insulation: Thermoplastic; minimum 0.8 mm (1/32 inch) thick.

D. Shielding: For speaker-microphone leads and elsewhere where recommended by manufacturer; No. 34 AWG, tinned, soft-copper strands formed into a braid or equivalent foil.

E. Minimum Shielding Coverage on Conductors: 60 percent.

F. Cabling must be riser rated, plenum rated in designated spaces.

2.6 RACEWAYS

A. Raceways and Boxes: Comply with requirements in Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS.

B. Each open top raceway must be NRTL listed for telecommunications systems and partitioned with metal partitions in order to comply with NEC Parts 517 and 800 to “mechanically separate” telecommunications systems of different service, protect installed cables from falling out when vertically mounted and allow junction boxes to be attached to the side to interface “drop” type conduit cable feeds.

C. IC System Cable Infrastructure: EMT and cable tray NRTL classified for suitability and NRTL listed for telecommunications.

D. Pull boxes must be minimum 63.5 mm (2-1/2 inches) deep and 152.4 mm (6 inches) wide by 152.4 (6 inches) long.

2.7 UNINTERRUPTIBLE POWER SUPPLY (UPS)

A. Provide UPS for system to allow normal operation and function (as if there was no AC power failure) in event of an AC power failure or during input power fluctuations for a minimum of 30 minutes.

B. As an alternative solution, telephone system UPS can be utilized to meet this requirement at head-end location, as long as this function is specifically accepted by telephone contractor and COR.
   1. Do not make any attachments or connection to telephone system until specifically directed to do so, in writing, by COR.

C. Provide UPS for active system components including:
   1. System Amplifiers.
   2. Microphone Consoles.
   3. System Interface Units.
   4. Head End Equipment Racks.
   5. Control Consoles.

2.8 FINISHES

A. Provide finishes for exposed work such as plates, racks, panels, speakers, etc. accepted by design professional, COR and 005OP3B.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Review and coordinate with telecommunications cabling installer for location of intercom equipment in Telecommunications Rooms.

B. Verification of Conditions: Before beginning work, verify location, quantity, size and access for the following:
   1. Isolated ground AC power circuits provided for systems.
   2. Pull boxes, wall boxes, wire troughs, conduit stubs and other related infrastructure for systems.
   3. System components installed by others.
   4. Overhead supports and rigging hardware installed by others.

C. Installer must immediately notify COR, general contractor and design professional in writing of any discrepancies.

D. Needs Assessment:
   1. Provide a one-on-one meeting with nursing manager of each unit affected by installation of system.
   2. Review floor plans and drawings, educate nursing manager on functions of the equipment and gather details specific to individual units; coverage and priorities of calls; staffing patterns; and other pertinent details that affect system programming and training.
   3. Prepare a summary report of the assessment.

3.2 INSTALLATION

A. General:
   1. Install work plumb and square and in a manner consistent with standard industry practice.
   2. Protect work from dust, paint and moisture as dictated by site conditions. Contractor is responsible for protection of work until final acceptance by Government.
   3. Install equipment according to OEM's recommendations.
   4. Provide any hardware, adaptors, brackets, rack mount kits or other accessories recommended by OEM for complete assembly and installation.
   5. Secure equipment firmly in place, including IC stations, speakers, equipment racks, system cables, etc.:
      a. Supports, mounts, fasteners, attachments and attachment points must support loads with a safety factor of at least 5:1.
      b. Do not impose weight of equipment on supports provided for other trades or systems.
      c. Any suspended equipment or associated hardware must be certified by OEM for overhead suspension.
      d. Contractor is responsible for means and methods in design, fabrication, installation and certification of any supports, mounts, fasteners and attachments.
   6. Coordinate cover plates with field conditions. Size and install cover plates to hide joints between back boxes and surrounding wall. Do not allow cable to leave or enter boxes without cover plates installed.
   7. Where cover plates are not fitted with connectors, provide grommeted holes in size and quantity required.

B. Equipment Racks:

1. Fill unused equipment mounting spaces with blank panels or vent panels; match color to equipment racks.
2. Provide security covers for devices not requiring routine operator control.
3. Provide vent panels and cooling fans as required for operation of equipment within OEM's specified temperature limits.
   a. Provide adequate ventilation space between equipment for cooling.
   b. Follow manufacturer’s recommendations regarding ventilation space between amplifiers.
4. Provide insulated connections of raceway to equipment racks.
5. Provide continuous conduit with no more than 40 percent fill between wire troughs and equipment racks for non-plenum-rated cable.
6. Ensure each system is mechanically separated from each other in wireway.

C. Wiring Practice: In addition to requirements in Section 27 10 00, STRUCTURED CABLING, adhere to the following additional practices:
   1. Execute wiring in strict adherence to National Electrical Code, applicable local building codes and standard industry practices.
   2. Where raceway and wire way are EMT (conduit), wiring of differing classifications must be run in separate conduit.
   3. Where raceway and wire way are an enclosure (rack, tray, wire trough, utility box) wiring of differing classifications which share same enclosure must be mechanically partitioned and separated by 102 mm (four inches). Where wiring of differing classifications must cross, they must cross perpendicular to one another.
   4. Do not splice wiring anywhere along entire length of run.
   5. Make sure cables are insulated and shielded from each other and from raceway for entire length of run.
   6. Do not pull wire through any enclosure where a change of raceway alignment or direction occurs.
   7. Do not bend wires to less than radius recommended by manufacturer.
   8. Replace entire length of run of any wire or cable that is damaged or abraded during installation. There are no acceptable methods of repairing damaged or abraded wiring.
   9. Do not apply wire pulling lubricants unless specifically recommended by cable OEM.
   10. Use grommets around cut-outs and knock-outs where conduit or chase nipples are not installed.
   11. Do not use tape-based or glue-based cable anchors.
   12. Bond shields and drain wires to ground.
   13. Terminate field wiring entering equipment racks as follows:
      a. Provide service loops at harness break-outs, plates, panels and equipment to allow plates, panels and equipment to be removed for service and inspection.
      b. Line level and speaker level wiring can be terminated inside equipment rack using specified terminal blocks.
      c. Provide 15 percent spare terminals inside each rack.
      d. Microphone level wiring can only be terminated at equipment served.
      e. If specified terminal blocks are not designed for rack mounting, utilize 3/4 inch plywood or 1/8 inch thick aluminum plates/blank panels as a mounting surface.
      f. Do not mount terminal blocks on bottom of rack.
      g. Employ permanent strain relief for any cable with an outside diameter of 1 inch or greater.
   14. Use only balanced audio circuits unless indicated otherwise.
   15. Make connections as follows:
      a. Use rosin-core solder or mechanical connectors appropriate to application.
      b. For crimp-type connections, use only crimp tool specified by manufacturer for the application.
      c. Use only insulated spade lugs on screw terminals. Spade lugs must be sized to fit wire gauge; do not exceed two lugs per terminal.
      d. Twist on wire connectors and electrical tape are not permitted for any application.

D. Cable Installation: In addition to requirements in Section 27 10 00, STRUCTURED CABLING, comply to the following practices.
   1. Acceptable means of cable support are cable tray, wire way, and conduit. Hook and loop wrap cable bundles loosely to cable tray with plenum rated Velcro straps. Plastic tie wraps are not permitted as a means to bundle or support cables.
   2. Run cables parallel to walls.
   3. Do not lay cables on top of luminaires, ceiling tiles, mechanical equipment, or ductwork.
   4. Maintain minimum 61 cm (2'-0") clearance from all shielded electrical apparatus.
   5. Test cables after the total installation is complete. Document test results. Remedy any cabling problems or defects in order to pass or comply with testing. This includes re-pull of new cable as required.
   6. Terminate both ends of cables per industry and OEM's recommendations.
   7. Provide proper temporary protection of cable after pulling is complete before final dressing and terminations are complete. Do not leave cable lying on floor. Bundle and tie wrap up off of the floor until ready to terminate.
   8. Cover end of overall jacket with minimum 25.4 mm (1 inch) length of transparent heat-shrink tubing.
      a. Cut unused insulated conductors minimum 50.8 mm (2 inches) passed heat-shrink, fold back over jacket and secure with cable-tie.
      b. Cut unused shield/drain wires minimum 50.8 mm (2 inches) passed heat-shrink cover shield/drain wires with heat-shrink tubing extending to overall jacket. Extend tubing 6 mm (1/4 inch) passed end of unused wires, fold back over jacket and secure with cable tie.
   9. For each solder-type connection, cover bare wire and solder connection with heat-shrink tubing.
   10. Terminate conductors; no cable must contain unterminated elements. Make terminations only at outlets and terminals.
   11. Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Cables cannot be spliced.
   12. Bundle, lace, and train conductors to terminal points without exceeding OEM's limitations on bending radii. Install lacing bars and distribution spools.
   13. Cold-Weather Installation: Bring cable to room temperature before de-reeling. Heat lamps are not permitted.
   14. Cable must not be run through structural members or be in contact with pipes, ducts, or other potentially damaging items.
   15. Separation of Wires: (Refer to Raceway Installation)
      a. Separate speaker-microphone, line-level, speaker-level, and power wiring runs.
      b. Install in separate raceways or, where exposed or in same enclosure, separate conductors at minimum 30.5 cm (12 inches) apart for speaker microphones and adjacent parallel power and telephone wiring.
      c. Separate other intercommunication equipment conductors as recommended by equipment manufacturer.

E. System Conduit: Install manufactured conduit sweeps and long radius elbows according to wire and cable OEM instructions.

F. Labeling:
   1. Permanently mark switches, connectors, jacks, relays, receptacles and electronic and other equipment.
   2. Engrave and paint fill receptacle panels using minimum 3.17 mm (1/8 inch) high lettering and contrasting paint.
   3. For rack-mounted equipment, use engraved Lamacoid labels with white minimum 3.17 mm (1/8 inch) high lettering on black background. Label front and back of rack-mounted equipment.
   4. Where multiple pieces of equipment reside in same rack group, label each indicating to which room, channel, receptacle location, etc. they correspond.

5. Permanently label cables at each end, including intra-rack connections. Labels must be covered by same, transparent heat-shrink tubing covering end of overall jacket. Alternatively, provide computer generated labels of type which include a clear protective wrap.
6. Contractor's name cannot appear more than once on each continuous set of racks. Contractor's name cannot appear on wall plates or portable equipment.
7. Ensure each piece of OEM supplied equipment has appropriate NRTL labels for the service equipment is performing. Equipment installed not bearing NRTL label will not be permitted. Contractor is responsible to provide listed replacement equipment with approved NRTL label.

G. Protection during Installation:
1. Protect electronic devices during unpacking and installation by wearing electrostatic discharge (ESD) wrist straps tied to chassis ground.
2. Wrist straps must meet OSHA requirements for prevention of electrical shock, if technician comes in contact with high voltage.

H. Cutting and Patching:
1. Keep work area clear of debris and clean area daily at completion of work.
2. Patch and paint any wall or surface that has been disturbed by execution of this work.
3. Provide any additional cutting, drilling, fitting or patching required that is not indicated as provided by others to complete work or to make its parts fit together properly.
4. Do not damage or endanger fully or partially completed construction of Government or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. Contractor cannot cut or otherwise alter such construction by facility or separate contractor except with written consent of Government or of such separate contractor; such consent cannot be unreasonably withheld. Contractor cannot unreasonably withhold consent to cutting or otherwise altering work, by facility or a separate contractor.
5. Where coring of in-place concrete is specified or required, including coring indicated under unit prices, location of such coring must be identified in the field and accepted by COR prior to commencement of coring work.

I. Fireproofing:
1. Fireproof openings where IC cables penetrate fire rated walls, floors and ceilings.
2. Provide conduit sleeves (if not already provided) for cables that penetrate fire rated walls and floors and ceilings. After cabling installation is complete, install fire proofing material in and around conduit sleeves and openings. Install fire proofing material thoroughly and neatly. Seal floor and ceiling penetrations.
3. Use only materials and methods that preserve integrity of fire stopping system and its rating.

J. Grounding:
1. Provide grounding system per Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.
2. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common mode returns, noise pickup, cross talk, and other impairments.
3. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.
4. Install grounding electrodes as specified in Section 27 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
5. Do not use "3rd or 4th" wire internal electrical system conductors for ground.
6. Do not connect system ground to building's external lightning protection system.
7. Do not "mix grounds" of different systems.

3.3 FIELD QUALITY CONTROL

A. Assign only technicians trained, qualified, and certified by OEM on engineering, installation, operation, and testing of system.

B. Performance Testing:
1. Intermediate Testing:
   a. After completion of 25 percent of installation of equipment, including one master station, and remote station, and prior to any further work, this portion of system must be pretested, inspected, and certified. Check each item of installed equipment to ensure appropriate NRTL labels are affixed, NFPA, Life Safety, and Joint Commission guidelines are followed, and proper installation practices are followed. Include a full operational test.
   b. Arrange for inspection and test conducted by a factory-certified representative to be witnessed by Government and SMCS 005OP2H3 at a minimum and COR. An identical inspection can be conducted between 65 and 75 percent of system construction phase, at direction of COR.
2. Pretesting:
   a. Upon completing installation of system:
      1) Align, balance, and completely pretest entire system under full operating conditions.
      2) Verify (utilizing approved test equipment) system is operational and meets performance requirements of this standard.
      3) Verify that system functions are operational, and no unwanted aural effects, (e.g. signal distortion, noise pulses, glitches, audio hum, poling noise, etc.) are present. At a minimum, pretest each of the following locations:
         a) Networked locations.
         b) System trouble reporting.
         c) System electrical supervision.
         d) UPS operation.
   b. Provide recorded system pretest measurements and written certification that system is ready for formal acceptance test to COR.
3. Acceptance Test:
   a. Schedule acceptance test date giving COR 30 days' written notice prior to date acceptance test is expected to begin. System must be tested in the presence of a Government representative and OEM-certified representative. System must be tested utilizing approved test equipment to certify proof of performance and emergency compliance. Test must verify that the total system meets specification requirements. Notification of acceptance test must include expected duration of time of the test.
4. Acceptance Test Procedure:
   a. Physical and Mechanical Inspection:
      1) Government representative may tour areas where system and sub-systems are completely and properly installed to ensure they are operationally ready for proof of performance testing. Prepare system inventory including available spare parts. Each item of installed equipment must be checked to ensure appropriate NRTL labels are affixed.
      2) System diagrams, record drawings, equipment manuals, Auto CAD Disks, intermediate, and pretest results must be inventoried and reviewed.
      3) Failure of system to meet installation requirements of this specification can be grounds for terminating all testing.
   b. Operational Test:
      1) Contractor must demonstrate full functionality of system including:
         a) Station to master calls.
         b) Station to station calls.
         c) Broadcast calls.
         d) Location identification of stations at intercom master station.
   c. Test Conclusion: Government will accept results of the test or require additional testing on deficiencies and shortages. Retesting to comply with these specifications must be done at Government's convenience and contractor's expense.

3.4 TRAINING

A. Provide training of facility-identified staff assigned to units receiving communications by an IC system. Implement training from master console operator's perspective, and likewise, for any person whose specific responsibilities include answering IC calls and dispatching an appropriate response, provide operational training from their perspective. A separate training room may be set up that allows this type of individualized training utilizing in-service training unit, prior to cut over of new system.

B. Provide the following minimum training times and durations:
   1. 24 hours prior to facility opening,
   2. 24 hours during the standard work week, and
   3. 24 hours for supervisors and system administrators.

3.5 MAINTENANCE

A. Provide Government personnel with ability to contact contractor and OEM for maintenance and logistic assistance, remote diagnostic testing, and assistance in resolving technical problems at any time, during warranty period.

B. Response Time during Warranty Period:
   1. COR is contractor's only official reporting and contact official for IC system trouble calls, during the warranty period.
   2. A standard work week is considered 8:00 A.M. to 5:00 P.M. or as designated by COR, Monday through Friday exclusive of Federal holidays.
   3. Respond and correct on-site trouble calls, during the standard work week:
      a. A routine trouble call within one working day of its report. A routine trouble is considered a trouble which causes one IC station, or master IC station to be inoperable.
      b. An emergency trouble call within four hours of its report.
         1) An emergency trouble is considered a trouble which causes a IC sub system or equipment cabinet, to be inoperable at any time.
         2) Emergency trouble calls include routine trouble calls in critical emergency health care facilities (i.e., cardiac arrest, intensive care units, etc.). COR must notify contractor of this type of trouble call.
   4. If an IC component failure cannot be corrected within four hours (exclusive of the standard work time limits), provide alternate IC equipment.
   5. Complete installation of alternate equipment/system within sixteen hours after the four hour trouble shooting time and restore operation of effected location to system performance standards.
   6. Replace any sub-system or major system that cannot be corrected within one working day, with compatible temporary equipment returning system or sub-system to full operational capability, until repairs are complete.

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SECTION 27 52 23

NURSE CALL AND CODE BLUE SYSTEMS

PART 1 - GENERAL

1.1 SECTION SUMMARY

A. Work covered by this document includes design, engineering, labor, material and products, equipment warranty and system warranty, training and services for, and incidental to, the complete installation of new and fully operating National Fire Protection Association (NFPA) – Life Safety Code 101.3-2 (a) Labeled and (b) Listed, Emergency Service Nurse-Call and/or Life Safety listed Code Blue Communication System and associated equipment (here-in-after referred to as the System) provided in approved locations indicated on the contract drawings. These items shall be tested and certified capable of receiving, distributing, interconnecting and supporting Nurse-Call and/or Code Blue communications signals generated local and remotely as detailed herein.

B. Work shall be complete, Occupational Safety and Health Administration (OSHA), National Recognized Testing Laboratory (NRTL – i.e. Underwriters Laboratory UL) Listed and Labeled; and VA Central Office (VACO), Telecommunications Voice Engineering (TVE 005OP3B) tested, certified and ready for operation.

C. The System shall be delivered free of engineering, manufacturing, installation, and functional defects. It shall be designed, engineered and installed for ease of operation, maintenance, and testing.

D. The term “provide”, as used herein, shall be defined as: designed, engineered, furnished, installed, certified, tested, and warranty by the Contractor.

E. Specification Order of Precedence: In the event of a conflict between the text of this document and the Project’s Contract Drawings outlined and/or cited herein; THE TEXT OF THIS DOCUMENT TAKES PRECEDENCE. HOWEVER, NOTHING IN THIS DOCUMENT WILL SUPERSEDE APPLICABLE EMERGENCY LAWS AND REGULATIONS, SPECIFICALLY NATIONAL AND/OR LOCAL LIFE AND PUBLIC SAFETY CODES. The Local Fire Marshall and/or VA Public Safety Officer are the only authorities that may modify this document’s EMERGENCY CODE COMPLIANCE REQUIREMENTS, on a case by case basis, in writing and confirmed by VA’s Project Manager (PM), Resident Engineer (RE) and TVE-005OP3B. The VA PM is the only approving authority for other amendments to this document that may be granted, on a case by case basis, in writhing with technical concurrencies by VA’s PM, RE, TVE-005OP3B and identified Facility Project Personnel.

F. The Original Equipment Manufacturer (OEM) and Contractor shall ensure that all management, sales, engineering and installation personnel have read and understand the requirements of this specification before the system is designed, engineered, delivered and provided. The Contractor shall furnish a written statement stating this requirement as a part of the technical submittal that includes each name and certification, including the OEMs. The Contractor is cautioned to obtain in writing, all approvals for system changes relating to the published contract specifications and drawings, from the PM and/or the RE before proceeding with the change.

1.2 RELATED SECTIONS

A. 01 33 23 – Shop Drawings, Product Data and Samples.

B. 07 84 00 – Firestopping.

C. 26 05 19 – Low – Voltage Electrical Power Conductors and Cables (600 Volts and Below).

E. 27 05 11 – Requirements for Communications Installations.

F. 27 05 26 – Grounding and Bonding for Communications Systems.

G. 27 05 33 – Raceways and Boxes for Communications Systems.

H. 27 10 00 – CONTROL, COMMUNICATION AND SIGNAL WIRING.

I. 27 11 00 – TIP Communications Interface and Equipment Rooms Fittings.

J. 27 15 00 – TIP Communications Horizontal and Vertical Cabling.

1.3 DEFINITION

A. Provide: Design, engineer, furnish, install, connect complete, test, certify and warranty.

B. Work: Materials furnished and completely installed.

C. Review of contract drawings: A service by the engineer to reduce the possibility of materials being ordered which do not comply with contract documents. The engineer's review shall not relieve the Contractor of responsibility for dimensions or compliance with the contract documents. The reviewer's failure to detect an error does not constitute permission for the Contractor to proceed in error.

D. Headquarters (aka VACO) Technical Review, for National and VA Communications and Security, Codes, Frequency Licensing Standards, Guidelines and Compliance:

i. Office of Telecommunications
ii. Special Communications Team (005OP3B)
iii. 1335 East West Highway – 3rd Floor
iv. Silver Spring, Maryland 20910,
v. (O) 301-734-0350, (F) 301-734-0360

E. Contractor: Systems Contractor; you; successful bidder.

1.4 REFERENCES

A. The installation shall comply fully with all governing authorities, laws and ordinances, regulations, codes and standards, including, but not limited to:

1. United States Federal Law:
   a. Departments of:
      1) Commerce, Consolidated Federal Regulations (CFR), Title 15 – Under the Information Technology Management Reform Act (Public Law 104-106), the Secretary of Commerce approves standards and guidelines that are developed by the:
         a) Chapter II, National Institute of Standards Technology (NIST – formerly the National Bureau of Standards). Under Section 5131 of the Information Technology Management Reform Act of 1996 and the Federal Information Security Management Act of 2002 (Public Law 107-347), NIST develops – Federal Information Processing Standards Publication (FIPS) 140-2—Security Requirements for Cryptographic Modules.
         b) Chapter XXIII, National Telecommunications and Information Administration (NTIA – aka ‘Red Book’) Chapter 7.8 / 9; CFR, Title 47 Federal communications Commission (FCC) Part 15, Radio Frequency Restriction of Use and Compliance in “Safety of Life” Functions & Locations.
      2) FCC - Communications Act of 1934, as amended, CFR, Title 47 – Telecommunications, in addition to Part 15 – Restrictions of use for Part 15 listed Radio Equipment in Safety of Life / Emergency Functions / Equipment/ Locations (also see CFR, Title 15 – Department of Commerce, Chapter XXIII – NTIA):

a) Part 15 – Restrictions of use for Part 15 listed Radio Equipment in Safety of Life / Emergency Functions / Equipment/Locations.
b) Part 58 – Television Broadcast Service.
c) Part 90 – Rules and Regulations, Appendix C.

3) Health, (Public Law 96-88), CFR, Title 42, Chapter IV Health & Human Services, CFR, Title 46, Subpart 1395(a)(b) JCAHO "a hospital that meets JCAHO accreditation is deemed to meet the Medicare conditions of Participation by meeting Federal Directives:"
a) All guidelines for Life, Personal and Public Safety; and, Essential and Emergency Communications.

4) Labor, CFR, Title 29, Part 1910, Chapter XVII - Occupational Safety and Health Administration (OSHA), Occupational Safety and Health Standard:
a) Subpart 7 - Definition and requirements (for a NRTL – 15 Laboratory's, for complete list, contact (http://www.osha.gov/dts/otpca/nrtl/faq_nrtl.html):

b. 1) UL:
a) 44-02 – Standard for Thermoset-Insulated Wires and Cables.
b) 65 – Standard for Wired Cabinets.

c. 1) 83-03 – Standard for Thermoplastic-Insulated Wires and Cables.

d. 1) 467-01 – Standard for Electrical Grounding and Bonding Equipment
2) 468 – Standard for Grounding and Bonding Equipment.

e. 1) 486A-01 – Standard for Wire Connectors and Soldering Lugs for Use with Copper Conductors
2) 486C-02 – Standard for Splicing Wire Connectors.

2. 486D-02 – Standard for Insulated Wire Connector Systems for Underground Use or in Damp or Wet Locations.
a. 486E-00 – Standard for Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors.
b. 493-01 – Standard for Thermoplastic-Insulated Underground Feeder and Branch Circuit Cable.
c. 514B-02 – Standard for Fittings for Cable and Conduit.
1) 1069 – Hospital Signaling and Nurse Call Equipment.
d. 1449 – Standard for Transient Voltage Surge Suppressors.
e. 1479-03 – Standard for Fire Tests of Through-Penetration Fire Stops.
f. 1666 – Standard for Wire/Cable Vertical (Riser) Tray Flame Tests.
g. 1863 – Standard for Safety, Communications Circuits Accessories.
1) 2024 – Standard for Optical Fiber Raceways.
h. 60950-1/2 – Information Technology Equipment – Safety.

3. Canadian Standards Association (CSA): same tests as for UL.

4. Communications Certifications Labatory (CCL): same tests as for UL.
a. Intertek Testing Services NA, Inc. (ITSNA formerly Edison Testing Laboratory ETL): same tests as for UL.
a) Subpart 35 – Compliance with NFPA 101 – Life Safety Code.
b) Subpart 36 - Design and construction requirements for exit routes.
c) Subpart 268 - Telecommunications.
d) Subpart 305 - Wiring methods, components, and equipment for general use.
2) Department of Transportation, CFR, Title 49 (Public Law 89-670), Part 1, Subpart C – Federal Aviation Administration (FAA):
a) Standards AC 110/460-ID & AC 707 / 460-2E – Advisory
b) Circulars for Construction of Antenna Towers.
c) Forms 7450 and 7460-2 – Antenna Construction Registration.
3) Veterans Affairs (Public Law No. 100-527), CFR, Title 38, Volumes I & II:
a) Office of Telecommunications:

4) Handbook 6100 – Telecommunications.
   a) Spectrum Management FCC & NTIA Radio Frequency Compliance and Licensing Program.
   b) Special Communications Proof of Performance Testing,
5) VACO Compliance and Life Safety Certification(s).
   a) Office of Cyber and Information Security (OCIS):
   b) Handbook 6500 - Information Security Program.
   c) Wireless and Handheld Device Security Guideline Version 3.2, August 15, 2005.
   d) VA's National Center for Patient Safety – Veterans Health Administration Warning System, Failure of Medical Alarm Systems using Paging Technology to Notify Clinical Staff, July 2004.
   e) VA's Center for Engineering Occupational Safety and Health, concurrence with warning identified in VA Directive 7700.
   f) Office of Construction and Facilities Management (CFM):
      i. Master Construction Specifications (PG-18-1).
      ii. Standard Detail and CAD Standards (PG-18-4).
      iii. Equipment Guide List (PG-18-5).
      iv. Electrical Design Manual for VA Facilities (PG 18-10), Articles 7 & 8.
      v. Minimum Requirements of A/E Submissions (PG 18-15): Volume B, Major New Facilities, Major Additions; and Major Renovations, Article VI, Paragraph B.
      vi. Volume C - Minor and NRM Projects, Article III, Paragraph S.
      vii. Volume E - Request for Proposals Design/Build Projects, Article II, Paragraph F.
      viii. Mission Critical Facilities Design Manual (Final Draft – 2007).
      ix. Life Safety Protected Design Manual (Final Draft – 2007).
      x. Solicitation for Offerors (SFO) for Lease Based Clinics – (05-2009).

b. Federal Specifications (Fed. Specs.):
   1) A-A-59544-00 - Cable and Wire, Electrical (Power, Fixed Installation).

5. National Codes:
   a. American Institute of Architects (AIA): Guidelines for Healthcare Facilities.
   b. American National Standards Institute/Electronic Industries Association/Telecommunications Industry Association (ANSI/EIA/TIA):
      1) 568-B - Commercial Building Telecommunications Wiring Standards:
         a) B-1 – General Requirements.
         b) B-2 – Balanced twisted-pair cable systems.
         c) B-3 - Fiber optic cable systems.
      2) 569 - Commercial Building Standard for Telecommunications Pathways and Spaces.
      3) 606 – Administration Standard for the Telecommunications Infrastructure of Communications Buildings.
      4) 607 – Commercial Building Grounding and Bonding Requirements for Telecommunications.
      5) REC 127-49 – Power Supplies.
      6) RS 270 – Tools, Crimping, Solderless Wiring Devices, Recommended Procedures for User Certification.
   c. American Society of Mechanical Engineers (ASME):
      1) Standard 17.4 – Guide for Emergency Personnel.
      2) Standard 17.5 – Elevator & Escalator Equipment (prohibition of installing non-elevator equipment in Elevator Equipment Room / Mechanical Penthouse).
   d. American Society of Testing Material (ASTM):

1) D2301-04 - Standard Specification for Vinyl Chloride Plastic Pressure Sensitive Electrical Insulating Tape.

e. Building Industries Communications Services Installation (BICSI):

1) All standards for smart building wiring, connections and devices for commercial and medical facilities.

1.5 QUALIFICATIONS

A. The OEM shall have had experience with three (3) or more installations of Nurse Call systems of comparable size and interfacing complexity with regards to type and design as specified herein. Each of these installations shall have performed satisfactorily for at least one (1) year after final acceptance by the user. Include the names, locations and point of contact for these installations as a part of the submittal.

B. The Contractor shall submit certified documentation that they have been an authorized distributor and service organization for the OEM for a minimum of three (3) years. The Contractor shall be authorized by the OEM to pass thru the OEM's warranty of the installed equipment to VA. In addition, the OEM and Contractor shall accept complete responsibility for the design, installation, certification, operation, and physical support for the System. This documentation, along with the System Contractor and OEM certifications must be provided in writing as part of the Contractor's Technical submittal.

C. The Contractor's Communications Technicians assigned to the System shall be fully trained, qualified, and certified by the OEM on the engineering, installation, operation, and testing of the System. The Contractor shall provide formal written evidence of current OEM certification(s) for the installer(s) as a part of the submittal or to the RE before being allowed to commence work on the System.

D. The Contractor shall display all applicable national, state and local licenses.

E. The Contractor shall submit copy (s) of Certificate of successful completion of OEM's installation/training school for installing technicians of the System's Nurse Call and/or Code Blue equipment being proposed.

1.6 CODES AND PERMITS

A. Provide all necessary permits and schedule all inspections as identified in the contract's milestone chart, so that the system is proof of performance tested, certified and approved by VA and ready for operation on a date directed by the Owner.

B. The contractor is responsible to adhere to all codes described herein and associated contractual, state and local codes.

1.7 SCHEDULING

A. After the award of contract, the Contractor shall prepare a detailed schedule (aka milestone chart) using "Microsoft Project" software or equivalent. The Contractor Project Schedule (CPS) shall indicate detailed activities for the projected life of the project. The CPS shall consist of detailed activities and their restraining relationships. It will also detail manpower usage throughout the project.

B. It is the responsibility of the Contractor to coordinate all work with the other trades for scheduling, rough-in, and finishing all work specified. The owner will not be liable for any additional costs due to missed dates or poor coordination of the supplying contractor with other trades.

1.8 REVIEW OF CONTRACT DRAWINGS AND EQUIPMENT DATA SUBMITTALS (AKA TECHNICAL SUBMITTALS)

(Note: The Contractor is encouraged, but not required, to submit separate technical submittal(s) outlining alternate technical approach(s) to the system requirements stated here-in as long as each alternate technical document(s) is complete, separate, and submitted in precisely the same manner as outlined herein. VA will review and rate each received alternate

submittal, which follows this requirement, in exactly the same procedure as outlined herein. Partial, add-on, or addenda type alternates will not be accepted or reviewed.)

A. Submit at one time within 10 days of contract awarding, drawings and product data on all proposed equipment and system. Check for compliance with contract documents and certify compliance with Contractor's "APPROVED" stamp and signature.

B. Support all submittals with descriptive materials, i.e., catalog sheets, product data sheets, diagrams, and charts published by the manufacturer. These materials shall show conformance to specification and drawing requirements.

C. Where multiple products are listed on a single cut-sheet, circle or highlight the one that you propose to use. Provide a complete and through equipment list of equipment expected to be installed in the system, with spares, as a part of the submittal. Special Communications (TVE-005OP3B) will not review any submittal that does not have this list.

D. Provide four (4) copies to the PM for technical review. The PM will provide a copy to the offices identified in Paragraph 1.3.C & D, at a minimum for compliance review as described herein where each responsible individual(s) shall respond to the PM within 10 days of receipt of their acceptance or rejection of the submittal(s).

E. Provide interconnection methods, conduit (where not already installed), junction boxes (J-Boxes), cable, interface fixtures and equipment lists for the: ENR(s) (aka DMARC), TER, TCR, MCR, MCOR, PCR, ECR, Stacked Telecommunications Rooms (STR), Nurses Stations (NS), Head End Room (HER), Head End Cabinet (HEC), Head End Interface Cabinet (HEIC) and approved TCO locations TIP interface distribution layout drawing, as they are to be installed and interconnected to teach other (REFER TO APPENDIX B – SUGGESTED TELECOMMUNI-CAITONS ONE LINE TOPOLOGY pull-out drawing).

F. Equipment technical literature detailing the electrical and technical characteristics of each item of equipment to be furnished.

G. Engineering drawings of the System, showing calculated of expected signal levels at the headend input and output, each input and output distribution point, and signal level at each telecommunications outlet.

H. Surveys Required as a Part of The Technical Submittal:

1. The Contractor shall provide the following System surveys that depict various system features and capacities required in addition to the on-site survey requirements described herein (see Specification Paragraph 2.4.3). Each survey shall be in writing and contain the following information (the formats are suggestions and may be used for the initial Technical Submittal Survey requirements), as a minimum:

a. Nurse Call Cable System Design Plan:

1) An OEM and contractor designed functioning Nurse Call System cable plan to populate the entire TIP empty conduit/pathway distribution systems provided as a part of Specification 27 11 00 shall be provided as a part of the technical proposal. A specific functioning Nurse Call: cable, interfaces, J-boxes and back boxes shall coincide with the total growth items as described herein. It is the Contractor's responsibility to provide the Systems' entire Nurse Call cable and accessory requirements and engineer a functioning Nurse Call distribution system and equipment requirement plan of the following paragraph(s), at a minimum:

2) The required Nurse Call and/or Code Blue Equipment Locations:

EQUIPPED ITEM	CAPACITY	GROWTH
Master Stations		
Dome Lights		
Room		

EQUIPPED ITEM	CAPACITY	GROWTH
Corridor		
Other		
Patient Stations		
Single		
Dual		
Isolation		
Other		
Emergency Stations		
Bath		
Toilet		
Isolation		
Other		
Staff Stations		
Duty Stations		
Code Blue		
Patient Locations		
Surgical Recovery Locations		
Medical Recovery Locations		
ICU Locations		
SICU		
MICU		
CCU		
Other		
Emergency Room Locations		
Other		
Supervisory Locations		
Nurse Stations		
On-Call Rooms		
Other		
Remote Locations		
Telephone Operator’s Room		
Police Control Room		
Other		

EQUIPPED ITEM	CAPACITY	GROWTH
Radio Paging Access (when pre-approved by TVE-005OP3B)		
Audio Paging Access (when pre-approved by TVE-005OP3B)		
Wireless Access (when pre-approved by TVE-005OP3B)		
Maintenance/Programming Console		
Location(s)		
Central Control Cabinet/Equipment		
Location		
Power Supply(s)		
UPS(s)		

3) The required Nurse Call and/or Code Blue Cable Plant/Connections:
4) The Contractor shall clearly and fully indicate this category for each item identified herein as a part of the technical submittal. For this purpose, the following definitions and sample connections are provided to detail the system's capability:

EQUIPPED ITEM	CAPACITY	GROWTH
Central Control Cabinet/Equipment		
Location		
Power Supply(s)		
UPS(s)		
Essential Electrical Power Panel(s)		
Other		
Cable Plant		
Supply to Locations Identified in Paragraph 1.8.H.1.a.2)		
Remote Locations		
Telephone Operator Room		
Police Control Room		
Other		
Maintenance/Program Console		
Location(s)		
Other		
LAN (Local Facility) Access/Equipment/Location (when pre-approved by TVE-005OP3B)		
Wireless Access/Equipment/Location (when pre-approved by TVE-005OP3B)		

EQUIPPED ITEM	CAPACITY	GROWTH
PA Access/Equipment/Location (when pre-approved by TVE-005OP3B)		
Other		

1.9 PROJECT RECORD DOCUMENTS (AS BUILTS)

A. Throughout progress of the Work, maintain an accurate record of changes in Contract Documents. Upon completion of Work, transfer recorded changes to a set of Project Record Documents.

B. The floorplans shall be marked in pen to include the following:
1. Each device specific locations with UL labels affixed.
2. Conduit locations.
3. Each interface and equipment specific location.
4. Head-end equipment and specific location.
5. Wiring diagram.
6. Labeling and administration documentation.
7. Warranty certificate.
8. System test results.

1.10 WARRANTIES / GUARANTY

A. The Contractor shall warrant the installation to be free from defect in material and workmanship for a period of two (2) years from the date of acceptance of the project by the owner. The Contractor shall agree to remedy covered defects within four (4) hours of notification of major failures or within twenty-four (24) hours of notification for individual station related problems.

B. The Contractor shall agree to grantee the system according to the guidelines outlined in Article 4 herein.

1.11 USE OF THE SITE

A. Use of the site shall be at the GC's direction.

B. Coordinate with the GC for lay-down areas for product storage and administration areas.

C. Coordinate work with the GC and their sub-contractors.

D. Access to buildings wherein the work is performed shall be directed by the GC.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft.

B. Store products in original containers.

C. Coordinate with the GC for product storage. There may be little or no storage space available on site. Plan to potentially store materials off site.

D. Do not install damaged products. Remove damaged products from the site and replaced with new product at no cost to the Owner.

1.13 PROJECT CLOSE-OUT

A. Prior to final inspection and acceptance of the work, remove all debris, rubbish, waste material, tools, construction equipment, machinery and surplus materials from the project site and thoroughly clean your work area.

B. Before the project closeout date, the Contractor shall submit:

1. OEM Equipment Warranty Certificates.
2. Evidence of compliance with requirements of governing authorities such as the Low Voltage Certificate of Inspection.
3. Project record documents.
4. Instruction manuals and software that is a part of the system.
5. System Guaranty Certificate.

C. Contractor shall submit written notice that:
1. Contract Documents have been reviewed.
2. Project has been inspected for compliance with contract.
3. Work has been completed in accordance with the contract.

PART 2 – PRODUCTS / FUNCTIONAL REQUIREMENTS

2.0 GENERAL REQUIREMENTS FOR EQUIPMENT AND MATERIALS

A. Basis of Design: Baxter Voalte Nurse Call System – required to match and continue existing station systems -no substitutions.

B. Furnish and install a complete and fully functional and operable Nurse Call System for each location shown on the contract drawings and TCOs WHOSE EMPTY CONDUIT SYSTEM WAS PROVIDED AS A PART OF SPECIFICATION 27 11 00.

C. The specific location for each Nurse Call: Central Control Cabinet is Electrical room Power Supply is Electrical room Electrical Supervisor Panel is Reception UPS is Electrical room, Master Station is Reception Duty Station is Reception, (list locations here AND indicate like locations on the contract drawings).

D. Coordinate features and select interface components to form an integrated Nurse Call system. Match components and interconnections between the systems for optimum performance of specified functions.

E. Expansion Capability: The Nurse Call equipment interfaces and cables shall be able to increase number of enunciation points in the future by a minimum of 50 percent (%) above those indicated without adding any internal or external components or main trunk cable conductors.

F. Equipment: Active electronic type shall use solid-state components, fully rated for continuous duty unless otherwise indicated. Select equipment for normal operation on input power usually supplied between 110 to 130 VAC, 60 Hz supplied from the Facility's Emergency Electrical Power System.

G. Meet all FCC requirements regarding equipment listing, low radiation and/or interference of RF signal(s). The system shall be designed to prevent direct pickup of signals from within and outside the building structure.

H. Weather/Water Proof Equipment: Listed and labeled by an OSHA certified NRTL (i.e. UL) for duty outdoors or in damp locations.

2.1 SYSTEM DESCRIPTION

A. Furnish and install a complete and fully functional and operable Nurse Call and/or Code Blue System WHOSE EMPTY CONDUIT SYSTEM WAS PROVIDED AS A PART OF SPECIFICATION 27 11 00.

B. The Contractor shall continually employ interfacing methods that are approved by the OEM and VA. At a minimum, an acceptable interfacing method requires not only a physical and mechanical connection, but also a matching of signal, voltage, and processing levels with regard to signal quality and impedance. The interface point must adhere to all standards described herein for the full separation of Critical Care and Life Safety systems.

C. The System Contractor shall connect the System ensuring that all NFPA and UL Critical Care and Life Safety Circuit and System separation guidelines are satisfied. The System

Contractor is not allowed to make any connections to the Telephone System. VA shall arrange for the interconnection between the Patient Bed Service Walls Systems with the appropriate responsible parties.

D. System hardware shall consist of a standalone (separate) nurse call Code Blue patient communications network comprised of nurse consoles, control stations, staff and duty stations, room and corridor dome lights, pillow speakers/call cords, pull cord and/or emergency push button stations, wiring. And, other options such as, pocket page interfaces, computer interfaces, printer interfaces, wireless / telephone network interfaces, and nurse locating system interface (when specifically approved first by TVE 005OP3B) and as shown on drawings. All necessary equipment required to meet the intent of these specifications, whether or not enumerated within these specifications, shall be supplied and installed to provide a complete and operating nurse call Code Blue patient communications network. It is not acceptable to utilize the telephone cable system for the control and distribution of nurse call (code Blue) signals and equipment.

E. System firmware shall be the product of a reputable firmware OEM of record with a proven history of product reliability and sole control over all source code. Manufacturer shall provide, free of charge, product firmware/software upgrades for a period of two (2) years from date of acceptance by VA for any product feature enhancements. System configuration programming changes shall not require any exchange of parts and shall be capable of being executed remotely via a modem connection (when specifically approved first by TVE 005OP3B).

F. The Nurse Call Head End Equipment shall be located in Telecommunications Room. The Nurse Call / Code Blue System may interface the PA system when specifically approved by VA Headquarters T VE 005OP3B during the project approval process prior to contract bidding.

G. The System shall utilize microprocessor components for all signaling and programming circuits and functions. Self contained or on board system program memory shall be non-volatile and protected from erasure from power outages for a minimum of 12 hours.

H. Provide a backup battery or a UPS for the System (including each distribution cabinet/point, CRT and Monitor) to allow normal operation and function (as if there was no AC power failure) in the event of an AC power failure or during input power fluctuations for a minimum of 30 minutes.

I. The System is defined as Critical Service and the Code Blue functions is defined as Life Safety/Support by NFPA (re Part 1.1.A) and so evaluated by JCAHCO. Therefore, the system shall have a minimum of two (2) additional remote enunciation points in order to satisfy NFPA's Life Safety Code 101 (the typical secondary locations are Telephone Operators Room, MAS ER Desk, Boiler Plant, etc; AND the primary location is required to be in the SCC Room

1. These two (2) additional remote locations shall be fully manned:
   a. 24/7/365 for certified Hospital.
   b. As long as other identified VA Medical / Servicing Facilities are open for servicing patients.
   c. At a minimum, Code Blue Functions shall be provided in all Recovery (Medical and Surgical) Rooms, Intensive Care Units (ICU), Cardiac Care Units (CCU), Step Down Room, Life Support / Monitoring Rooms, Oncology / Radiology Procedure Rooms, Dialysis Areas.
   d. The minimum remote enunciation locations shall be:
      1) The Telephone / PBX Operator Room.
      2) The Police Control / Operations Room.
      3) Other location(s) that is specifically approved by VA Headquarters TVE - 005OP3B DURING THE PROJECT DEVELOPMENT STAGES AND PRIOR TO EQUIPMENT PURCHASE.
2. In addition to the two (2) remote locations afore described, the following locations are the minimum required for additional Nurse Call /Code Blue Annunciation:
   a. "On Call" Rooms.

b. Each Nurse Master Station.
c. Each Staff Station.
d. Each Duty Station.

3. The MAXIMUM enunciation time period from placement of the Code Blue Call to enunciation at each remote locations is 10 seconds; and, 15 seconds to the subsequent enunciating media stations (i.e. PA, Radio Paging, Emergency Telephone or Radio Backup, etc.).

J. Each Code Blue System shall be designed to provide continuous electrical supervision of the complete and entire system (i.e. dome light bulbs each light will be considered supervised if they use any one or a combination of (UL) approved electrical supervision alternates, as identified in UL-1069, 1992 revision, wires, contact switch connections, circuit boards, data, audio, and communication busses, main and UPS power, etc.). All alarm initiating and signaling circuits shall be supervised for open circuits, short circuits, and system grounds. Main and UPS power circuits shall be supervised for a change in state (i.e. primary to backup, low battery, UPS on line, etc.). When an open, short or ground occurs in any system circuit, an audible and visual fault alarm signal shall be initiated at the nurse control station and all remote locations.

K. When the System is approved to connect to a separate communications system (i.e. LAN, WAN, Telephone, Public Address, radio raging, wireless systems, etc) the connection point shall meet the following minimum requirements for each hard wired / wireless connection (note each wireless system connection MUST BE APPROVED PRIOR TO CONTRACT BID BY VA HEADQUARTERS TVE - 005OP3B AND SPECTRUM MANAGEMENT - 005OP2B – hereinafter referred to as SM - 005OP2B):

1. UL 60950-1/2.
2. FIPS 142.
3. FCC Part 15 Listed Radio Equipment restriction compliance approved by SM – 005OP2B.

L. All passive distribution equipment shall meet or exceed -80 dB radiation shielding (aka RFI) shielding specifications and be provided with connectors specified by the OEM.

M. All equipment face plates utilized in the system shall be stainless steel, anodized aluminum or UL approved cycolac plastic for the areas where provided.

N. Noise filters and surge protectors shall be provided for each equipment interface cabinet, headend cabinet, control console and local and remote amplifier locations to insure protection from input primary AC power surges and to insure noise glitches are not induced into low voltage data circuits.

O. Plug-in connectors shall be provided to connect all equipment, except coaxial cables. Coaxial cable distribution points shall use coaxial cable connections recommended by the cable OEM and approved by the system OEM. Base band cable systems shall utilize barrier terminal screw type connectors, at a minimum. As an alternate, crimp type connectors installed with a ratchet type installation tool are acceptable provided the cable dress, pairs, shielding, grounding, connections and labeling are the same as the barrier terminal strip connectors. Tape of any type, wire nuts or solder type connections are unacceptable and will not be approved.

P. Audio Level Processing: The control equipment shall consist of audio mixer(s), volume limiter(s) and/or compressor(s), and power amplifier(s) to process, adjust, equalize, isolate, filter, and amplify each audio channel for each sub-zone in the system and distribute them into the System's RF interfacing distribution trunks and amplification circuits. It is acceptable to use identified Telephone System cable pairs designated for Two-Way Radio interface and control use or identified as spare telephone cable pairs by the Facility's Telephone System Contractor. The use of telephone cable to distribute RF signals, carrying system or sub-system AC or DC voltage is not acceptable and will not be approved. Additionally, each control location shall be provided with the equipment required to insure the system can produce its designed audio channel capacity at each speaker identified on the contract drawings. The Contractor shall provide: a spare set of telephone paging modules as recommended by the OEM (as a minimum

provide one spare module for each installed module); one spare audio power amplifier, one spare audio mixer, one spare audio volume limiter and/or compressor, and one spare audio automatic gain adjusting device, and minimum RF equipment recommended by the OEM.

Q. Contractor is responsible for pricing all accessories and miscellaneous equipment required to form a complete and operating system. Unless otherwise noted in this Part, equipment quantities shall be as indicated on the drawings.

R. System Performance:

1. At a minimum, each distribution, interconnection, interface, terminating point and TCO shall be capable of supporting the Facility's Nurse Call and/or Code Blue System voice and data service as follows:

a. Shall be compliant with and not degrade the operating parameters of the Public Switched Telephone Network (PSTN) and the Federal Telecommunications System (FTS) at each PSTN and FTS interface (if attachment is permitted by TVE 005OP3B), interconnection and TCO terminating locations detailed on the contract drawings.

b. The System shall provide the following minimum operational functions:

1) Code Blue calls shall be cancelable at the calling station only. The nurse call master station (s) that a managing Code Blue functions shall not have the ability to cancel Code Blue calls.

2) Each Code Blue system shall be able to receive audio calls from all bedside stations simultaneously.

3) Calls placed from any Code Blue station shall generate Code Blue emergency type audible and visual signals at each associated nurse control and duty station, respective dome lights and all local and remote annunciator panels. Calls placed from a bedside station shall generate emergency type visual signals at the bedside station and associated dome light(s) in addition to the previous stated stations and panels.

4) Activating the silencing device at any location, while a Code Blue call or system fault is occurring shall mute the audible signals at the alarm location.

a) The audible alarm shall regenerate at the end of the selected time-out period until the call or fault is corrected.

b) The visual signals shall continue until the call is canceled and/or a fault is corrected. When the fault is corrected, all signals generated by the fault shall automatically cease, returning the System to a standby status.

c) Audible signals shall be regenerated in any local or remote annunciator panel that is in the silence mode, in the event an additional Code Blue call is placed in any Code Blue system.

d) The additional Code Blue call shall also generate visual signals at all annunciators to identify the location of the call.

2. Each System Nurse Call location shall generate a minimum of distinct calls:

a. Routine: single flashing dome lights & master station color and audio tone,
b. Staff Assist: rapid flashing dome lights & master station color and audio tone,
c. Emergency: Red flashing done lights & master station color and audio tone,
d. Code Blue (if equipped): Blue flashing dome lights and master station color and audio tone,
e. Each generated call shall be cancelable at ONLY the originating location,
f. Staff Locator: Green Flashing dome lights & master station color and audio tone, and,

2.3 MANUFACTURERS

A. The products specified shall be new, FCC and UL Listed, labeled and produced by OEM manufacturer of record. An OEM of record shall be defined as a company whose main occupation is the manufacture for sale of the items of equipment supplied and which:

1. Maintains a stock of replacement parts for the item submitted,

2. Maintains engineering drawings, specifications, and operating manuals for the items submitted, and
3. Has published and distributed descriptive literature and equipment specifications on the items of equipment submitted at least 30 days prior to the Invitation for Bid.

B. Specifications contained herein as set forth in this document detail the salient operating and performance characteristics of equipment in order for VA to distinguish acceptable items of equipment from unacceptable items of equipment. When an item of equipment is offered or furnished for which there is a specification contained herein, the item of equipment offered or furnished shall meet or exceed the specification for that item of equipment.

C. Equipment Standards and Testing:
1. The System has been defined herein as connected to systems identified as Critical Service performing various Emergency and Life Support Functions. Therefore, at a minimum, the system shall conform to all aforementioned National and/or Local Life Safety Codes (which ever are the more stringent), NFPA, NEC, this specification, JCAHCO Life Safety Accreditation requirements, and the OEM recommendations, instructions, and guidelines.
2. All supplies and materials shall be listed, labeled or certified by UL or a NRTL where such standards have been established for the supplies, materials or equipment.
3. The provided equipment required by the System design and approved technical submittal must conform with each UL standard in effect for the equipment, as of the date of the technical submittal (or the date when the RE approved system equipment necessary to be replaced) was technically reviewed and approved by VA. Where a UL standard is in existence for equipment to be used in completion of this contract, the equipment must bear the approved UL seal.
4. Each item of electronic equipment to be provided under this contract must bear the approved UL seal or the seal of the testing laboratory that warrants the equipment has been tested in accordance with, and conforms to the specified standards. The placement of the UL Seal shall be a permanent part of the electronic equipment that is not capable of being transportable from one equipment item to another.

2.4 PORDUCTS

A. General.
1. Contractor is responsible for pricing all accessories and miscellaneous equipment required to form a complete and operating system. The equipment quantities provided herein shall be as indicated on the drawings with the exception of the indicated spare equipment.
2. Contractor Furnished Equipment List (CFEs):
a. The Contractor is required to provide a list of the CFE equipment to be furnished. The quantity, make and model number of each item is required. Select the required equipment items quantities that will satisfy the needs of the system as described herein and with the OEM's concurrence applied to the list(s), in writing.

Item	Quantity	Unit
1.	As required	Interface Panel(s)
1.a	As required	Electrical Supervision Trouble Enunciator
1.a.1	As required	Equipment Back Box(s)
1.b	As required	Telephone
1.c	As required	Public Address
1.d	As required	Radio Paging / Equipment
1.e	As required	Wireless / Equipment
1.f.	As required	Radio Pager / Equipment
1.g	As required	Wireless / Equipment
1.f	As required	Personal Communicator / Equipment
2.	As required	Lightning Arrestor
3.	As required	Head End Equipment/Locations

3.a	As required	Cabinet(s)
3.a.1	As required	AC Power Conditioner & Filter
3.a.2	As required	AC Power Strip
3.a.3	As required	UPS
3.a.4	As required	Interconnecting Wire/Cables
3.a.5	As required	Wire / Cable Connector(s)
3.a.6	As required	Wire / Cable Terminator(s)
3.b	As required	Wire Management System
3.b	As required	Head End Function(s)
3.b.1	As required	H7 Interface
3.b.2	As required	Nurse Locator
3.b.3	As required	Staff Locator
4.	As required	Master Station(s)
4.a	As required	Nurse Locator
4.b	As required	Staff Locator

B. NS Room(s):

Refer to CFM Physical Security Manual (07-2007) for VA Facilities, Chapters 9.3 & 1) and PG 18-10, EDM, Chapters 7- Table 7-1, 8 & Appendix B, Telecommunications One Line Topology for specific Room and TIP Connection Requirements.

C. TER, SCC, PCR, STR, HER Rooms and Equipment:

Refer to CFM Physical Security Manual (07-2007) for VA Facilities, Chapters 9.3 & 1) and PG 18-10, EDM, Chapters 7- Table 7-1, 8 & Appendix B, Telecommunications One Line Topology for specific Room and TIP Connection Requirements.

D. Telecommunications Room(s) (TR):

1. Locate the Nurse Call and/or Code Blue floor distribution equipment as required by system design and OEM direction. Provide secured and lockable cabinet/rack(s) as required.

2. Head-End Equipment:

a. Provide all required power supplies, communications hubs, network switches, intelligent controllers and other devices necessary to form a complete system. Head-end components may be rack mounted or wall mounted in an enclosed metal enclosure.

b. Provide the head end equipment in the closest Telecommunications Room where the System is installed.

c. Provide the System UPS inside the cabinet or in a separate cabinet adjacent to the head end cabinet that shall maintain a minimum of 30 minute battery back-up to all system components.

d. Equipment Cabinet: Comply with TIA/EIA-310-D. Lockable, ventilated metal cabinet houses terminal strips, power supplies, amplifiers, system volume control, and other switching and control devices required for conversation channels and control functions. See Paragraph 2.5.E for the Cabinet's minimum internal items that are in addition to the installed System equipment.

e. Vertical Equipment Rack, Wall Mounted (to be included inside of the Equipment Cabinet) containing the following minimum items:

1) 36" (28RU) internal rack space, welded steel construction, minimum 20" usable depth, adjustable front mounting rails.

2) Install the following products in rack provided by same manufacturer or as specified:

a) Security screws w/ nylon isolation bushings.
b) Textured blank panels.
c) Custom mounts for components without rack mount kits.
d) Security covers.

e) Internal system ground copper buss (may be substituted with a bare #0 AWG copper wire or equivalent size copper mesh strip connected to ONLY THE FACILITY'S SIGNAL GROUNDING SYSTEM.

f) Power Sequencer- rack-mounted power conditioner and (provide as-needed) delayed sequencer(s) with (2) unswitched outlets each and contact closure control inputs. Connect the conditioner to one of the dual duplex outlets.

g) Two (2) each 120VAC @ 20A dual duplex outlets, connected via conduit to the nearest Electrical Service Panel that is supplied by the Facility's Essential Electrical System.

h) One (1) each 120VAC @ 15A Power Distribution Strip(s). Connect each strip to the unstitched outlet on the power conditioner.

3. HL7 Interface:

a. The system may support downloading and updating of patient data from the hospital admission system (or other database) via the HL7 standard. The data only has to travel one way, i.e. from the admission system to the nurse-call system.

b. Coordinate with the Owner the exact fields that will be populated from the admissions system in the nurse-call system.

c. The Facility's LAN/WAN is not allowed for Nurses Call/Code Blue main wiring / function that must be a "stand alone primary cable infrastructure" as described herein.

d. Connections to the VA LAN/WAN for functional or operable conditions will be allowed ONLY when the LAN/WAN system has been demonstrated and NFPA (at a minimum by TVE-005OP3B) Certified meeting Life Safety Standards.

e. Provide one (1) spare HL Interface unit.

4. Wireless:

a. Radio Paging Equipment / Systems

1) The nurse call/code blue system shall have the ability to interface ONLY with VA Certified and Licensed radio paging system (FCC Part 15 listed pagers and transmitters are not allowed for "Safety of Life" functions or installed in those specific areas – VA Headquarters TVE - 005OPB2 and SM - 005OPB2 are the ONLY approving authorities for this function) and must have the following minimum system features:

a) Ability to pass-through location information (such as a room number) and call-type as well as other text messages simultaneously to shift supervisor identified staff members

b) System shall allow the operator to select staff members by name and pager number and to select a message consisting of a room number and a condition code (aka priority level). Operator may also choose to type in a unique alpha-numeric text message (the text message shall meet or exceed all HIPA and VA OCIS Communications Security Guidelines for the transmission of Patient or Staff Specific information aka PII – VA Headquarters TVE - 005OP2B is the approving authority for this function) into the system to be read by the holder of the pager unit.

c) While a patient station is connected to the nurse's master station, the system shall allow the operator to automatically page the staff member assigned to that room. An alternate staff member may be selected for paging purposes in place of the primary staff member. The System must allow an alternate staff member to be paged when the primary staff member is unable to respond to patient's needs within a specified period of time. The System must have the ability to assign any bed to any pager or pager group, and to assign an unlimited amount of pagers to any patient bed.

d) System shall have the ability to send all code blue calls to staff members by predetermined group (as required) automatically by simply pressing one “Code Blue” button. Pager shall indicate room number of code call, and state “Code Blue” in plain English format on pagers (FCC Part 15 listed pagers are not allowed to be use as “Safety of Life” functions or those specific locations – VA Headquarters TVE - 005OP2B is the approving authority for this requirement).

2) When pagers are approved, provide a minimum of ten (10) spare pagers with one spare pager for each 10 issued.

5. Personal Wireless Communicator

a. The System will only be allowed to connect to the personal wireless communications system, pass text data and provide a 2-way communication between the Telephone Interface and the personal wireless communicator as long as it is not a FCC Part 15 listed device(s), meets or exceeds UL 60950-1/2, meets OCIS Guide Lines for FIPS 140-2 certification and the using staff shows an extensive training program along with recertification(s) according to the Facility Emergency Plan concerning HIPA requirements.

b. VA Headquarters TVE - 005OP3B and SM - 005OP2B are the approving authority for this requirement.

c. When communicators are approved, provide a minimum of ten (10) spare communicators for each 10 communicators issued.

6. Other Wireless Equipment / Systems

a. Each proposed wireless system and/or equipment to be connected to or be a part of the System, each shall meet the minimum requirements outlines in Paragraph 2.7.A.

b. Contact TVE - 005OP3B and SM – 005OP2B for specific required PRE approvals (full or conditional) as described herein.

c. When approved, TVE-005OP3B and SM-005OP2B will provide the spare equipment requirements.

d. When other wireless components are approved, provide ten (10) components with one spare components for each 10 issued.

F. TIP Cable Systems:

Connect the system to the TIP system provided as a part of Speciation Section 27 15 00. Provide additional TIP equipment, interfaces and connections as required by System design. Provide secured pathway(s) and lockable cabinet/rack(s) as required.

G. Interface Equipment:

1. TCR:

a. Code Blue Annunciation Station:

1) The Code Blue Remote Annunciation Station shall be located in the Telephone Operators Room, Police Control Center.

2) The Annunciation Station shall be connected to the System via hard wire connection(s) that shall contain all the electrical supervisory tone signals, visual bulbs, read out panel to indicate the location of the Code and system troubles.

3) The System shall not be connected to the Telephone system unless specifically APPROVED BY VA HEADQUARTERS (005OP3B) and (005OP2B) PRIOR TO CONTRACT BID.

4) The Annunciation Station shall be installed in a location directly viewable and the readout is completely readable from the Public Address Microphone Control Console.

5) Provide one (1) spare panel.

b. Electrical Supervision Trouble Annunciator Panel:

1) The Electrical Supervision Trouble Annunciation Panel shall be located in the Telephone Operators Room, Police Control Center, associate Nurses Station(s).
2) The panel(s) shall be compatible with the generated electrical and/or electronic supervising signals to continuously monitor the operating condition for the System head-end processing equipment, master stations, staff stations, patient stations, duty stations, audio power amplifier(s), UPS, power supplies, dome lights and interconnecting trunks. The panels shall generate an audible and visual signal when the System's supervising system detects a system and equipment trouble or trunk-line is malfunctioning.
3) Provide one (1) spare panel.

2. Hospital Bed Interface (s):
   a. Provide a multi-pin receptacle for bed connection.
   b. Connect cable from the multi-pin receptacle to the nurse-call system, so that alarms, such as bed exit, shall be monitored by the nurse-call system.
   c. Connect cable from the multi-pin receptacle to the nurse-call system, so that the bedside control buttons, such as nurse call, and television controls are functional and monitored.
   d. The hospital uses the following beds:
      1) Hill Rohm
      2) Stryker
      3) Other
   e. Provide one (1) spare interface for each ten (10) interfaces installed.
3. Nurse (aka Staff) Locator Interface:
   a. The System must be capable of performing nurse-locator functions.
   b. The System must be capable of performing staff-locator functions
   c. These functions may be combined into one operation.
   d. Provide two (2) spare interfaces.
4. Lighting Interface Module:
   a. Provide an interface module for the pillow speakers to control up to 2 lights. Coordinate with the electrical contractor the exact voltage requirements.
   b. Provide one (1) spare module for each ten (10) modules installed.
5. Pillow Speaker Interfaces:
   a. See functional requirements herein.
   b. Provide (1) pillow speaker for each patient station.
   c. Provide one (1) spare pillow speaker for each twenty (20) speakers installed.
6. TV Remote Control Interface:
   a. The pillow speaker shall have the following TV control capability:
      1) Play the TV audio through the pillow speaker.
      2) Change channels up and down.
      3) Increase and decrease the volume.
      4) TV audio mute.
      5) UL Certified for direct patient contact.
   b. Provide one (1) spare interface for each 20 interfaces installed.
7. TV Control Jack and Wiring:
   a. Provide connection from the pillow speaker to the TV location. Terminate wire on a jack in the TV low voltage faceplate. Coordinate faceplate opening with the cabling contractor. Coordinate jack type with the TV (typically it is a ¼" jack, but verify prior to installation).
   b. Provide patch cord from the TV control jack to the TV.
   c. Provide one (1) spare complete assembly for each twenty (20) assemblies installed.
8. Additional Functions / Interfaces:

The nurse-call system may perform _____ additional services/ functions when specifically approved by TVE-005OP3B during the project design phases and prior to the bid process.

H. Call Initiation, Annunciation and Response:
1. Light and Tones:
a) Calls may be initiated through:
1) Patient station.
2) Staff station.
3) Code Blue station.
4) Toilet Emergency Station pull cord / push button.
5) Shower Emergency Station pull cord.
6) Bed Pillow speaker.
7) Bed Push-button cordset.
8) Hospital Bed Integrated controls.
b) Once a call is initiated, it must be annunciated at the following locations:
1) The Corridor, Intersectional and Room dome light associated with the initiating device.
2) A local master control station indicating the call location and priority.
3) Each duty station.
4) Each staff station.
5) Each remote location.
c) All calls must be displayed until they are cleared by the nursing staff ONLY from the initiating device location.

2. Voice:
a) Calls may be initiated through:
1) Patient station.
2) Staff station.
3) Code Blue station.
4) Toilet Emergency pull cord / push button station.
5) Shower Emergency pull cord station.
6) Pillow speaker.
7) Push-button cordset.
8) Integrated bed controls.
9) Master Station.
3. Provide two-way voice communication between a master station and patient, staff, duty and each of the two (2) remote stations.
4. Failure of voice intercom portion of system shall not interfere with visual and audible signal systems.
5. All calls must be displayed on the master station until they are cleared by the nursing staff at ONLY the originating station. If multiple calls are received at the master station within a short period of time, they shall be stacked based on priority and wait time. If there are more calls than the master station screen can display at one time (four 4 minimum), the system must provide a simple scrolling feature. The nurse must be able to answer any call in any order at the master station. The nurse must also be able to forward calls to staff members. If a call is not answered within a programmable time period, then the system must forward the call to appropriate back-up staff identified by each shift supervisor in a manner technically approved by VA Headquarters 005OP3B.
6. Radio pager (within the restrictions identified herein)
7. Wireless personal communicator (within the restrictions identified herein)

I. Auxiliary Alarm Monitoring:
1. Each patient station must have the ability to connect a separate and isolated auxiliary alarm to it such as an infusion pump or data tracking / recording device (patient life support units ARE NOT allowed to be connected to these units UNLESS APPROVED BY TVE - 005OP3B DURING THE PROJECT DEVELOPMENT PHASE AS DESCRIBED

HEREIN. The System must support naming the device that is being monitored as well as display its alarms at the master station and via the room / corridor dome light(s).
2. Provide (2) alarm jacks at each patient station.
3. The above requirements may ONLY be allowed when the system has been approved by VA Headquarters TVE - 005OP3B and TVE - 005OP2B and concurred by the appropriate Medical Service(s) indicates it meets the minimum guidelines and requirements of Paragraph 2.8.A.

J. Patient and Staff Assignment:
1. System may provide for transfer of one or more individual or groups of stations from one master station to another without mechanical switches or additional wiring of the stations. The transfer may be initiated manually be the nurse or automatically at certain times of the day.
2. The Facility's LAN/WAN IS NOT ALLOWED for Nurses Call/Code Blue main wiring which must be a "stand alone primary cable infrastructure." Connections to the VA LAN/WAN will be allowed ONLY when the LAN/WAN system has been demonstrated and certified by TVE - 005OP3B meeting the minimum guidelines and requirements of the Life Safety Code.

K. Reports:
1. The system's generated reports logging all calls, alarms, response time, bed, and staff assignments may be allowed to transmit these reports to a central archiving entity.
2. Reports function shall be limited by passwords and security tier level access, so that only supervisors may access it when desired.
3. Provide instructions to the owner on how to enable/disable the reporting functions.
4. The Facility's LAN/WAN IS NOT ALLOWED for Nurses Call/Code Blue main wiring that must be a "stand alone primary cable infrastructure." Connections to the VA LAN/WAN will be allowed ONLY when the system has been demonstrated and certified by 005OP2B meeting the minimum guidelines and requirements of the Life Safety Code.

L. System/Management Software:
1. Provide and install system/management software on minimum of three (3) owner-provided computers.
   a. The management software shall at a minimum provide all historical reporting features of the system as well as real-time monitoring of events.
   b. The system software shall at a minimum provide the system's operating and functioning parameters and script. The OEM shall provide VA with access to the software's script writing and functions.
2. Provide two (2) spare CD's with the software installed and operable.
3. Rights in Data: VA shall have the right to all script and programming language of system management software. If commercial off the shelf (COTS) or a memorandum of understanding (MOU) is required for follow-on maintenance, the Contractor is required to accomplish the COTS Survey document and the RE is required to accomplish the COTS Acquisition document supplied in Part 5 Attachments herein.

M. System Functional Station:
1. Master Control:
   a. Simple Tone and Light:
      1) A visual / aural (tone only) system shall be provided, protected and located in the Day Hospital, Mental Health & Blind Rehabilitation Areas, OPC where surgery or procedures are not performed. The System shall include a push-button emergency station (pull cord in Day Hospital and pushbutton in Mental Health & Blind Rehabilitation areas) with an associated corridor dome light in each dressing room (OPC) and toilet (OPC, Day Hospital, Mental Health, Blind Rehabilitation

2) The visual / aural (tone only) system shall also include a power supply and a visual / aural (tone only) display panel in the respective OPC receptionist / secretary's office and the Day Hospital area and as shown on the drawings. The visual / tone display panel shall generate audible and visual emergency signals to indicate the location of a placed call.

3) The Visual Display Panel shall be a digital readout touch screen to visually announce the location of incoming calls placed in the System including room and bed number and priority of the call. Identify each calling station with an individual display, including separate displays for each patient sharing a dual bedside station. If a digital readout touch screen standard is not required or approved by the Facility during the project design phase, an alpha - numeric scheme shall be provided that identifies the: ward, room and bed (i.e. Ward 2a, Room 201, Bed A (or 1) shall read 2A201A -or- 2A201-1. Equivalent readouts are acceptable as long as TVE 005OP3B and the Facility approve the readout).

a) Calls placed at emergency stations located in toilets and baths inside bedrooms shall be displayed for the bed closest to the nurse control station. Beds in multi-bed bedrooms shall be identified in a clock-wise pattern upon entering the bedroom.

b) It shall display a minimum of four incoming calls. Additional placed calls shall be stored in order of placement and priority.

4) The visual / aural (tone only) system shall be installed according to the same Procedures, guidelines and standards outlined for a regular Nurse Call System for emergency NOT CODE BLUE OPERATION.

5) Speakerphone and handset communication.

6) Provide one (1) spare station for each ten (1) stations installed.

b. Touch Screen:

1) Provide a touch screen master station with 15” minimum monitor size.

2) The master station shall have a full control capability over staff assignment to patients and beds as well as pagers and wireless personal communication devices (when specifically approved by 005OP3B on a case by case basis).

3) Speakerphone and handset communication.

4) Provide one (1) spare station for each ten (1) stations installed.

2. Staff:

a. Light and Tine Only.

b. Voice Communications Enabled.

c. Provide one (1) spare station for each twenty (20) stations installed.

3. Duty:

a. Light and Tine Only.

b. Voice Communications Enabled.

c. Provide one (1) spare station for each twenty (20) stations installed.

4. Patient:

a. Single & Dual:

1) Provide each patient station with the following minimum Feature.

a) Call button.

b) Call answered button.

c) Pillow speaker jack.

d) Auxiliary alarm monitoring jack.

e) Hospital bed interface jack (when specially approved by TVE - 005OP3B).

f) Provide one (1) spare station for each twenty (20) stations installed.

N. Distribution System: Refer to Specification Sections 27 11 00, Structured TIP Communications Cables; 27 11 00, TIP Communications Interface and Equipment Rooms Fittings and 27 15 00, HORIZONTAL and Vertical TIP Communications Cabling for additional specific TIP wire and cable standards and installation requirements used to install the Facility's TIP network.

1. In addition to the TIP provided under the aforementioned Specification Sections, the contractor shall provide the following additional TIP installation and testing requirements, provide the following minimum additional System TIP requirements, cables & interconnections:

a. Each wire and cable used in the System shall be specifically OEM certified by tags on each reel and recommended and approved for installation in the Facility.

b. The Contractor shall provide the RE a 610 mm (2 foot) sample of each wire and/or cable actually employed in the System and each certification tag for approval before continuing with the installation as described herein.

c. Fiberoptic Cables: Refer to Specification Section 27 15 00, Horizontal and Vertical TIP Communications Cabling; Paragraph 2.4.C12.d. Fiberoptic Cables – for minimum technical standards and requirements for additional System cables.

d. Copper Cables: Refer to Specification Section 27 15 00, Horizontal and Vertical TIP Communications Cabling; Paragraph 2.4.C12.c. Copper Cables – for minimum technical standards and requirements for additional System voice and data cables.

e. Line Level Audio and Microphone Cable:

1) Line level audio and microphone cable for inside racks and conduit.

2) Shielded, twisted pair Minimum 22AWG, stranded conductors and 24AWG drain wire with overall jacket.

f. Speaker Level Audio (70.7Volt RMS):

1) For use with 70.7V speaker circuits.

2) 18AWG stranded pair, minimum.

g. All cabling shall be plenum rated.

h. Provide one (1) spare 1,000 foot roll of approved System (not microphone) cable only.

2. Raceways, Back Boxes and conduit:

a. In addition to the Raceways, Equipment Room Fittings provided under Specification Sections 27 15 00 TIP Communication Room Fittings and 27 15 00 – TIP Communications Horizontal and Vertical Cabling, provide the following additional TIP raceway and fittings:

b. Each raceway that is open top, shall be: UL certified for telecommunications systems, partitioned with metal partitions in order to comply with NEC Parts 517 & 800 to "mechanically separate telecommunications systems of different service, protect the installed cables from falling out when vertically mounted and allow junction boxes to be attached to the side to interface "drop" type conduit cable feeds.

c. Intercommunication System cable infrastructure: EMT above accessible ceilings, 24 inches on center.

d. Junction boxes shall be not less than 2-1/2 inches deep and 6 inches wide by 6 inches long.

e. Flexible metal conduit is prohibited unless specifically approved by 005OP3B.

f. System Conduit:

1) The PA system is NFPA listed as Emergency / Public Safety Communication System which requires the entire system to be installed in a separate conduit system.

2) The use of centralized mechanically partitioned wireways may be used to augment main distribution conduit on a case by case basis when specifically approved by VA Headquarters (005OP3B).

3) Conduit Sleeves:
a) The AE has made a good effort to identify where conduit sleeves through full-height and fire rated walls on the drawings, and has instructed the electrician to provide the sleeves as shown on the drawings.
b) While the sleeves shown on the drawings will be provided by others, the contractor is responsible for installing conduit sleeves and fire-proofing where necessary. It is often the case, that due to field conditions, the nurse-call cable may have to be installed through an alternate route. Any conduit sleeves required due to field conditions or those omitted by the engineer shall be provided by the cabling contractor.

g. Device Back Boxes:
1) Furnish to the electrical contractor all back boxes required for the PA system devices.
2) The electrical contractor shall install the back boxes as well as the system conduit. Coordinate the delivery of the back boxes with the construction schedule.

3. UPS:
a. Provide a backup battery or a UPS for the System to allow normal operation and function (as if there was no AC power failure) in the event of an AC power failure or during input power fluctuations for a minimum of 30 minutes.
b. As an alternate solution, the telephone system UPS may be utilized to meet this requirement at the headend location, as long as this function is specifically approved by the Telephone Contractor and the RE.
c. The Nurse Call Contractor shall not make any attachments or connection to the telephone system until specifically directed to do so, in writing, by the RE.
d. Provide UPS for all active system components including but not limited to:
1) System Amplifiers.
2) Microphone Consoles.
3) Telephone Interface Units.
4) TER, TR & Headend Equipment Rack(s).

O. Patient Bedside Prefabricated Units (PBPU):
1. Where PBPU's exist in the Facility; the Contractor shall identify the "gang box" location on the PBPU designated for installation of the telephone jack. This location shall here-in-after be identified as the unit's TCO. The Contractor shall be responsible for obtaining written approval and specific instructions from the PBPU OEM regarding the necessary disassembly and reassembly of each PBPU to the extent necessary to pull wire from above the TIP ceiling junction box to the PBPU's reserved gang box for the unit's TCO. A Contractor provided stainless steel cover plate approved for use by the PBPU OEM and Facility IRM Chief shall finish out the jack installation.
2. Under no circumstances shall the Contractor proceed with the PBPU installations without the written approval of the PBPU OEM and the specific instructions regarding the attachment to or modifying of the PBPU. The RE shall be available to assist the Contractor in obtaining approvals and instructions in a timely manner as related to the project's time constraints.
3. It is the responsibility of the Contractor to maintain the UL integrity of each PBPU. If the Contractor violates that integrity, it shall be the responsibility of the Contractor to obtain on site UL re-certification of the violated PBPU at the direction of the RE and at the Contractor's expense.

P. Installation Kit:
1. General: The kit shall be provided that, at a minimum, includes all connectors and terminals, labeling systems, audio spade lugs, barrier strips, punch blocks or wire wrap terminals, heat shrink tubing, cable ties, solder, hangers, clamps, bolts, conduit,

cable duct, and/or cable tray, etc., required to accomplish a neat and secure installation. All wires shall terminate in a spade lug and barrier strip, wire wrap terminal or punch block. Unfinished or unlabeled wire connections shall not be allowed. Turn over to the RE all unused and partially opened installation kit boxes, coaxial, fiberoptic, and twisted pair cable reels, conduit, cable tray, and/or cable duct bundles, wire rolls, physical installation hardware. The following are the minimum required installation sub-kits:

2. System Grounding:
   a. The grounding kit shall include all cable and installation hardware required. All radio equipment shall be connected to earth ground via internal building wiring, according to the NEC.
   b. This includes, but is not limited to:
      1) Fiberoptic Optic Cable Armor/External Braid
      2) Coaxial Cable Shields.
      3) Control Cable Shields.
      4) Data Cable Shields.
      5) Equipment Racks.
      6) Equipment Cabinets.
      7) Conduits.
      8) Cable Duct.
      9) Cable Trays.
      10) Interduct
      11) Power Panels.
      12) Connector Panels.
      15) Grounding Blocks.
3. Fiberoptic Cable: The fiberoptic cable kit shall include all fiberoptic connectors, cable tying straps, interduct, heat shrink tubing, hangers, clamps, etc. required to accomplish a neat and secure installation.
4. Coaxial Cable: The coaxial cable kit shall include all coaxial connectors, cable tying straps, heat shrink tubing, hangers, clamps, etc., required to accomplish a neat and secure installation.
5. Wire and Cable: The wire and cable kit shall include all connectors and terminals, audio spade lugs, barrier straps, punch blocks, wire wrap strips, heat shrink tubing, tie wraps, solder, hangers, clamps, labels etc., required to accomplish a neat and orderly installation.
6. Conduit, Cable Duct, and Cable Tray: The kit shall include all conduit, duct, trays, junction boxes, back boxes, cover plates, feed through nipples, hangers, clamps, other hardware required to accomplish a neat and secure conduit, cable duct, and/or cable tray installation in accordance with the NEC and this document.
7. Equipment Interface: The equipment kit shall include any item or quantity of equipment, cable, mounting hardware and materials needed to interface the systems with the identified sub-system(s) according to the OEM requirements and this document.
8. Labels: The labeling kit shall include any item or quantity of labels, tools, stencils, and materials needed to completely and correctly label each subsystem according to the OEM requirements, as-installed drawings, and this document.
9. Documentation: The documentation kit shall include any item or quantity of items, computer discs, as installed drawings, equipment, maintenance, and operation manuals, and OEM materials needed to completely and correctly provide the system documentation as required by this document and explained herein.

PART 3 - EXECUTION

3.1 PROJECT MANAGEMENT

A. Assign a single project manager to this project who will serve as the point of contact for the Owner, the General Contractor, and the Engineer.

B. The Contractor shall be proactive in scheduling work at the hospital, specifically the Contractor will initiate and maintain discussion with the general contractor regarding the schedule for ceiling cover up and install cables to meet that schedule.

C. Contact the Office of Telecommunications, Special Communications Team (005OP2B) at (301) 734-0350 to have a VA Certified Telecommunications COTR assigned to the project for telecommunications review, equipment and system approval and co-ordination with VA's Spectrum Management and OCIS Teams.

3.2 COORDINATION WITH OTHER TRADES

A. Coordinate with the cabling contractor the location of the TV faceplate and the faceplate opening for the nurse call TV control jack.

B. Coordinate with the cabling contractor the location of TIP equipment in the TER, TCR, PCR, SCC, ECR, STRs, NSs, and TCOs in order to connect to the TIP cable network that was installed as a part of Section Specification 27 11 00. Contact the RE immediately, in writing, if additional location(s) are discovered to be activated that was not previously provided.

C. Before beginning work, verify the location, quantity, size and access for the following:
1. Isolated ground AC power circuits provided for systems.
2. Primary, emergency and extra auxiliary AC power generator requirements.
3. Junction boxes, wall boxes, wire troughs, conduit stubs and other related infrastructure for the systems.
4. System components installed by others.
5. Overhead supports and rigging hardware installed by others.

D. Immediately notify the Owner, GC and Consultant(s) in writing of any discrepancies.

3.3 NEEDS ASSESSMENT

A. Provide a one-on-one meeting with the particular nursing manager of each unit affected by the installation of the new nurse call/code blue system. Review the floor plan drawing, educate the nursing manager with the functions of the equipment that is being provided and gather details specific to the individual units; coverage and priorities of calls; staffing patterns; and other pertinent details that will affect system programming and training.

3.4 INSTALLATION

A. General:
1. Execute work in accordance with National, State and local codes, regulations and ordinances.
2. Install work neatly, plumb and square and in a manner consistent with standard industry practice. Carefully protect work from dust, paint and moisture as dictated by site conditions. The Contractor will be fully responsible for protection of his work during the construction phase up until final acceptance by the Owner.
3. Install equipment according to OEM's recommendations. Provide any hardware, adaptors, brackets, rack mount kits or other accessories recommended by OEM for correct assembly and installation.
4. Secure equipment firmly in place, including receptacles, speakers, equipment racks, system cables, etc.
   a. All supports, mounts, fasteners, attachments and attachment points shall support their loads with a safety factor of at least 5:1.
   b. Do not impose the weight of equipment or fixtures on supports provided for other trades or systems.
   c. Any suspended equipment or associated hardware must be certified by the OEM for overhead suspension.
   d. The Contractor is responsible for means and methods in the design, fabrication, installation and certification of any supports, mounts, fasteners and attachments.

5. Finishes for any exposed work such as plates, racks, panels, speakers, etc. shall be approved by the Architect, Owner and TVE 005OP3B.
6. Coordinate cover plates with field conditions. Size and install cover plates as necessary to hide joints between back boxes and surrounding wall. Where cover plates are not fitted with connectors, provide grommeted holes in size and quantity required. Do not allow cable to leave or enter boxes without cover plates installed.
7. Active electronic component equipment shall consist of solid state components, be rated for continuous duty service, comply with the requirements of FCC standards for telephone and data equipment, systems, and service.
8. Color code all distribution wiring to conform to the Nurse Call Industry Standard, EIA/TIA, and this document, whichever is the more stringent. At a minimum, all equipment, cable duct and/or conduit, enclosures, wiring, terminals, and cables shall be clearly and permanently labeled according to and using the provided record drawings, to facilitate installation and maintenance.
9. Connect the System's primary input AC power to the Facility' Critical Branch of the Emergency AC power distribution system as shown on the plans or if not shown on the plans consult with RE regarding a suitable circuit location prior to bidding.
10. Product Delivery, Storage and Handling:
    a. Delivery: Deliver materials to the job site in OEM's original unopened containers, clearly labeled with the OEM's name and equipment catalog numbers, model and serial identification numbers. The RE may inventory the cable, patch panels, and related equipment.
    b. Storage and Handling: Store and protect equipment in a manner, which will preclude damage as directed by the RE.
11. Where TCOs are installed adjacent to each other, install one outlet for each instrument.
12. Equipment installed outdoors shall be weatherproof or installed in weatherproof enclosures with hinged doors and locks with two keys.

B. Equipment Racks/Cabinets:
1. Fill unused equipment mounting spaces with blank panels or vent panels. Match color to equipment racks/cabinets.
2. Provide security covers for all devices not requiring routine operator control.
3. Provide vent panels and cooling fans as required for the operation of equipment within the OEM' specified temperature limits. Provide adequate ventilation space between equipment for cooling. Follow manufacturer's recommendations regarding ventilation space between amplifiers.
4. Provide insulated connections of the electrical raceway to equipment racks.
5. Provide continuous raceway/conduit with no more than 40% fill between wire troughs and equipment racks/cabinets for all non-plenum-rated cable. Ensure each system is mechanically separated from each other in the wireway.
6. Ensure a minimum of 36 inches around each cabinet and/or rack to comply with OSHA Safety Standards. Cabinets and/or Racks installed side by side – the 36" rule applies to around the entire assembly

C. Distribution Frames.
1. A new stand-alone (i.e., self supporting, free standing) PA rack/frame may be provided in each TR to interconnect the TCR, PCR, SCC, NS, STRs & ECRs. Rack/frames shall be wired in accordance with industry standards and shall employ "latest state-of-the-art" modular cross-connect devices. The PA riser cable shall be sized to satisfy all voice/digital requirements plus not less than 50% spare (growth) capacity in each TR which includes a fiber optic backbone.
2. The frames/racks shall be connected to the TER/MCR system ground.

D. Wiring Practice - in addition to the MANDATORY infrastructure requirements outlined in VA Construction Specifications 27 10 00 – TIP Structured Communications Cabling, 27 11 00 –

TIP Communications Rooms Fittings and 27 15 00 – TIP Horizontal and Vertical Communicators Cabling, the following additional practices shall be adhered too:

1. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway and Boxes for Electrical Systems."
2. Execute all wiring in strict adherence to the National Electrical Code, applicable local building codes and standard industry practices.
3. Wiring shall be classified according to the following low voltage signal types:
   a. Balanced microphone level audio (below -20dBm) or Balanced line level audio (-20dBm to +30dBm)
   b. 70V audio speaker level audio.
   c. Low voltage DC control or power (less than 48VDC)
4. Where raceway is to be EMT (conduit), wiring of differing classifications shall be run in separate conduit. Where raceway is to be an enclosure (rack, tray, wire trough, utility box) wiring of differing classifications which share the same enclosure shall be mechanically partitioned and separated by at least four (4) inches. Where Wiring of differing classifications must cross, they shall cross perpendicular to one another.
5. Do not splice wiring anywhere along the entire length of the run. Make sure cables are fully insulated and shielded from each other and from the raceway for the entire length of the run.
6. Do not pull wire through any enclosure where a change of raceway alignment or direction occurs. Do not bend wires to less than radius recommended by manufacturer.
7. Replace the entire length of the run of any wire or cable that is damaged or abraided during installation. There are no acceptable methods of repairing damaged or abraided wiring.
8. Use wire pulling lubricants and pulling tensions as recommended by the OEM.
9. Use grommets around cut-outs and knock-outs where conduit or chase nipples are not installed.
10. Do not use tape-based or glue-based cable anchors.
11. Ground shields and drain wires to the Facility's signal ground system as indicated by the drawings.
12. Field wiring entering equipment racks shall be terminated as follows:
    a. Provide OEM directed service loops at harness break-outs and at plates, panels and equipment. Loops should be sufficient to allow plates, panels and equipment to be removed for service and inspection.
    b. Line level and speaker level wiring may be terminated inside the equipment rack using specified terminal blocks (see "Products.") Provide 15% spare terminals inside each rack. Microphone level wiring may only be terminated at the equipment served.
    c. If specified terminal blocks are not designed for rack mounting, utilize ¾" plywood or 1/8" thick aluminum plates/blank panels as a mounting surface. Do not mount on the bottom of the rack.
    d. Employ permanent strain relief for any cable with an outside diameter of 1" or greater.
13. Use only balanced audio circuits unless noted otherwise directed and indicated on the drawings.
14. Make all connections as follows:
    a. Make all connections using rosin-core solder or mechanical connectors appropriate to the application.
    b. For crimp-type connections, use only tools that are specified by the manufacturer for the application.
    c. Use only insulated spade lugs on screw terminals. Spade lugs shall be sized to fit the wire gauge. Do not exceed two lugs per terminal.
    d. Wire nuts, electrical tape or "Scotch Lock" connections are not acceptable for any application.
15. Noise filters and surge protectors shall be provided for each equipment interface cabinet, switch equipment cabinet, control console, local, and remote active equipment

locations to ensure protection from input primary AC power surges and noise glitches are not induced into low Voltage data circuits.

16. Wires or cables previously approved to be installed outside of conduit, cable trays, wireways, cable duct, etc:

a) Only when specifically authorized as described herein, will wires or cables be identified and approved to be installed outside of conduit. The wire or cable runs shall be UL rated plenum and OEM certified for use in air plenums.

b) Wires and cables shall be hidden, protected, fastened and tied at 600 mm (24 in.) intervals, maximum, as described herein to building structure.

c) Closer wire or cable fastening intervals may be required to prevents sagging, maintain clearance above suspended ceilings, remove unsightly wiring and cabling from view and discourage tampering and vandalism. Wire or cable runs, not provided in conduit, that penetrate outside building walls, supporting walls, and two hour fire barriers shall be sleeved and sealed with an approved fire retardant sealant.

d) Wire or cable runs to system components installed in walls (i.e.: volume attenuators, circuit controllers, signal, or data outlets, etc.) may, when specifically authorized by the RE, be fished through hollow spaces in walls and shall be certified for use in air plenum areas.

e) Completely test all of the cables after installation and replace any defective cables.

f) Wires or cables that are installed outside of buildings shall be in conduit, secured to solid building structures. If specifically approved, on a case by case basis, to be run outside of conduit, the wires or cables shall be installed, as described herein. The bundled wires or cables must: Be tied at not less than 460 mm (18 in.) intervals to a solid building structure; have ultra violet protection and be totally waterproof (including all connections). The laying of wires or cables directly on roof tops, ladders, drooping down walls, walkways, floors, etc. is not allowed and will not be approved.

E. Cable Installation - Cable Installation - In addition to the MANDATORY infrastructure requirements outlined in VA Construction Specifications 27 10 00 – Structured TIP Communications Cabling, 27 11 00 – TIP Communications Rooms and Fittings and 27 15 00 – TIP Communications Horizontal and Vertical Cabling and the following additional practices shall be adhered too:

1. Support cable on maximum 2’-0” centers. Acceptable means of cable support are cable trays. Velcro wrap cable bundles loosely to the means of support with plenum rated Velcro straps. Plastic tie wraps are not acceptable as a means to bundle cables.
2. Run cables parallel to walls.
3. Install maximum of 10 cables in a single row. Provide necessary rows as required by the number of cables.
4. Do not lay cables on top of light fixtures, ceiling tiles, mechanical equipment, or ductwork. Maintain at least 2’-0” clearance from all shielded electrical apparatus.
5. All cables shall be tested after the total installation is fully complete. All test results are to be documented. All cables shall pass acceptable test requirements and levels. Contractor shall remedy any cabling problems or defects in order to pass or comply with testing. This includes the re-pull of new cable as required at no additional cost to the Owner.
6. Ends of cables shall be properly terminated on both ends per industry and OEM’s recommendations.
7. Provide proper temporary protection of cable after pulling is complete before final dressing and terminations are complete. Do not leave cable lying on floor. Bundle and tie wrap up off of the floor until you are ready to terminate.
8. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at outlets and terminals.

9. Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Cables may not be spliced.
10. Bundle, lace, and train conductors to terminal points without exceeding OEM's limitations on bending radii. Install lacing bars and distribution spools.
11. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used.
12. Cable shall not be run through structural members or be in contact with pipes, ducts, or other potentially damaging items.
13. Separation of Wires: (REFER TO RACEWAY INSTALLATION) Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate raceways or, where exposed or in same enclosure, separate conductors at least 12 inches apart for speaker microphones and adjacent parallel power and telephone wiring. Separate other intercommunication equipment conductors as recommended by equipment manufacturer.
14. Serve all cables as follows:
    a. Cover the end of the overall jacket with a 1” (minimum) length of transparent heat-shrink tubing. Cut unused insulated conductors 2” (minimum) past the heat-shrink, fold back over jacket and secure with cable-tie. Cut unused shield/drain wires 2” (minimum) past the Heatshrink and serve as indicated below.
    b. Cover shield/drain wires with heat-shrink tubing extending back to the overall jacket. Extend tubing ¼” past the end of unused wires, fold back over jacket and secure with cable tie.
    c. For each solder-type connection, cover the bare wire and solder connection with heat-shrink tubing.

F. Labeling: Provide labeling in accordance with ANSI/EIA/TIA-606-A. All lettering for Nurse Call and/or Code Blue circuits shall be stenciled using laser printers.

1. Cable and Wires (Hereinafter referred to as “Cable”): Cables shall be labeled at both ends in accordance with ANSI/EIA/TIA-606-A. Labels shall be permanent in contrasting colors. Cables shall be identified according to the System “Record Wiring Diagrams.”
2. Equipment: System equipment shall be permanently labeled with contrasting plastic laminate or Bakelite material. System equipment shall be labeled on the face of the unit corresponding to its source.
    a. Clearly, consistently, logically and permanently mark switches, connectors, jacks, relays, receptacles and electronic and other equipment.
    b. Engrave and paint fill all receptacle panels using 1/8” (minimum) high lettering and contrasting paint.
    c. For rack-mounted equipment, use engraved Lamacoid labels with white 1/8” (minimum) high lettering on black background. Label the front and back of all rack-mounted equipment.
3. Conduit, Cable Duct, and/or Cable Tray: The Contractor shall label all conduit, duct and tray, including utilized GFE, with permanent marking devices or spray painted stenciling a minimum of 3 meters (10 ft.) identifying it as the System. In addition, each enclosure shall be labeled according to this standard.
4. Termination Hardware: The Contractor shall label TCOs and patch panel connections using color coded labels with identifiers in accordance with ANSI/EIA/TIA-606-A and the “Record Wiring Diagrams.”
5. Where multiple pieces of equipment reside in the same rack group, clearly and logically label each indicating to which room, channel, receptacle location, etc. they correspond.
6. Permanently label cables at each end, including intra-rack connections. Labels shall be covered by the same, transparent heat-shrink tubing covering the end of the overall jacket. Alternatively, computer generated labels of the type which include a clear protective wrap may be used.
7. Contractor’s name shall appear no more than once on each continuous set of racks. The Contractor’s name shall not appear on wall plates or portable equipment.

8. Ensure each OEM supplied item of equipment has appropriate UL Labels / Marks for the service the equipment is performed permanently attached / marked to a non-removal board in the unit. EQUIPMENT INSTALLED NOT BEARING THESE UL MARKS WILL NOT BE ALLOWED TO BE A PART OF THE SYSTEM. THE CONTRACTOR SHALL BEAR ALL COSTS REQUIRED TO PROVIDE REPLACEMENT EQUIPMENT WITH APPROVED UL MARKS.

G. Conduit and Signal Ducts: When the Contractor and/or OEM determines additional system conduits and/or signal ducts are required in order to meet the system minimum performance standards outlined herein, the contractor shall provide these items as follows:

1. Conduit:
   a. The Contractor shall employ the latest installation practices and materials. The Contractor shall provide conduit, junction boxes, connectors, sleeves, weather heads, pitch pockets, and associated sealing materials not specifically identified in this document as GFE. Conduit penetrations of walls, ceilings, floors, interstitial space, fire barriers, etc., shall be sleeved and sealed.
   b. All cables shall be installed in separate conduit and/or signal ducts (exception from the separate conduit requirement to allow Nurse Call and/or Code Blue cables to be installed in partitioned cable tray with voice cables may be granted in writing by the RE if requested). Conduits shall be provided in accordance with Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and NEC Articles 517 for Critical Care and 800 for Communications systems, at a minimum.
   c. When metal, plastic covered, etc., flexible cable protective armor or systems are specifically authorized to be provided for use in the System, their installation guidelines and standards shall be as specified herein, Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and the NEC.
   d. When ”interduct” flexible cable protective systems is specifically authorized to be provided for use in the System, it’s installation guidelines and standards shall be as the specified herein, Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS, and the NEC.
   e. Conduit fill (including GFE approved to be used in the system) shall not exceed 40%. Each conduit end shall be equipped with a protective insulator or sleeve to cover the conduit end, connection nut or clamp, to protect the wire or cable during installation and remaining in the conduit. Electrical power conduit shall be installed in accordance with the NEC. AC power conduit shall be run separate from signal conduit.
   f. Ensure that Critical Care Nurse Call and/or Code Blue Systems (as identified by NEC Section 517) are completely separated and protected from all other systems.
2. Signal Duct, Cable Duct, or Cable Tray:
   a. The Contractor shall use GFE signal duct, cable duct, and/or cable tray, when identified and approved by the RE.
   b. Approved signal and/or cable duct shall be a minimum size of 100 mm x 100 mm (4 in. X 4 in.) inside diameter with removable tops or sides, as appropriate. Protective sleeves, guides or barriers are required on all sharp corners, openings, anchors, bolts or screw ends, junction, interface and connection points.
   c. Approved cable tray shall be fully covered, mechanically and physically partitioned for multiple electronic circuit use, and be UL certified and labeled for use with telecommunication circuits and/or systems. The RE shall approve width and height dimensions.
   d. All cable junctions and taps shall be accessible. Provide an 8” X 8” X 4” (minimum) junction box attached to the cable duct or raceway for installation of distribution system passive equipment. Ensure all equipment and tap junctions are accessible

3.5 PROTECTION OF NETWORK DEVICES

A. Contractor shall protect network devices during unpacking and installation by wearing manufacturer approved electrostatic discharge (ESD) wrist straps tied to chassis ground. The

wrist strap shall meet OSHA requirements for prevention of electrical shock, should technician come in contact with high voltage.

3.6 CUTTING, CLEANING AND PATCHING

A. It shall be the responsibility of the contractor to keep their work area clear of debris and clean area daily at completion of work.

B. It shall be the responsibility of the contractor to patch and paint any wall or surface that has been disturbed by the execution of this work.

C. The Contractor shall be responsible for providing any additional cutting, drilling, fitting or patching required that is not indicated as provided by others to complete the Work or to make its parts fit together properly.

D. The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate Contractor the Contractor's consent to cutting or otherwise altering the Work.

E. Where coring of existing (previously installed) concrete is specified or required, including coring indicated under unit prices, the location of such coring shall be clearly identified in the field and the location shall be approved by the Project Manager prior to commencement of coring work.

3.7 FIREPROOFING

A. Where Nurse Call and/or Code Blue wires, cables and conduit penetrate fire rated walls, floors and ceilings, fireproof the opening.

B. Provide conduit sleeves (if not already provided by electrical contractor) for cables that penetrate fire rated walls and Telecommunications Rooms floors and ceilings. After the cabling installation is complete, install fire proofing material in and around all conduit sleeves and openings. Install fire proofing material thoroughly and neatly. Seal all floor and ceiling penetrations.

C. Use only materials and methods that preserve the integrity of the fire stopping system and its rating.

D. Install fireproofing where low voltage cables are installed in the same manholes with high voltage cables; also cover the low voltage cables with arc proof and fireproof tape.

E. Use approved fireproofing tape of the same type as used for the high voltage cables, and apply the tape in a single layer, one-half lapped or as recommended by the manufacturer. Install the tape with the coated side towards the cable and extend it not less than 25 mm (one inch) into each duct.

F. Secure the tape in place by a random wrap of glass cloth tape.

3.8 GROUNDING

A. Ground Nurse Call and/or Code Blue cable shields and equipment to eliminate shock hazard and to minimize ground loops, commonmode returns, noise pickup, cross talk, and other impairments as specified in CFM Division 27, Section 27 05 26 – Grounding and Bonding for Communications Systems.

B. Facility Signal Ground Terminal: Locate at main room or area signal ground within the room (i.e. head end and telecommunications rooms) or area(s) and indicate each signal ground location on the drawings.

C. Extend the signal ground to inside each equipment cabinet and/or rack. Ensure each cabinet and/or rack installed item of equipment is connected to the extended signal ground. Isolate the signal ground from power and major equipment grounding systems.

D. When required, install grounding electrodes as specified in CFM Division 26, Section 26 05 26 – Grounding and Bonding for Electrical Systems.

E. Do not use "3rd or 4th" wire internal electrical system conductors for communications signal ground.

F. Do not connect the signal ground to the building's external lightning protection system.

G. Do Not "mix grounds" of different systems.

H. Insure grounds of different systems are installed as to not violate OSHA Safety and NEC installation requirements for protection of personnel.

PART 4 – TESTING / GUARANTY / TRAINING

4.0 SYSTEM LISTING

A. The Nurses Call System is NFPA listed as an "Emergency" Communication system. Where Code Blue signals are transmitted, that listing is elevated to "Life Support/Safety." Therefore, the following testing and guaranty provisions are the minimum to be performed and provided by the contractor and Warranted by the OEM.

4.1 PROOF OF PERFORMANCE TESTING

A. Intermediate Testing:

1. After completion of 30 – 40% of the installation of a head end cabinet(s) equipment, one master stations, local and remote stations, treatment rooms, and prior to any further work, this portion of the system must be pretested, inspected, and 1certified. Each item of installed equipment shall be checked to ensure appropriate UL Listing and Certification Labels are affixed as required by NFPA -Life Safety Code 101-3.2 (a) & (b), UL Nurse Call Standard 1069 and JCHCO evaluation guidelines, and proper installation practices are followed. The intermediate test shall include a full operational test.
2. All inspections and tests shall be conducted by an OEM-certified contractor representative and witnessed by TVE-005OP3B if there is no local Government Representative that processes OEM and VA approved Credentials to inspect and certify the system. The results of the inspection will be officially recorded by the Government Representative and maintained on file by the RE, until completion of the entire project. The results will be compared to the Acceptance Test results. An identical inspection may be conducted between the 65 - 75% of the system construction phase, at the direction of the RE.

B. Pretesting:

1. Upon completing installation of the Nurse Call and/or Code Blue System, the Contractor shall align, balance, and completely pretest the entire system under full operating conditions.
2. Pretesting Procedure:
   a. During the System Pretest the Contractor shall verify (utilizing approved test equipment) that the System is fully operational and meets all the System performance requirements of this standard.
   b. The Contractor shall pretest and verify that all PSM System functions and specification requirements are met and operational, no unwanted aural effects, such as signal distortion, noise pulses, glitches, audio hum, poling noise, etc. are present. At a minimum, each of the following locations shall be fully pretested:
      1) Central Control Cabinets.
      2) Nurse Control Stations.
         a) Master Stations
         b) Patient Stations

c) Staff Stations
d) Emergency Stations
e) Code Blue Stations

3) 3) Dome Lights.
a) Patient Rooms
b) Corridors
c) Intersectional

4) STRs
5) Local and Remote Enunciation Panels (code blue).
6) Electrical Supervision Panels/Functions/locations.
7) All Networked locations.
8) System interface locations (i.e. wireless, PA, telephone, etc.).
9) System trouble reporting.
10) System electrical supervision.
11) UPS operation.
12) Primary / Emergency AC Power Requirements
13) Extra Auxiliary Generator Requirements.
14) NSs.

3. The Contractor shall provide four (4) copies of the recorded system pretest measurements and the written certification that the System is ready for the formal acceptance test shall be submitted to the RE.

I. Acceptance Test:

1. After the Nurse Call and/or Code Blue System has been pretested and the Contractor has submitted the pretest results and certification to the RE, then the Contractor shall schedule an acceptance test date and give the RE 15 working days written notice prior to the date the acceptance test is expected to begin. The System shall be tested in the presence of a TVE 005OP3B and OEM certified representatives. The System shall be tested utilizing the approved test equipment to certify proof of performance and Life Safety / Critical Service compliance. The tests shall verify that the total System meets all the requirements of this specification. The notification of the acceptance test shall include the expected length (in time) of the test.
2. The acceptance test shall be performed on a "go-no-go" basis. Only those operator adjustments required to show proof of performance shall be allowed. The test shall demonstrate and verify that the installed System does comply with all requirements of this specification under operating conditions. The System shall be rated as either acceptable or unacceptable at the conclusion of the test. Failure of any part of the System that precludes completion of system testing, and which cannot be repaired in four (4) hours, shall be cause for terminating the acceptance test of the System. Repeated failures that result in a cumulative time of eight (8) hours to affect repairs shall cause the entire System to be declared unacceptable.
3. Retesting of the entire System shall be rescheduled at the convenience of the Government and costs borne by the Contractor at the direction of the SRE.

J. Acceptance Test Procedure:

1. Physical and Mechanical Inspection:
   a. The TVE 005OP3B Representative will tour all major areas where the Nurse Call and/or Code Blue System and all sub-systems are completely and properly installed to insure they are operationally ready for proof of performance testing. A system inventory including available spare parts will be taken at this time. Each item of installed equipment shall be checked to ensure appropriate UL certification labels are affixed.
   b. The System diagrams, record drawings, equipment manuals, TIP Auto CAD Disks, intermediate, and pretest results shall be formally inventoried and reviewed.
   c. Failure of the System to meet the installation requirements of this specification shall be grounds for terminating all testing.
2. Operational Test:

a. After the Physical and Mechanical Inspection, the central terminating and nurse call master control equipment shall be checked to verify that it meets all performance requirements outlined herein. A spectrum analyzer and sound level meter may be utilized to accomplish this requirement.
b. Following the central equipment test, a pillow speaker (or on board speaker) shall be connected to the central terminating and nurse call master control equipment's output tap to ensure there are no signal distortions such as intermodulation, data noise, popping sounds, erratic system functions, on any function.
c. The distribution system shall be checked at each interface, junction, and distribution point, first, middle, and last intersectional, room, and bed dome light in each leg to verify that the nurse call distribution system meets all system performance standards.
d. Each MATV outlet that is controlled by a nurse call pillow speaker shall be functionally tested at the same time utilizing the Contractor's approved hospital grade HDTV receiver and TV remote control cable.
e. The RED system and volume stepper switches shall be checked to insure proper operation of the pillow speaker, the volume stepper and the RED system (if installed).
f. Additionally, each installed emergency, patient, staff, duty, panic station, intersectional, room, and bed dome light, power supply, code one, and remote annunciator panels shall be checked insuring they meet the requirements of this specification.
g. Once these tests have been completed, each installed sub-system function shall be tested as a unified, functioning and fully operating system. The typical functions are: nurse follower, three levels of emergency signaling (i.e. flashing red emergency, flashing white patient emergency, flashing white or combination lights for staff emergency, separate flashing code blue), minimum of 10 minutes of UPS operation, memory saving, minimum of ten station audio paging, canceling emergency calls at each originating station only, and storage and prioritizing of calls.
h. Individual Item Test: The TVE 005OP3B Representative will select individual items of equipment for detailed proof of performance testing until 100% of the System has been tested and found to meet the contents of this specification. Each item shall meet or exceed the minimum requirements of this document.

3. Test Conclusion:
   a. At the conclusion of the Acceptance Test, using the generated punch list (or discrepancy list) the VA and the Contractor shall jointly agree to the results of the test, and reschedule testing on deficiencies and shortages with the RE. Any retesting to comply with these specifications will be done at the Contractor's expense.
   b. If the System is declared unacceptable without conditions, all rescheduled testing expenses will be borne by the Contractor.

E. Acceptable Test Equipment: The test equipment shall furnished by the Contractor shall have a calibration tag of an acceptable calibration service dated not more than 12 months prior to the test. As part of the submittal, a test equipment list shall be furnished that includes the make and model number of the following type of equipment as a minimum:

4. Spectrum Analyzer.
5. Signal Level Meter.
6. Volt-Ohm Meter.
7. Sound Pressure Level (SPL) Meter.
8. Oscilloscope.
9. Pillow Speaker Test Set (Pillow Speaker with appropriate load and cross connections in lieu of the set is acceptable).
10. Patient Push Button Cord Test Set.
11. Patient Bed with connecting multiple conductor cord.

4.2 WARRANTY

A. Comply with FAR 52.246-21, except that warranty shall be as follows:

B. Contractor's Responsibility:

1. The Contractor shall warranty that all provided material and equipment will be free from defects, workmanship and will remain so for a period of one year from date of final acceptance of the System by the VA. The Contractor shall provide OEM's equipment warranty documents, to the RE (or Facility Contracting Officer if the Facility has taken procession of the building), that certifies each item of equipment installed conforms to OEM published specifications.
2. The Contractor's maintenance personnel shall have the ability to contact the Contractor and OEM for emergency maintenance and logistic assistance, remote diagnostic testing, and assistance in resolving technical problems at any time. This contact capability shall be provided by the Contractor and OEM at no additional cost to the VA.
3. All Contractor maintenance and supervisor personnel shall be fully qualified by the OEM and must provide two (2) copies of current and qualified OEM training certificates and OEM certification upon request.
4. Additionally, the Contractor shall accomplish the following minimum requirements during the two year guaranty period:
   a. Response Time during the Two Year Guaranty Period:
      1) The RE (or Facility Contracting Officer if the system has been turned over to the Facility) is the Contractor's ONLY OFFICIAL reporting and contact official for nurse call system trouble calls, during the guaranty period.
      2) A standard work week is considered 8:00 A.M. to 5:00 P.M. or as designated by the RE (or Facility Contracting Officer), Monday through Friday exclusive of Federal Holidays.
   b. 3) The Contractor shall respond and correct on-site trouble calls, during the standard work week to:
         a) A routine trouble call within one (1) working day of its report. A routine trouble is considered a trouble which causes a pillow speaker or cordset, one (1) master nurse control station, patient station, emergency station, or dome light to be inoperable.
         b) Routine trouble calls in critical emergency health care facilities (i.e., cardiac arrest, intensive care units, etc.) shall also be deemed as an emergency trouble call. The RE (or Facility Contracting Officer) shall notify the Contractor of this type of trouble call.
         c) An emergency trouble call within four hours of its report. An emergency trouble is considered a trouble which causes a sub-system (ward), distribution point, terminal cabinet, or code one system to be inoperable at anytime.
      4) If a Nurse Call and/or Code Blue/ component failure cannot be corrected within four (4) hours (exclusive of the standard work time limits), the Contractor shall be responsible for providing alternate nurse call equipment. The alternate equipment/system shall be operational within a maximum of 20 hours after the four (4) hour trouble shooting time and restore the effected location operation to meet the System performance standards. If any sub-system or major system trouble cannot be corrected within one working day, the Contractor shall furnish and install compatible substitute equipment returning the System or sub-system to full operational capability, as described herein, until repairs are complete.
   c. Required On-Site Visits during the Two Year Guaranty Period
      1) The Contractor shall visit, on-site, for a minimum of eight (8) hours, once every 12 weeks, during the guaranty period, to perform system preventive maintenance, equipment cleaning, and operational adjustments to maintain the System according the descriptions identified in this document.

2) The Contractor shall arrange all Facility visits with the RE (or Facility Contracting Officer) prior to performing the required maintenance visits.
3) Preventive maintenance shall be performed by the Contractor in accordance with the OEM's recommended practice and service intervals during non-busy time agreed to by the RE (or Facility Contracting Officer) and Contractor.
4) The preventive maintenance schedule, functions and reports shall be provided to and approved by the RE (or Facility Contracting Officer).
5) The Contractor shall provide the RE (or Facility Contracting Officer) a type written report itemizing each deficiency found and the corrective action performed during each required visit or official reported trouble call. The Contractor shall provide the RE with sample copies of these reports for review and approval at the beginning of the Acceptance Test. The following reports are the minimum required:
   a) The Contractor shall provide a monthly summary all equipment and sub-systems serviced during this warranty period to RE (or Facility Contracting Officer) by the fifth (5th) working day after the end of each month. The report shall clearly and concisely describe the services rendered, parts replaced and repairs performed. The report shall prescribe anticipated future needs of the equipment and systems for preventive and predictive maintenance.
   b) The Contractor shall maintain a separate log entry for each item of equipment and each sub-system of the System. The log shall list dates and times of all scheduled, routine, and emergency calls. Each emergency call shall be described with details of the nature and causes of emergency steps taken to rectify the situation and specific recommendations to avoid such conditions in the future.
6) The RE (or Facility Contracting Officer) shall convey to the Facility Engineering Officer, two (2) copies of actual reports for evaluation.
   a) The RE (or Facility Contracting Officer) shall ensure a copy of these reports is entered into the System's official acquisition documents.
   b) The Facility Chief Engineer shall ensure a copy of these reports is entered into the System's official technical record documents.

C. Work Not Included: Maintenance and repair service shall not include the performance of any work due to improper use; accidents; other vendor, contractor, or owner tampering or negligence, for which the Contractor is not directly responsible and does not control. The Contractor shall immediately notify the RE or Facility Contracting Officer in writing upon the discovery of these incidents. The RE or Facility Contracting Officer will investigate all reported incidents and render

4.3 TRAINING

A. Provide thorough training of all nursing staff assigned to those nursing units receiving new networked nurse/patient communications equipment. This training shall be developed and implemented to address two different types of staff. Floor nurses/staff shall receive training from their perspective, and likewise, unit secretaries (or any person whose specific responsibilities include answering patient calls and dispatching staff) shall receive operational training from their perspective. A separate training room will be set up that allows this type of individualized training utilizing in-service training unit, prior to cut over of the new system.

B. Provide the following minimum training times and durations:
1. 48 hours prior to opening for nursing staff (in 8-hour increments) – split evenly over 3 weeks and day and night shifts. Coordinate schedule with Owner.
2. 32 hours during the opening week for nursing staff – both day and night shifts.
3. 24 hours for supervisors and system administrators.

5.0 ATTACHMENTS

A. The following items are required as a part of the system:

1. COTS Documents:

a.

CHECKLIST FOR SOFTWARE LICENSING AGREEMENTS

(For use in commercial item acquisition [COTS] conforming to – FAR Part 12)

The Government may not be able to accept standard commercial licensing agreement without modification; *you must* negotiate terms and conditions so it is consistent with the FAR and the VAAR.		
Is the license (check all that apply):	**Yes**	**No**
Exclusive		
Non-exclusive		
Perpetual		
Limited term		
If limited term, state the period (months or years):		
If limited term, is there an automatic renewal provision?		
CPU based		
If CPU based, state number of machines and whether simultaneous use is permitted:		
Site license		
If site license, state the site/location:		
Network license		
Other basis (e.g., # of users, # of transactions, etc.) (state specifics)		
Applicable to only the current version (doesn't apply to future versions)		
Software maintenance included at no extra cost		
Allow for office relocation or transfer		
Allow copying for backup or archival purpose		
Allow no cost copy at disaster recovery site		
Restricted on Use: (see note below)		
Restricted on the processing of data by or for user's subsidiaries and affiliates		
Restricted on processing of third party data (or use in service bureau)		
Restricted on network use		
Restricted on site and equipment limitations		
Restricted on number of users (e.g., cannot exceed _____ # of users)		

Terms and Conditions that may need to be negotiated:	**Yes**	**No**
Does the license prohibit use of the software outside of the Government? If yes, this needs to be deleted/modified if other Government contractors need access to the software (as GFP) to fulfill obligations of their own contracts.		
Does license state that the software is Year 2000 compliant or include a Year 2000 warranty? If no, must ensure it is compliant per FAR 39 or include a Y2K warranty.		
Does the license state that it provides no warranties or guarantees of any kind? If yes, need to determine whether additional warranty would be in the best interest of the Government.		
Does the license warrant that the software does not contain any code (e.g., virus) that will disable the software, and if such code exists, that Licensor agrees to indemnify the licensee (user) for all damages suffered as a result of such code? If no, need to negotiate for such warranty.		
Does the license allow access to source code? If no, negotiate for access if software will be modified or customized for the Government's needs or if the Government intends to maintain the software itself.		
Does the license require Licensor to deposit source code in escrow account? If no and source code is needed, consider negotiating for this provision, and state what "release conditions" are.		
Does the license allow the Government to hold the rights to customized code and to the data that the software manipulates? If no, negotiate for the rights if the Government (customer) requires them.		
Does the license authorize us to copy user manuals for internal purposes? If no, negotiate for authorization if multiple copies must be made for our internal use or ensure that the vendor supplies adequate number of copies. May also negotiate for updated manuals at periodic intervals, e.g., with each major update.		
Does the license state that licensee modifications to the software void all warranties? If yes, ensure that the vendor still warrants the unmodified portions.		
Does the license include clauses that prohibit needed uses of software, restrict the use of output from the software, or inappropriately burden the operation of the computer facilities? If yes, need to negotiate better terms and conditions.		
Is the dispute clause in the license consistent with FAR 52.233-1, Disputes Clause? If no, then need to modify license to be consistent with FAR.		
Does the default clause in the license allow for the Government to terminate for convenience or for cause, consistent with FAR 52.212-4(l) or FAR 52.212-4(m)? If no, then need to modify license to be consistent with FAR Part 12 (not FAR Part 49).		

b.

SOLICITATION/CONTRACT/ORDER FOR COMMERCIAL ITEMS OFFEROR TO COMPLETE BLOCKS 12, 17, 23, 24, & 30			1. REQUISITION NUMBER	PAGE 1 OF 7
2. CONTRACT NO.	3. AWARD/EFFECTIVE DATE SEE BLOCK 31C	4. ORDER NUMBER	5. SOLICITATION NO.	6. SOLICITATION ISSUE DATE
7. FOR SOLICITATION INFORMATION CALL:	a. NAME		b. TELEPHONE NUMBER (No collect calls)	8. OFFER DUE DATE/ LOCAL TIME

9. ISSUED BY: CODE	10. THIS ACQUISITION IS ☐ UNRESTRICTED ☐ SETASIDE: 100 % FOR ☐ SMALL BUSINESS ☐ HUBZONE SMALL BUSINESS ☐ 8(A) NAICS: 541511 SIZE STANDARD:	11. DELIVERY FOR FOB DESTINATION UNLESS BLOCK IS MARKED ☐ SEE SCHEDULE	12. DISCOUNT TERMS
		☐ 13a. THIS CONTRACT IS A RATED ORDER UNDER DPAS (15 CFR 700)	
		13b. RATING	
		14. METHOD OF SOLICITATION ☒ RFQ ☐ IFB ☐ RFP	
15. DELIVER TO CODE	16. ADMINISTERED BY CODE See #9 above		
17a. CONTRACTOR/ OFFEROR CODE FACILITY CODE TELEPHONE NO: 703.246-0392	18a. PAYMENT WILL BE MADE BY CODE UNITED STATES OF AMERICA Department of Veterans Affairs FMS P.O. Box 149971 Austin, TX 78714-8971		

☐ 17b. CHECK IF REMITTANCE IS DIFFERENT AND PUT SUCH ADDRESS IN OFFER	18b. SUBMIT INVOICES TO ADDRESS SHOWN IN BLOCK 18a. UNLESS BLOCK BELOW IS CHECKED ☒ SEE ADDENDUM

19. ITEM NO.	20. SCHEDULE OF SUPPLIES/SERVICES	21. QUANTITY	22. UNIT	23. UNIT PRICE	24. AMOUNT
	See page 2 Use Reverse and/or (Attach Additional Sheets as Necessary)				

25. ACCOUNTING AND APPROPRIATION DATA	26. TOTAL AWARD AMOUNT (For Govt. Use Only)

☐ 27a. SOLICITATION INCORPORATES BY REFERENCE FAR 52.212-1, 52.212-4. FAR 52.212-3 AND 52.212-5 ARE ATTACHED. ADDENDA ☐ ARE ☐ ARE NOT ATTACHED.

☒ 27b. CONTRACT/PURCHASE ORDER INCORPORATES BY REFERENCE FAR 52.212-4, 52.227-14, 52.227-16, and 52.227-19. ADDENDA ☒ ARE ☐ ARE NOT ATTACHED.

☒ 28. CONTRACTOR IS REQUIRED TO SIGN THIS DOCUMENT AND RETURN __1_ COPIES TO ISSUING OFFICE. CONTRACTOR AGREES TO FURNISH AND DELIVER ALL ITEMS SET FORTH OR OTHERWISE IDENTIFIED ABOVE AND ON ANY ADDITIONAL SHEETS SUBJECT TO THE TERMS AND CONDITIONS SPECIFIED HEREIN.	☐ 29. AWARD OF CONTRACT: REF. _____OFFER DATED___ _____. YOUR OFFER ON SOLICITATION (BLOCK 5), INCLUDING ANY ADDITIONS OR CHANGES WHICH ARE SET FORTH HEREIN, IS ACCEPTED AS TO ITEMS:
30A. SIGNATURE OF OFFEROR/CONTRACTOR	31a. UNITED STATES OF AMERICA (SIGNATURE OF CONTRACTING OFFICER)

30b. NAME AND TITLE OF SIGNER (Type or Print)	30c. DATE SIGNED	31b. NAME OF CONTRACTING OFFICER (Type or Print) Contracting Officer	31c. DATE SIGNED

AUTHORIZED FOR LOCAL REPRODUCTION
PREVIOUS EDITION IS NOT USABLE

COMPUTER-GENERATED

STANDARD FORM 1449 (REV. 4/2002)
Prescribed By GSA - FAR (48CFR) 53.212

19. ITEM NO.	20. SCHEDULE OF SUPPLIES/SERVICES	21. QUANTITY	22. UNIT	23. UNIT PRICE	24. AMOUNT

This Contract is Firm Fixed Price (FFP). The Contractor is required to provide the software, software license, and software maintenance services for the computer software identified below. Distribution of maintenance copies shall be accomplished by using an appropriate magnetic, electronic or printed media. Software maintenance includes periodic updates, enhancements and corrections to the software, and reasonable technical support, all of which are customarily provided by the Contractor to its customers.

The name of the software is: Word 2008

License Type: Perpetual or Term?????

Software Manufacturer: Microsoft

Governing Law. Federal law and regulations, including the Federal Acquisition Regulations ("FAR"), shall govern this Contract or Order (Contract/Order). Commercial license agreements may be made a part of this Contract/Order but only if both parties expressly make them an addendum. If the commercial license agreement is not made an addendum, it shall not apply, govern, be a part of or have any effect whatsoever on this Contract/Order; this includes, but is not limited to, any agreement embedded in the computer software (clickwrap) or any agreement that is otherwise delivered with or provided to the Government with the commercial computer software or documentation (shrinkwrap), or any other license agreement otherwise referred to in any document. If a commercial license agreement is made an addendum, only those provisions addressing data rights regarding the Government's use, duplication and disclosure of data (e.g., restricted computer software) are included and made a part of this Contract/Order, and only to the extent that those provisions are not duplicative or inconsistent with Federal law, Federal regulation or the incorporated FAR clauses; those provisions in the commercial license agreement that do not address data rights regarding the Government's use, duplication and disclosure of data shall not be included or made a part of the Contract/Order. Federal law and regulation, including without limitation, the Contract Disputes Act (41 U.S.C. §601-613), the Anti-Deficiency Act (31 U.S.C. §1341 et seq.), the Competition in Contracting Act (41 U.S.C. §251, et seq), the Prompt Payment Act (31 U.S.C. §3901, et seq.) and FAR clauses 52.212-4, 52.227-14, 52.227-19 shall supersede, control and render ineffective any inconsistent, conflicting or duplicative provision in any commercial license agreement. In the event of conflict between this clause and any provision in the Contract/Order or the commercial license agreement or elsewhere, the terms of this clause shall prevail. Claims of patent or copyright infringement brought against the Government as a party shall be defended by the U.S. Department of Justice (DOJ). 28 U.S.C. § 516. At the discretion of DOJ, the Contractor may be allowed reasonable participation in the defense of the litigation. Any additional changes to the Contract/Order must be made by contract modification (Standard Form 30). Nothing in this Contract/Order or any commercial license agreement shall be construed as a waiver of sovereign immunity.

See also Addendum A and B attached hereto.

1	Microsoft Word 2008 Software License, Part No. 9891-7069. Software may be installed on four separate personal computers and be used by any VA employee or support service contractor. Licenses are perpetual.	4	EA	$10,000.00	$40,000.00
2	12 months of Standard Microsoft Word Software Maintenance and Technical Support Services for the software being acquired under CLIN 1; Part No. 9891-7069.	4	EA	$2,500.00	$10,000.00
	Total				$50,000.00

32a. QUANTITY IN COLUMN 21 HAS BEEN

☐ RECEIVED ☐ INSPECTED ☐ ACCEPTED, AND CONFORMS TO THE CONTRACT, EXCEPT AS NOTED:

32b. SIGNATURE OF AUTHORIZED GOVT. REPRESENTATIVE	32c. DATE	32d. PRINTED NAME AND TITLE OF AUTHORIZED GOVERNMENT REPRESENTATIVE
32e. MAILING ADDRESS OF AUTHORIZED GOVERNMENT REPRESENTATIVE		32f. TELEPHONE NO. OF AUTHORIZED GOVERNMENT REPRESENTATIVE 32g. E-MAIL OF AUTHORIZED GOVERNMENT REPRESENTATIVE

33. SHIP NUMBER	34. VOUCHER NUMBER	35. AMOUNT VERIFIED CORRECT FOR	36. PAYMENT ☐ COMPLETE ☐ PARTIAL ☐ FINAL	37. CHECK NUMBER
☐ PARTIAL ☐ FINAL				
38. S/R ACCOUNT NUMBER	39. S/R VOUCHER NUMBER	40. PAID BY		

41a. I CERTIFY THIS ACCOUNT IS CORRECT AND PROPER FOR PAYMENT		42a. RECEIVED BY (Print)	
41b. SIGNATURE AND TITLE OF CERTIFYING OFFICER	41c. DATE	42b. RECEIVED AT (Location)	
		42c. DATE REC'D (YY/MM/DD)	42d. TOTAL CONTAINERS

STANDARD FORM 1449 (REV. 4/2002) BACK

1.2 ADDENDUM A –ADDITIONAL TERMS AND CONDITIONS FOR CONTRACT # _____OR ORDER#_____

A.1 Federal Acquisition Regulation (FAR) Incorporated by Reference. The Contractor agrees to comply with the following FAR clauses, which the Contracting Officer has indicated as being incorporated in this Contract/Order by reference, to implement provisions of law or executive orders applicable to acquisitions of this nature, to implement department policy or to clarify the Government's requirement. Copies of clauses in full text will be provided on request. FAR Clauses can be viewed at http://www.arnet.gov/far/.

FAR 52.212-4, Contract Terms and Conditions-Commercial Items (Oct 2003)
FAR 52.227-14, Rights in Data—General (Dec 2007), Alt III
FAR 52.227-16, Additional Data Requirements (Jun 1987)
FAR 52.227-19, Commercial Computer Software License (Dec 2007)

A.2 Contracting Officer's Authority. The Contracting Officer is the only person authorized to make or approve any changes in any of the requirements of this Contract, and notwithstanding any provisions contained elsewhere in this Contract/Order, the said authority remains solely within the Contracting Officer. In the event the Contractor makes any changes at the direction of any person other than the Contracting Officer, the changes will be considered to have been made without authority and no adjustment will be made in the contract price to cover any increase in costs incurred as a result thereof.

A.3 VAAR 852.270-1 Representatives of Contracting Officers (APR 1984). The Contracting Officer reserves the right to designate representatives to act for him/her in furnishing technical guidance and advice or generally supervise the work to be performed under this Contract/Order. Such designation will be in writing and will define the scope and limitations of the designee's authority. A copy of the designation shall be furnished the Contractor.

A.4 VAAR 852.270-4 Commercial Advertising (NOV 1984). The Contractor will not advertise the award of this Contract/Order in his/her commercial advertising in such a manner as to state or imply that the Department of Veterans Affairs endorses a product, project or commercial line of endeavor.

A.5 VAAR 852.237-70 Contractor Responsibilities (APR 1984) The Contractor shall obtain all necessary licenses and/or permits required to perform this work. He/she shall take all reasonable precautions necessary to protect persons and property from injury or damage during the performance of the Contract/Order. He/she shall be responsible for any injury to himself/herself, his/her employees, as well as for any damage to personal or public property that occurs during the performance of the Contract/Order that is caused by his/her employees fault or negligence, and shall maintain personal liability and property damage insurance having coverage for a limit as required by the laws of the state where services are performed. Further, it is agreed that any negligence of the Government, its officers, agents, servants and employees, shall not be the responsibility of the Contractor hereunder with the regard to any claims, loss, damage, injury, and liability resulting there from.

A.6 Indemnification. The Contractor shall save and hold harmless and indemnify the Government against any and all liability claims, and cost of whatsoever kind and nature for injury to or death of any person or persons and for loss or damage to any Contractor property or property owned by a third party occurring in connection with or in any way incident to or arising out of the occupancy, use service, operation, or performance of work under the terms of the Contract/Order, resulting in whole or in part from the acts or omissions of the Contractor, any subcontractor, or any employee, agent, or representative of the Contractor or subcontractor.

A.7 Government's Liability. The Government shall not be liable for any injury to the Contractor's personnel or damage to the Contractor's property unless such injury or damage is due to negligence on the part of the Government and is recoverable under the Federal Torts Claims Act, or pursuant to other Federal statutory authority.

A.10 Uniform Computer Information Transaction Act (UCITA). UCITA is not applicable to the Contract/Order.

A.11 Software License and Software Maintenance Subscription and Technical Support.

(1) Definitions.
Licensee. The term “licensee” shall mean the U.S. Department of Veterans Affairs (“VA”) and is synonymous with “Government.”
Licensor. The term “licensor” shall mean the software manufacturer of the computer software being acquired. The term “Contractor” is the company identified in Block 17a on the SF1449. If the Contractor is a reseller and not the Licensor, the Contractor remains responsible for performance under this Contract.
Software. The term “software” shall mean the licensed computer software product(s) cited in the Schedule of Supplies (Page 2).
Maintenance. The term “maintenance” is the process of enhancing and optimizing software, as well as remedying defects. It shall include all new fixes, patches, releases, updates, versions and upgrades, as further defined below.
Technical Support. The term “technical support” refers to the range of services providing assistance for the software via the telephone, email, a website or otherwise.
Release or Update. The term “release” or “update” are terms that refer to a revision of software that contains defect corrections, minor enhancements or improvements of the software’s functionality. This is usually designated by a change in the number to the right of the decimal point (e.g., from Version 5.3 to 5.4). An example of an update is the addition of new hardware.
Version or Upgrade. The term “version” or “upgrade” are terms that refer to a revision of software that contains new or improved functionality. This is usually designated by a change in the number to the left of the decimal point (e.g., from Version 5.4 to 6).

(2) License. Grant of License and Term.

See also Addendum B.
Unless otherwise stated in the Schedule of Supplies/Services, the software license provided to the Government is a perpetual, nonexclusive license to use the software.
The license authorizes the Government to use the software in processing data for other federal agencies.
If the licensed software requires a password (or license key) to be operational, it shall be delivered with the software media and have no expiration date.
If the Government decides to outsource or contract its services, the Government may allow the outsourcer to use the licensed software solely to provide the services on its behalf. The outsourcer shall be bound by the provisions of this Contract relating to the use of the software.
If the software is for use in a networked environment, as may be reflected by the number of servers or users described in the Contract/Order, the license grant provided by the Contractor includes the Government’s use of the software in such environment.
Any dispute regarding the license grant or usage limitations shall be resolved in accordance with the Disputes Clause incorporated in FAR 52.212-4(d).
If the Government purchases additional licenses, the terms and conditions for those additional licenses (including technical support and upgrade subscription) shall be the same as agreed to in this Contract/Order, unless negotiated otherwise by mutual agreement of the parties.
The licensed software contains critical product functionality that meets the minimum needs of the Government and is the basis for the Government’s procurement of the software; consequently, the Contractor agrees that the Government has the right to successor products at no additional cost when functionality is later unbundled from the product licensed herein and bundled into a new or different product, provided the Government is current on maintenance.
If the Contractor is a reseller for the computer software being acquired under this Contract/Order, it is permissible for the actual software manufacturer (Licensor) to deliver the software directly to the Government.
All limitations of software usage are expressly stated in the SF 1449 and Addendum A and Addendum B.

Software Maintenance Subscription and Technical Support.

See also Addendum B.

Software maintenance and technical support are included at the agreed upon price. However, if additional charges are assessed during the maintenance and technical support period as a result of negotiated changes in the license (e.g., CPU upgrades), the fee shall be by mutual agreement of the parties and any dispute thereof shall be resolved in accordance with the Disputes Clause incorporated herein at FAR 52.212-4(g).
If the Government desires to continue software maintenance and support beyond the period identified in this Contract/Order, the Government will issue a separate contract or order to renew annual maintenance and technical support. Conversely, if an order or contract to renew software maintenance and technical support is not received, no assumption by the Contractor shall be made that it has been renewed. It shall not be automatically renewed.
Unless otherwise agreed, for any new additional software that may be licensed, the Contractor shall provide for software maintenance and technical support for the first year of the license at no additional cost.
Unless otherwise agreed, the Contractor shall provide VA with software maintenance, which includes periodic updates, upgrades, enhancements and corrections to the software, and reasonable technical support, all of which are customarily provided by the Contractor to its customers so as to cause the software to perform according to its specifications, documentation or demonstrated claims.
Any telephone support provided by Contractor shall be at no additional cost.
All technical support services will be provided in a timely manner in accordance with the Contractor's customary practice. However, prolonged delay in resolving software problems will be noted in the Government's various past performance records on the Contractor (e.g., www.ppirs.gov).
If the Government allows the maintenance and/or technical support to lapse and subsequently wishes to reinstate maintenance and technical support, any reinstatement fee charged shall not exceed the amounts that would have been charged if the Government had not allowed it to lapse.

A.12 Disabling Software Code. The Government requires delivery of computer software that does not contain any code that will, upon the occurrence or the nonoccurrence of any event, disable the software. Such code includes but is not limited to a computer virus, restrictive key, node lock, time-out or other function, whether implemented by electronic, mechanical, or other means, which limits or hinders the use or access to any computer software based on residency on a specific hardware configuration, frequency of duration of use, or other limiting criteria. If any such code is present, the Contractor agrees to indemnify the Government for all damages suffered as a result of a disabling caused by such code, and the Contractor agrees to remove such code upon the Government's request at no extra cost to the Government. Inability of the Contractor to remove the disabling software code will be considered an inexcusable delay and a material breach of contract, and the Government may exercise its right to terminate for cause. In addition, the Government is permitted to remove the code as it deems appropriate and charge the Contractor for consideration for the time and effort in removing the code.

A.13 Disaster Recovery Clause. Government hereby certifies to Contractor that it has a bona fide disaster plan with respect to the computer software programs used in its operations. The Contract/Order authorizes the Government's operation to maintain a second copy of software on tape for use at loading at sites that are not live (e.g. subscription-based disaster recovery services) for the sole purpose of duplicating or mirroring the software environment of the "primary" licenses at the designated licensed site and as described herein. Additionally, use of the software at the contingency sites must not include general access or any processing for program development or production. Contractor shall permit operation and testing of all licensed programs at the contingency sites as designated by the Government without prior approval and at no additional cost to the Government solely for the purpose of maintaining or implementing disaster recovery readiness including continuity of business operations. CPU's, MIPS or MSU's at these contingency sites are excluded from the total CPU's, MIPS or MSU's count included elsewhere in the Contract/Order and are not separately billable. Activation of operations at a contingency site shall be at Government's discretion. Government is authorized to install all software at the contingency sites for testing, problem resolution purposes, and to ensure there will be no operational delays in association with transition of workload from the designated licensed site to the contingency sites. Use of the software at the contingency sites in the event of a disaster shall continue until such time as normal processing can be resumed at the "primary" site regardless of the duration required. Nothing in the Contract/Order diminishes the Government's rights in accordance with the data rights clause(s). Any

license keys, codes, or passwords required by the Contractor in order to use the software at the contingency sites shall be provided to the Government within 10 days of the Government's request.

A.14 NOTICE OF THE FEDERAL ACCESSIBILITY LAW AFFECTING ALL ELECTRONIC AND INFORMATION TECHNOLOGY PROCUREMENTS (SECTION 508)

On August 7, 1998, Section 508 of the Rehabilitation Act of 1973 was amended to require that when Federal departments or agencies develop, procure, maintain, or use Electronic and Information Technology, that they shall ensure it allows Federal employees with disabilities to have access to and use of information and data that is comparable to the access to and use of information and data by other Federal employees.

Section 508 required the Architectural and Transportation Barriers Compliance Board (Access Board) to publish standards setting forth a definition of electronic and information technology and the technical and functional criteria for such technology to comply with Section 508. These standards have been developed were published with an effective date of December 21, 2000. Federal departments and agencies must develop all Electronic and Information Technology requirements to comply with the standards found in 36 CFR 1194 .___*____ in performing this contract. (Fill in Section Number and Title)

ADDENDUM B – STATEMENT OF WORK FOR CONTRACT #_____ or ORDER#_____

B.1 License. BROADLY DESCRIBE COMPUTING ENVIRONMENT AND HOW VA INTENDS TO USE THE SOFTWARE, HOW ITS LICENSED, WHAT THE SOFTWARE IS EXPECTED TO DO, ETC. TO GET YOU STARTED: The Department of Veterans Affairs (VA) has a need for the computer software identified on the Schedule of Supplies/Services (page 2) (software media and license) and software support services. The software will be installed onto multiple servers at the ITAC in Austin Texas for support/training/staging of the _____ Project. These are processor-based licenses that allow for unlimited users utilizing the processor(s). Contractor shall grant the Government the necessary license to accommodate this need. VA may move the software to any other location or hardware at any time.

B.2 Maintenance. The Contractor will provide software maintenance services, which includes periodic updates, enhancements and corrections to the software, and reasonable technical support, all of which are customarily provided by the Contractor to its customers so as to cause the software to perform according to its specifications, documentation or demonstrated claims. Add detailed, specific maintenance and support information here. The Contractor will distribute maintenance updates or releases by using an appropriate magnetic, electronic, or printed media to the address in Block 15 of page one, but to the attention of Joe Smith. Alternatively, the Contractor may offer access to maintenance copies through its website. All maintenance services will be provided in a timely manner in accordance with the Contractor's customary practice. However, prolonged delay in resolving software problems will be noted in the Government's various past performance records on the Contractor (e.g., www.ppirs.gov).

2. MOU

Department of Veterans Affairs

Memorandum

Date: (Current Date)

From: Department of Veterans Affairs
Office of Telecommunications (005OP)
Spectrum Management (005OP2H3 – Room 047))
Telecommunications Voice Engineering (005OP2H2)
810 Vermont Avenue, NW
Washington, DC 20420

Subj: Memorandum of Understanding (MOU) for Non - VA Licensed Wireless Operations

To: Facility Director (00)
(Address)
(Address)

1. The following circumstances are the minimum necessary for conditional use of Wireless Equipment / System (s) in VA Owned or Leased Facilities (here-in after referred to as 'the Facility'). VA Headquarters OI&T's (005) Spectrum Management (005OP2H3), Telecommunications Voice Engineering, Special Communications (TVE - 005OP2H2) and Office of Cyber Security (OCIS – 0050P2) are the responsible entities insuring conformity of each requirement:

   a. Each item of equipment or system whose Radio Frequency (RF) equipment is listed under Consolidated Federal Regulations (CFR), Title 47 – Federal Communications Commission (FCC), Part 15, Chapter 7, *Use of Non Licensed Devices* must be installed and operated in a manner consistent with Part 15's "*Safety of Life*" restrictions. This information is re-emphasized in CFR, Title 15 – Department of Commerce, Under the Information Technology Management Reform Act (Public Law 104-106), National Telecommunications Information Administration (NTIA) *Manual of Regulations and Procedures for Federal Radio Frequency Management* (aka 'The Red Book').

   b. FCC Part 15 listed RF devices ***shall not*** be Installed or used in areas where "*Safety of Life*" functions / operations are accomplished or where a 'Code Blue' enunciation may occur. A list of the minimum areas affected by this statement is provided as Attachment One.

   c. If external or internal interference is detected and cannot be corrected, ***the FCC Part 15 Listed RF Equipment affected must be turned off until corrections and/or substitutions can be made***. Contact VA's Office of Spectrum Management (OSM – 005OP2H3), 202 461-5301 for specific conditional approval(s) concerning this issue.

3. Risk Assessment

Memorandum

Department of
Veterans Affairs

Date: (current date)

From: Director (XXXXX)
Address
Address
Address

Subj: VA Headquarters (VACO) Memorandum of Understanding (MOU) for Federal Communications Commission (FCC) Part 15 Listed "Non-Regulated Equipment Wireless Operations"

To: Department of Veterans Affairs
Office of Telecommunications (005OP)
Spectrum Management (005OP2H3)
Telecommunications Voice Engineering (005OP2H2)
1335 East West Highway, 3rd Floor
Silver Spring, Maryland 20420

1. We have received the subject VACO MOU (signed copy attached), and are pleased to provide the following information and comments for your review that includes our risks and risk-mitigation factors that prompted our Facility's decision:
a. RISK ASSESSMENT AND MITIGATION:
(1) Background:
(a) (name) VAMC (here-in-after referred to as "the Facility") has used (OEM Mdl Nr©) for over 10 years to allow nurses in the telemetry studio to communicate with nurses at the patients' bedside. This communication medium is a vital patient safety tool that allows for rapid response to the development of a potentially fatal arrhythmia such as ventricular tachycardia. The only information the telemetry technician states on the phone is "bed 109-2 Smith has an alarm for XXXXX." Last four is never communicated. In terms of the pager we have limited the information on the pager to sector, bed number and last name. We must include the last name as occasionally the patients are moved without the knowledge of the telemetry technician, if we were to have a patient mix up the page must contain the last name for safety reasons. Facility Management Services (FMS) has restricted paging access to the telemetry system only. Because pager access is restricted, only an administrator from Technology and Information Management (TIM) or FMS can troubleshoot a pager malfunction.
VAMC (City), (State – ZIP Code), Unregulated FCC Equipment Use, Risk Assessment and Mitigation, Page Two
(b) Because the phones are used 24X7 and have exceeded their life expectancy, many of them have begun to fail which creates a need to purchase newer models that will continue to insure system integrity.
(c) Our Facility has been prevented from purchasing replacement phones because VACO now has updated security and Information Technology (IT) connection controls along with continuing FCC Part 15 restrictions (described in the attached MOU) on devices of which these wireless phones are but one example. These updated security and connection controls are in place to address risks related life safety, information security, personal privacy and IT system integrity. The FCC restrictions continue to warn against the use of "non-regulated radio / wireless based equipment in safety of life locations and functions." Of note, these controls are intended to prevent use of these devices in areas especially where a code-blue annunciation might occur, yet our devices have been used in such areas for over 10 years and so far has not prevented a code-blue annunciation from happening.
(d) Because the Facility does not have a near-term alternative to the current wireless phones, it now faces a set of competing risks. On the one hand are the risks of privacy, connection and interference or

security breach(s) that are behind the controls in place for these devices. On the other hand are risks to patient safety if the current phones were to fail and telemetry nurses would lose the ability to rapidly communicate with nurses at the bedside. Our Facility does have a Life Safety approved Nurses Call / Code Blue hardwired system that is installed in those affected areas as the primary Code Blue Enunciation media.

(2) SECURITY:

(a) NEC provides a proprietary scrambling algorithm that is applied to handset registration / authentication and all communications. Every time a (OEM Mdl Nr©) user enters a designated area within the systems' coverage; an automatic user authentication process is performed to confirm the device is authorized for service on the system. This information is scrambled using a proprietary coding scheme to prevent duplication. All voice conversations are also scrambled to enhance security.

(b) The (OEM Mdl Nr©) has several built in security features in each of the wireless handsets are administered through the Facility's Telephone Private Branch Exchange (PBX) administration tool; therefore, the PBX Administrator has full control over the (OEM Mdl Nr©) wireless phones, if one gets lost or stolen it can be disabled immediately. Because of this feature you cannot purchase a similar wireless phone and have it work on our network. These phones have a 50 ft radius from the Zone radio frequency (RF) transceiver; they can only be used within the hospital as there is no handoff via other cellular networks.

(c) These items are not NIST FIPS compliant; but based on the aforementioned facts, we feel patient / staff privacy and HIPAA instructions have been and will continue to be met.

(d) Our Facility will work with (OEM) and VACO's Office of Cyber Security (Name and Phone Nr) to secure the appropriate NIST FIPS certifications will allow VA to issue a Official Approvals from the onset in the IT equipment / system procurement process.

VAMC (City), (State – ZIP Code), Unregulated FCC Equipment Use, Risk Assessment and Mitigation, Page Three

(3) RADIO FREQUENCY (RF) INTERFERENCE:

(a) (OEM) engineers provided us with extensive information on the potential for RF along with electromagnetic (EM) interference to medical equipment within our Facility from the (OEM System) Wireless radio transceivers.

1) Field Experience: Since introduction of the (OEM System) Wireless product in 1996, NEC has installed this system at many health care institutions across the spectrum of medical departments. In all this time there have been zero reports of either suspected or actual RF and EM interference. This includes the experience using these devices at Portland VAMC and our continued testing documentation is available for review if requested.

2) Potential interference called Near Field Coupling: In these cases, an EM field emanating from one device may cause another device within its field area to malfunction. Typically the distances for these fields are less than six (6) inches. In attempts to mitigate these sources of interference, standards have been put in place, namely IEC 60601. This standard calls for devices susceptible to interference to provide shielding against fields of up to three (3) Volts per Meter. In contrast, the (OEM System) wireless products are classified under the FCC Part 15 rules as Class B unlicensed devices, and as such must meet very tight restrictions regarding field emissions of a maximum of from 100 to 500 micro (μ) Volts per Meter across the band of RFs from 30 Hz to 18 gHz. Thus, any medical device even marginally meeting the IEC Standard has not had problems with any near field emissions.

3) Potential phenomenon known as Far Field Induced RFI: should be considered when studying RF and EM interference sources. In this case, a part of the device subject to interference (e.g., a wire, probe, or the casing itself) can inadvertently act as a receiving antenna for a signal transmitted from another device within close proximity (within 6 to 18 inches, depending on the source power levels). To realize this type of interference, the source transmitter power must be fairly strong to conduct through the inefficient nature of the unintended antenna of the receiving device, and the material acting as the antenna must be of a shape and length that matches or is a near multiple of the wavelength of the transmitted RF signal. Finally, this unintentional antenna must not have the typical shielding between it and the subject device's electronics, which if present would prevent such a received signal from causing interference. In the case of the (OEM System) Wireless transmission, which operates between 1,920 mHz and 1,930 mHz, a probe or such piece of any medical device measuring at about six (6) inches would match the wavelength of the RF carrier, and if not properly shielded from the units electronics may indeed conduct the RF energy within. However, even in this case, one must consider the power level at the so-

called antenna receiving the signal. The average output of the (OEM Mdl Nr©) handset is approximately 10 mili (m) Watts when in use. This very low power, even further reduced by the distance between any handset in use and the subject receiving equipment, considered along with the high loss of the "antenna", results in a very low probability of actual interference. These facts, along with the standard procedures of your engineering department's efforts to check the medical equipment for such shielding and filtering defects, should mitigate this potential source.

4) Potential interference between intentional radiators operating in the RF band. Known as either in-band or out-of-band interference, these are cases where a transmitter broadcasts a signal of significant power at the other device's receiver to either overload the receiving radio or mix with the subject's transmitted signal to cause an interfered signal to be received. In-band interference

in the Unlicensed PCS band of which the (OEM System) Wireless system operates is prevented by the FCC rules requiring our equipment to monitor the carrier on which a device intends to transmit on before doing so, so as to sense any current use by another device. If such a signal is received during monitoring, we move to another carrier and try again. This protocol has been demonstrated many times within the FCC labs as well as at many industry trade shows where 5 or more vendors with U-PCS devices have operated in booths close to each other without interference. As for out-of-band interference, because of the extremely low power our devices operate with and the very strict out-of-band emission requirements placed upon the U-PCS devices, and the additional factor of a wide separation in the operating frequencies of our system and the typical radio telemetry equipment used in many hospital environments, such interference is very remote and would require extremely close proximity of the two devices.

5) All of our (OEM Mdl Nr©) are FCC listed and has not interfered with other traffic within the same band. We expect the FCC listed (OEM Mdl Nr©) equipment will perform in the same manner.

(b) Our Facility will work with (OEM) and VACO's Spectrum Management (005OP2H3) to find a RF band that can be utilized for this operation that will allow VA to issue a formal and Official Radio Use Permit that will negate the "unregulated equipment use" issues.

(4) CONNECTION TO IT/CABLE NETWORKS:

(a) Each item or system that attaches to a VA IT Network (telephone or data) must be Department of Commerce's National Recognized Testing Laboratory (NRTL) Underwriters Laboratory (UL) 60950-1/2; Information Technology Equipment - Safety listed and bears UL's mark.

1) Paragraph 1.1.1; Equipment Covered by this Standard specifically identifies these systems / networks as one affected system.

2) Paragraph 1.1.2; Additional Requirements further identifies this requirement for electomedical applications with physical connections to the patient be met.

(b) This requirement is paramount since the Facility's Telephone PABX and associated system is listed by the National Fire Protection Association as Critical Service. Additionally, since it carries our Code Blue Radio and Overhead Audio Paging Signals, VA elevates it to Life Safety Service.

(c) Presently the (OEM Mdl Nr©) wireless phones are UL Listed but does not have the aforementioned specific UL certification. Our Facility is working with (The OEM) in this arena to have them meet or exceed this UL requirement. In the meantime we will abide within the confines outlined in the attached MOU for insuring an approved IT Network / System connection is maintained until the appropriate UL certification has been obtained allowing it to be directly connected to our telephone system.

b. The Facility Director after careful review of the attached MOU and consultation with the Facility's CIO, (OEM) engineers, Biomedical and NFPA Engineers, ISO, HIPAA / Privacy Officer, Clinical Staff and JACHAO Officials has decided this risk-benefit analysis strongly favors purchasing replacement (OEM Mdl Nr) phones.

2. Please feel free to contact me concerning the contents of this document.

DIRECTOR's NAME IN CAPS

cc: Office of General Counsel
Office of Telecommunications (05)
VA Enterprise Infrastructure Engineering
Telecommunications Engineering and Design
Office of Cyber Security

Attachment: VACO MOU

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SECTION 28 05 00

COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section, Common Work Results for Electronic Safety and Security (ESS), applies to all sections of Division 28.

B. Furnish and install fully functional electronic safety and security cabling system(s), equipment and approved accessories in accordance with the specification section(s), drawing(s), and referenced publications. Capacities and ratings of cable and other items and arrangements for the specified items are shown on each system's required Bill of Materials (BOM) and verified on the approved system drawing(s). If there is a conflict between contract's specification(s) and drawings(s), the contract's specification requirements shall prevail.

C. The Contractor shall provide a fully functional and operating ESS, programmed, configured, documented, and tested as required herein and the respective Safety and Security System Specification(s). The Contractor shall provide calculations and analysis to support design and engineering decisions as specified in submittals. The Contractor shall provide and pay all labor, materials, and equipment, sales and gross receipts and other taxes. The Contractor shall secure and pay for plan check fees, permits, other fees, and licenses necessary for the execution of work as applicable for the project. Give required notices; the Contractor will comply with codes, ordinances, regulations, and other legal requirements of public authorities, which bear on the performance of work.

D. The Contractor shall provide an ESS, installed, programmed, configured, documented, and tested. The security system shall include but not limited to: physical access control, intrusion detection, duress alarms, elevator control interface, video assessment and surveillance, video recording and storage, delayed egress, personal protection system, intercommunication system, fire alarm interface, equipment cabinetry, dedicated photo badging system and associated live camera, report printer, photo badge printer, and uninterruptible power supplies (UPS) interface. Operator training shall not be required as part of the Security Contractors scope and shall be provided by the Owner. The Security Contractor shall still be required to provide necessary maintenance and troubleshooting manuals as well as submittals as identified herein. The work shall include the procurement and installation of electrical wire and cables, the installation and testing of all system components. Inspection, testing, demonstration, and acceptance of equipment, software, materials, installation, documentation, and workmanship, shall be as specified herein. The Contractor shall provide all associated installation support, including the provision of primary electrical input power circuits.

E. Repair Service Replacement Parts On-site service during the warranty period shall be provided as specified under "Emergency Service". The Contractor shall guarantee all parts and labor for a term of one (1) year, unless dictated otherwise in this specification from the acceptance date of the system as described in Part 5 of this Specification. The Contractor shall be responsible for all equipment, software, shipping, transportation charges, and expenses associated with the service of the system for one (1) year. The Contractor shall provide 24-hour telephone support for the software program at no additional charge to the owner. Software support shall include all software updates that occur during the warranty period.

F. Section Includes:
   1. Description of Work for Electronic Security Systems,
   2. Electronic security equipment coordination with relating Divisions,
   3. Submittal Requirements for Electronic Security,
   4. Miscellaneous Supporting equipment and materials for Electronic Security,

5. Electronic security installation requirements.

1.2 RELATED WORK

A. Section 01 00 00 - GENERAL REQUIREMENTS. For General Requirements.

B. Section 07 84 00 - FIRESTOPPING. Requirements for firestopping application and use.

C. Section 08 71 00 - DOOR HARDWARE. Requirements for door installation.

D. Section 10 14 00 - SIGNAGE. Requirements for labeling and signs.

E. Section 26 05 11 - REQUIREMENTS FOR ELECTRICAL INSTALLATIONS. Requirements for connection of high voltage.

F. Section 26 05 19 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW). Requirements for power cables.

G. Section 26 05 33 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS. Requirements for infrastructure.

H. Section 26 56 00 - EXTERIOR LIGHTING. Requirements for perimeter lighting.

I. Section 28 05 13 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for conductors and cables.

J. Section 28 05 26 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY. Requirements for grounding of equipment.

K. Section 28 05 28.33 - CONDUITS AND BOXES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for infrastructure.

L. Section 28 08 00 - COMMISIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS. Requirements for Commissioning.

M. Section 28 13 00 - PHYSICAL ACCESS CONTROL SYSTEMS (PACS). For physical access control integration.

N. Section 28 23 00 - VIDEO SURVEILLANCE. Requirements for security camera systems.

1.3 DEFINITIONS

A. AGC: Automatic Gain Control.

B. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.

C. BICSI: Building Industry Consulting Service International.

D. CCD: Charge-coupled device.

E. Central Station: A PC with software designated as the main controlling PC of the security access system. Where this term is presented with initial capital letters, this definition applies.

F. Channel Cable Tray: A fabricated structure consisting of a one-piece, ventilated-bottom or solid-bottom channel section.

G. Controller: An intelligent peripheral control unit that uses a computer for controlling its operation. Where this term is presented with an initial capital letter, this definition applies.

H. CPU: Central processing unit.

I. Credential: Data assigned to an entity and used to identify that entity.

J. DGP: Data Gathering Panel – component of the Physical Access Control System capable to communicate, store and process information received from readers, reader modules, input modules, output modules, and Security Management System.

K. DTS: Digital Termination Service: A microwave-based, line-of-sight communications provided directly to the end user.

L. EMI: Electromagnetic interference.

M. EMT: Electric Metallic Tubing.

N. ESS: Electronic Security System.

O. File Server: A PC in a network that stores the programs and data files shared by users.

P. GFI: Ground fault interrupter.

Q. IDC: Insulation displacement connector.

R. Identifier: A credential card, keypad personal identification number or code, biometric characteristic, or other unique identification entered as data into the entry-control database for the purpose of identifying an individual. Where this term is presented with an initial capital letter, this definition applies.

S. I/O: Input/Output.

T. Intrusion Zone: A space or area for which an intrusion must be detected and uniquely identified, the sensor or group of sensors assigned to perform the detection, and any interface equipment between sensors and communication link to central-station control unit.

U. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).

V. LAN: Local area network.

W. LCD: Liquid-crystal display.

X. LED: Light-emitting diode.

Y. Location: A Location on the network having a PC-to-Controller communications link, with additional Controllers at the Location connected to the PC-to-Controller link with RS-485 communications loop. Where this term is presented with an initial capital letter, this definition applies.

Z. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.

AA. M-JPEG: Motion – Joint Photographic Experts Group.

BB. MPEG: Moving picture experts group.

CC. NEC: National Electric Code

DD. NEMA: National Electrical Manufacturers Association

EE. NFPA: National Fire Protection Association

FF. NTSC: National Television System Committee.

GG. NRTL: Nationally Recognized Testing Laboratory.

HH. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).

II. PACS: Physical Access Control System; A system comprised of cards, readers, door controllers, servers and software to control the physical ingress and egress of people within a given space

JJ. PC: Personal computer. This acronym applies to the Central Station, workstations, and file servers.

KK. PCI Bus: Peripheral component interconnect; a peripheral bus providing a high-speed data path between the CPU and peripheral devices (such as monitor, disk drive, or network).

LL. PDF: (Portable Document Format.) The file format used by the Acrobat document exchange system software from Adobe.

MM. RCDD: Registered Communications Distribution Designer.

NN. RFI: Radio-frequency interference.

OO. RIGID: Rigid conduit is galvanized steel tubing, with a tubing wall that is thick enough to allow it to be threaded.

PP. RS-232: An TIA/EIA standard for asynchronous serial data communications between terminal devices. This standard defines a 25-pin connector and certain signal characteristics for interfacing computer equipment.

QQ. RS-485: An TIA/EIA standard for multipoint communications.

RR. Solid-Bottom or Non-ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal side rails, and a bottom without ventilation openings.

SS. SMS: Security Management System – A SMS is software that incorporates multiple security subsystems (e.g., physical access control, intrusion detection, closed circuit television, intercom) into a single platform and graphical user interface.

TT. TCP/IP: Transport control protocol/Internet protocol incorporated into Microsoft Windows.

UU. Trough or Ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal rails and a bottom having openings sufficient for the passage of air and using 75 percent or less of the plan area of the surface to support cables.

VV. UPS: Uninterruptible Power Supply

WW. UTP: Unshielded Twisted Pair

XX. Workstation: A PC with software that is configured for specific limited security system functions.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: The manufacturer shall regularly and presently produce, as one of the manufacturer's principal products, the equipment and material specified for this project, and shall have manufactured the item for at least three years.

B. Product Qualification:
   1. Manufacturer's product shall have been in satisfactory operation, on three installations of similar size and type as this project, for approximately three years.
   2. The Government reserves the right to require the Contractor to submit a list of installations where the products have been in operation before approval.

C. Contractor Qualification:
   1. The Contractor or security sub-contractor shall be a licensed security Contractor with a minimum of five (5) years experience installing and servicing systems of similar scope and complexity. The Contractor shall be an authorized regional representative of the Security Management System's (PACS) manufacturer. The Contractor shall provide four (4) current references from clients with systems of similar scope and complexity which became operational in the past three (3) years. At least three (3) of the references shall be utilizing the same system components, in a similar configuration as the proposed system. The references must include a current point of contact, company or agency name, address, telephone number, complete system description, date of completion, and approximate cost of the project. The owner reserves the option to visit the reference sites, with the site owner's permission and representative, to verify the quality of installation and the references' level of satisfaction with the system. The Contractor shall provide copies of system manufacturer certification for all technicians. The Contractor

shall only utilize factory-trained technicians to install, program, and service the PACS. The Contractor shall only utilize factory-trained technicians to install, terminate and service controller/field panels and reader modules. The technicians shall have a minimum of five (5) continuous years of technical experience in electronic security systems. The Contractor shall have a local service facility. The facility shall be located within 60 miles of the project site. The local facility shall include sufficient spare parts inventory to support the service requirements associated with this contract. The facility shall also include appropriate diagnostic equipment to perform diagnostic procedures. The Resident Engineer reserves the option of surveying the company's facility to verify the service inventory and presence of a local service organization.

2. The Contractor shall provide proof project superintendent with BICSI Certified Commercial Installer Level 1, Level 2, or Technician to provide oversight of the project.
3. Cable installer must have on staff a Registered Communication Distribution Designer (RCDD) certified by Building Industry Consulting Service International. The staff member shall provide consistent oversight of the project cabling throughout design, layout, installation, termination and testing.

D. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within four hours of receipt of notification that service is needed. Submit name and address of service organizations.

1.5 GENERAL ARANGEMENT OF CONTRACT DOCUMENTS

A. The Contract Documents supplement to this specification indicates approximate locations of equipment. The installation and/or locations of the equipment and devices shall be governed by the intent of the design; specification and Contract Documents, with due regard to actual site conditions, recommendations, ambient factors affecting the equipment and operations in the vicinity. The Contract Documents are diagrammatic and do not reveal all offsets, bends, elbows, components, materials, and other specific elements that may be required for proper installation. If any departure from the contract documents is deemed necessary, or in the event of conflicts, the Contractor shall submit details of such departures or conflicts in writing to the owner or owner's representative for his or her comment and/or approval before initiating work.

B. Anything called for by one of the Contract Documents and not called for by the others shall be of like effect as if required or called by all, except if a provision clearly designed to negate or alter a provision contained in one or more of the other Contract Documents shall have the intended effect. In the event of conflicts among the Contract Documents, the Contract Documents shall take precedence in the following order: the Form of Agreement; the Supplemental General Conditions; the Special Conditions; the Specifications with attachments; and the drawings.

1.6 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. The Government's approval shall be obtained for all equipment and material before delivery to the job site. Delivery, storage or installation of equipment or material which has not had prior approval will not be permitted at the job site.

C. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.
   1. Mark the submittals, "SUBMITTED UNDER SECTION_____".
   2. Submittals shall be marked to show specification reference including the section and paragraph numbers.
   3. Submit each section separately.

D. The submittals shall include the following:

1. Information that confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, pictures, nameplate data and test reports as required.
2. Parts list which shall include those replacement parts recommended by the equipment manufacturer, quantity of parts, current price and availability of each part.

E. Submittals shall be in full compliance of the Contract Documents. All submittals shall be provided in accordance with this section. Submittals lacking the breath or depth these requirements will be considered incomplete and rejected. Submissions are considered multidisciplinary and shall require coordination with applicable divisions to provide a complete and comprehensive submission package. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings and other data necessary for the Government to ascertain that the proposed equipment and materials comply with specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify equipment being submitted. Additional general provisions are as follows:
1. The Contractor shall schedule submittals in order to maintain the project schedule. For coordination drawings refer to Specification Section 01 33 23 - Design Submittal Procedures, which outline basic submittal requirements and coordination. Section 01 33 23 shall be used in conjunction with this section.
2. The Contractor shall identify variations from requirements of Contract Documents and state product and system limitations, which may be detrimental to successful performance of the completed work or system.
3. Each package shall be submitted at one (1) time for each review and include components from applicable disciplines (e.g., electrical work, architectural finishes, door hardware, etc.) which are required to produce an accurate and detailed depiction of the project.
4. Manufacturer’s information used for submittal shall have pages with items for approval tagged, items on pages shall be identified, and capacities and performance parameters for review shall be clearly marked through use of an arrow or highlighting. Provide space for Resident Engineer and Contractor review stamps.
5. Technical Data Drawings shall be in the latest version of AutoCAD®, drawn accurately, and in accordance with VA CAD Standards CAD Standard Application Guide, and VA BIM Guide. FREEHAND SKETCHES OR COPIED VERSIONS OF THE CONSTRUCTION DOCUMENTS WILL NOT BE ACCEPTED. The Contractor shall not reproduce Contract Documents or copy standard information as the basis of the Technical Data Drawings. If departures from the technical data drawings are subsequently deemed necessary by the Contractor, details of such departures and the reasons thereof shall be submitted in writing to the Resident Engineer for approval before the initiation of work.
6. Packaging: The Contractor shall organize the submissions according to the following packaging requirements.
   a. Binders: For each manual, provide heavy duty, commercial quality, durable three (3) ring vinyl covered loose leaf binders, sized to receive 8.5 x 11 in paper, and appropriate capacity to accommodate the contents. Provide a clear plastic sleeve on the spine to hold labels describing the contents. Provide pockets in the covers to receive folded sheets.
      1) Where two (2) or more binders are necessary to accommodate data; correlate data in each binder into related groupings according to the Project Manual table of contents. Cross-referencing other binders where necessary to provide essential information for communication of proper operation and/or maintenance of the component or system.
      2) Identify each binder on the front and spine with printed binder title, Project title or name, and subject matter covered. Indicate the volume number if applicable.
   b. Dividers: Provide heavy paper dividers with celluloid tabs for each Section. Mark each tab to indicate contents.

c. Protective Plastic Jackets: Provide protective transparent plastic jackets designed to enclose diagnostic software for computerized electronic equipment.

d. Text Material: Where written material is required as part of the manual use the manufacturer's standard printed material, or if not available, specially prepared data, neatly typewritten on 8.5 inches by 11 inches 20 pound white bond paper.

e. Drawings: Where drawings and/or diagrams are required as part of the manual, provide reinforced punched binder tabs on the drawings and bind them with the text.
   1) Where oversized drawings are necessary, fold the drawings to the same size as the text pages and use as a foldout.
   2) If drawings are too large to be used practically as a foldout, place the drawing, neatly folded, in the front or rear pocket of the binder. Insert a type written page indicating the drawing title, description of contents and drawing location at the appropriate location of the manual.
   3) Drawings shall be sized to ensure details and text is of legible size. Text shall be no less than 1/16” tall.

f. Manual Content: Submit in accordance with Section 01 00 00, GENERAL REQUIREMENTS.
   1) Maintenance and Operation Manuals: Submit as required for systems and equipment specified in the technical sections. Furnish four copies, bound in hardback binders, (manufacturer's standard binders) or an approved equivalent. Furnish one complete manual as specified in the technical section but in no case later than prior to performance of systems or equipment test, and furnish the remaining manuals prior to contract completion.
   2) Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, equipment, building, name of Contractor, and contract number. Include in the manual the names, addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the system or equipment.
   3) The manuals shall include:
      a) Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.
      b) A control sequence describing start-up, operation, and shutdown.
      c) Description of the function of each principal item of equipment.
      d) Installation and maintenance instructions.
      e) Safety precautions.
      f) Diagrams and illustrations.
      g) Testing methods.
      h) Performance data.
      i) Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare parts, and name of servicing organization.
      j) Appendix; list qualified permanent servicing organizations for support of the equipment, including addresses and certified qualifications.

g. Binder Organization: Organize each manual into separate sections for each piece of related equipment. At a minimum, each manual shall contain a title page, table of contents, copies of Product Data supplemented by drawings and written text, and copies of each warranty, bond, certifications, and service Contract issued. Refer to Group I through V Technical Data Package Submittal requirements for required section content.

h. Title Page: Provide a title page as the first sheet of each manual to include the following information; project name and address, subject matter covered by the manual, name and address of the Project, date of the submittal, name, address,

and telephone number of the Contractor, and cross references to related systems in other operating and/or maintenance manuals.

i. Table of Contents: After the title page, include a type written table of contents for each volume, arranged systematically according to the Project Manual format. Provide a list of each product included, identified by product name or other appropriate identifying symbols and indexed to the content of the volume. Where more than one (1) volume is required to hold data for a particular system, provide a comprehensive table of contents for all volumes in each volume of the set.

j. General Information Section: Provide a general information section immediately following the table of contents, listing each product included in the manual, identified by product name. Under each product, list the name, address, and telephone number of the installer and maintenance Contractor. In addition, list a local source for replacement parts and equipment.

k. Drawings: Provide specially prepared drawings where necessary to supplement the manufacturers printed data to illustrate the relationship between components of equipment or systems, or provide control or flow diagrams. Coordinate these drawings with information contained in Project Record Drawings to assure correct illustration of the completed installation.

l. Manufacturer’s Data: Where manufacturer's standard printed data is included in the manuals, include only those sheets that are pertinent to the part or product installed. Mark each sheet to identify each part or product included in the installation. Where more than one (1) item in tabular format is included, identify each item, using appropriate references from the Contract Documents. Identify data that is applicable to the installation and delete references to information which is not applicable.

m. Where manufacturer's standard printed data is not available and the information is necessary for proper operation and maintenance of equipment or systems, or it is necessary to provide additional information to supplement the data included in the manual, prepare written text to provide the necessary information. Organize the text in a consistent format under a separate heading for different procedures. Where necessary, provide a logical sequence of instruction for each operating or maintenance procedure. Where similar or more than one product is listed on the submittal the Contractor shall differentiate by highlighting the specific product to be utilized.

n. Calculations: Provide a section for circuit and panel calculations.

o. Loading Sheets: Provide a section for DGP Loading Sheets.

p. Certifications: Provide section for Contractor’s manufacturer certifications.

7. Contractor Review: Review submittals prior to transmittal. Determine and verify field measurements and field construction criteria. Verify manufacturer’s catalog numbers and conformance of submittal with requirements of contract documents. Return non-conforming or incomplete submittals with requirements of the work and contract documents. Apply Contractor’s stamp with signature certifying the review and verification of products occurred, and the field dimensions, adjacent construction, and coordination of information is in accordance with the requirements of the contract documents.

8. Resubmission: Revise and resubmit submittals as required within 15 calendar days of return of submittal. Make resubmissions under procedures specified for initial submittals. Identify all changes made since previous submittal.

9. Product Data: Within 15 calendar days after execution of the contract, the Contractor shall submit for approval a complete list of all of major products proposed for use. The data shall include name of manufacturer, trade name, model number, the associated contract document section number, paragraph number, and the referenced standards for each listed product.

F. Group 1 Technical Data Package: Group I Technical Data Package shall be one submittal consisting of the following content and organization. Refer to VA Special Conditions Document for drawing format and content requirements. The data package shall include the following:

1. Section I - Drawings:
   a. General – Drawings shall conform to VA CAD Standards Guide. All text associated with security details shall be 1/8” tall and meet VA text standard for AutoCAD™ drawings.
   b. Cover Sheet – Cover sheet shall consist of Project Title and Address, Project Number, Area and Vicinity Maps.
   c. General Information Sheets – General Information Sheets shall consist of General Notes, Abbreviations, Symbols, Wire and Cable Schedule, Project Phasing, and Sheet Index.
   d. Floor Plans – Floor plans shall be produced from the Architectural backgrounds issued in the Construction Documents. The contractor shall receive floor plans from the prime A/E to develop these drawing sets. Security devices shall be placed on drawings in scale. All text associated with security details shall be 1/8” tall and meet VA text standard for AutoCAD™ drawings. Floor plans shall identify the following:
      1) Security devices by symbol,
      2) The associated device point number (derived from the loading sheets),
      3) Wire & cable types and counts
      4) Conduit sizing and routing
      5) Conduit riser systems
      6) Device and area detail call outs
   e. Architectural details – Architectural details shall be produced for each device mounting type (door details for EECS and IDS, Intrusion Detection system (motion sensor, vibration, microwave Motion Sensor and Camera mounting,
   f. Riser Diagrams – Contractor shall provide a riser diagram indicating riser architecture and distribution of the SMS throughout the facility (or area in scope).
   g. Block Diagrams – Contractor shall provide a block diagram for the entire system architecture and interconnections with SMS subsystems. Block diagram shall identify SMS subsystem (e.g., electronic entry control, intrusion detection, closed circuit television, intercom, and other associated subsystems) integration; and data transmission and media conversion methodologies.
   h. Interconnection Diagrams – Contractor shall provide interconnection diagram for each sensor, and device component. Interconnection diagram shall identify termination locations, standard wire detail to include termination schedule. Diagram shall also identify interfaces to other systems such as elevator control, fire alarm systems, and security management systems.
   i. Security Details:
      1) Panel Assembly Detail – For each panel assembly, a panel assembly details shall be provided identifying individual panel component size and content.
      2) Panel Details – Provide security panel details identify general arrangement of the security system components, backboard size, wire through size and location, and power circuit requirements.
      3) Device Mounting Details – Provide mounting detailed drawing for each security device (physical access control system, intrusion detection, video surveillance and assessment, and intercom systems) for each type of wall and ceiling configuration in project. Device details shall include device, mounting detail, wiring and conduit routing.
      4) Details of connections to power supplies and grounding
      5) Details of surge protection device installation
      6) Sensor detection patterns – Each system sensor shall have associated detection patterns.
      7) Equipment Rack Detail – For each equipment rack, provide a scaled detail of the equipment rack location and rack space utilization. Use of BISCI wire management standards shall be employed to identify wire management methodology. Transitions between equipment racks shall be shown to include use vertical and horizontal latter rack system.

8) Security Control Room – The contractor shall provide a layout plan for the Security Control Room. The layout plan shall identify all equipment and details associated with the installation.
9) Operator Console – The contractor shall provide a layout plan for the Operator Console. The layout plan shall identify all equipment and details associated with the installation. Equipment room - the contractor shall provide a layout plan for the equipment room. The layout plan shall identify all equipment and details associated with the installation.
10) Equipment Room – Equipment room details shall provide architectural, electrical, mechanical, plumbing, IT/Data and associated equipment and device placements both vertical and horizontally.

j. Electrical Panel Schedule – Electrical Panel Details shall be provided for all SMS systems electrical power circuits. Panel details shall be provided identifying panel type (Standard, Emergency Power, Emergency/Uninterrupted Power Source, and Uninterrupted Power Source Only), panel location, circuit number, and circuit amperage rating.

k. Door Schedule – A door schedule shall be developed for each door equipped with electronic security components. At a minimum, the door schedule shall be coordinated with Division 08 work and include the following information:
1) Item Number
2) Door Number (Derived from A/E Drawings)
3) Floor Plan Sheet Number
4) Standard Detail Number
5) Door Description (Derived from Loading Sheets)
6) Data Gathering Panel Input Number
7) Door Position or Monitoring Device Type & Model Number
8) Lock Type, Model Number & Power Input/Draw (standby/active)
9) Card Reader Type & Model Number
10) Shunting Device Type & Model Number
11) Sounder Type & Model Number
12) Manufacturer
13) Misc. devices as required
a) Delayed Egress Type & Model Number
b) Intercom
c) Camera
d) Electric Transfer Hinge
e) Electric Pass-through device
14) Remarks column indicating special notes or door configurations

2. Camera Schedule - A camera schedule shall be developed for each camera. Contractors shall coordinate with the Resident Engineer to determine camera starting numbers and naming conventions. All drawings shall identify wire and cable standardization methodology. Color coding of all wiring conductors and jackets is required and shall be communicated consistently throughout the drawings package submittal. At a minimum, the camera schedule shall include the following information:
a. Item Number
b. Camera Number
c. Naming Conventions
d. Description of Camera Coverage
e. Camera Location
f. Floor Plan Sheet Number
g. Camera Type
h. Mounting Type
i. Standard Detail Reference
j. Power Input & Draw
k. Power Panel Location
l. Remarks Column for Camera

3. Section II – Data Gathering Panel Documentation Package
   a. Contractor shall provide Data Gathering Panel (DGP) input and output documentation packages for review at the Shop Drawing submittal stage and also with the as-built documentation package. The documentation packages shall be provided in both printed and magnetic form at both review stages.
   b. The Contractor shall provide loading sheet documentation package for the associated DGP, including input and output boards for all field panels associated with the project. Documentation shall be provided in current version Microsoft Excel spreadsheets following the format currently utilized by VA. A separate spreadsheet file shall be generated for each DGP and associated field panels.
   c. The spreadsheet names shall follow a sequence that shall display the spreadsheets in numerical order according to the DGP system number. The spreadsheet shall include the prefix in the file name that uniquely identifies the project site. The spreadsheet shall detail all connected items such as card readers, alarm inputs, and relay output connections. The spreadsheet shall include an individual section (row) for each panel input, output and card reader. The spreadsheet shall automatically calculate the system numbers for card readers, inputs, and outputs based upon data entered in initialization fields.
   d. All entries must be verified against the field devices. Copies of the floor plans shall be forwarded under separate cover.
   e. The DGP spreadsheet shall include an entry section for the following information:
      1) DGP number
      2) First Reader Number
      3) First Monitor Point Number
      4) First Relay Number
      5) DGP, input or output Location
      6) DGP Chain Number
      7) DGP Cabinet Tamper Input Number
      8) DGP Power Fail Input Number
      9) Number of Monitor Points Reserved For Expansion Boards
      10) Number of Control Points (Relays) Reserved For Expansion Boards
   f. The DGP, input module and output module spreadsheets shall automatically calculate the following information based upon the associated entries in the above fields:
      1) System Numbers for Card Readers
      2) System Numbers for Monitor Point Inputs
      3) System Numbers for Control Points (Relays)
      4) Next DGP or input module First Monitor Point Number
      5) Next DGP or output module First Control Point Number
   g. The DGP spreadsheet shall provide the following information for each card reader:
      1) DGP Reader Number
      2) System Reader Number
      3) Cable ID Number
      4) Description Field (Room Number)
      5) Description Field (Device Type i.e.: In Reader, Out Reader, etc.)
      6) Description Field
      7) DGP Input Location
      8) Date Test
      9) Date Passed
      10) Cable Type
      11) Camera Numbers (of cameras viewing the reader location)
   h. The DGP and input module spreadsheet shall provide the following information for each monitor point (alarm input).
      1) DGP Monitor Point Input Number
      2) System Monitor Point Number
      3) Cable ID Number

4) Description Field (Room Number)
5) Description Field (Device Type i.e.: Door Contact, Motion Detector, etc.)
6) DGP or input module Input Location
7) Date Test
8) Date Passed
9) Cable Type
10) Camera Numbers (of associated alarm event preset call-ups)

i. The DGP and output module spreadsheet shall provide the following information for each control point (output relay).
1) DGP Control Point (Relay) Number
2) System (Control Point) Number
3) Cable ID Number
4) Description Field (Room Number)
5) Description Field (Device: Lock Control, Local Sounder, etc.)
6) Description Field
7) DGP or OUTPUT MODULE Output Location
8) Date Test
9) Date Passed Cable Type
10) Camera Number (of associated alarm event preset call-ups)

j. The DGP, input module and output module spreadsheet shall include the following information or directions in the header and footer:
1) Header
a) DGP Input and Output Worksheet
b) Enter Beginning Reader, Input, and Output Starting Numbers and Sheet Will Automatically Calculate the Remaining System Numbers.
2) Footer
a) File Name
b) Date Printed
c) Page Number

4. Section III - Construction Mock-up: In areas with exposed EMT/Conduit Raceways, contractor shall conceal raceway as much as practical and unobtrusively. In addition, historic significance must be considered to determine installation means and methods for approval by the owner.
5. Section IV - Manufacturers' Data: The data package shall include manufacturers' data for all materials and equipment, including sensors, local processors and console equipment provided under this specification.
6. Section V - System Description and Analysis: The data package shall include system descriptions, analysis, and calculations used in sizing equipment required by these specifications. Descriptions and calculations shall show how the equipment will operate as a system to meet the performance requirements of this specification. The data package shall include the following:
a. Central processor memory size; communication speed and protocol description; rigid disk system size and configuration; flexible disk system size and configuration; back-up media size and configuration; alarm response time calculations; command response time calculations; start-up operations; expansion capability and method of implementation; sample copy of each report specified; and color photographs representative of typical graphics.
b. Software Data: The data package shall consist of descriptions of the operation and capability of the system, and application software as specified.
c. Overall System Reliability Calculations: The data package shall include all manufacturers' reliability data and calculations required to show compliance with the specified reliability.
7. Section VI – Certifications & References: All specified manufacturer's certifications shall be included with the data package. Contractor shall provide Project references as outlined in Paragraph 1.4 "Quality Assurance".

G. Group II Technical Data Package
   1. The Contractor shall prepare a report of “Current Site Conditions” and submit a report to the Resident Engineer documenting changes to the site, particularly those conditions that affect performance of the system to be installed. The Contractor shall provide specification sheets, or written functional requirements to support the findings, and a cost estimate to correct those site changes or conditions which affect the installation of the system or its performance. The Contractor shall not correct any deficiency without written permission from the COR.
   2. System Configuration and Functionality: The contractor shall provide the results of the meeting with VA to develop system requirements and functionality including but not limited to:
      a. Baseline configuration
      b. Access levels
      c. Schedules (intrusion detection, physical access control, holidays, etc.)
      d. Badge database
      e. System monitoring and reporting (unit level and central control)
      f. f. Naming conventions and descriptors

H. Group III Technical Data Package
   1. Development of Test Procedures: The Contractor will prepare performance test procedures for the system testing. The test procedures shall follow the format of the VA Testing procedures and be customized to the contract requirements. The Contractor will deliver the test procedures to the Resident Engineer for approval at least 60 calendar days prior to the requested test date.

I. Group IV Technical Data Package
   1. Performance Verification Test
      a. Based on the successful completion of the pre-delivery test, the Contractor shall finalize the test procedures and report forms for the performance verification test (PVT) and the endurance test. The PVT shall follow the format, layout and content of the pre-delivery test. The Contractor shall deliver the PVT and endurance test procedures to the Resident Engineer for approval. The Contractor may schedule the PVT after receiving written approval of the test procedures. The Contractor shall deliver the final PVT and endurance test reports within 14 calendar days from completion of the tests. Refer to Part 3 of this section for System Testing and Acceptance requirements.
   2. Training Documentation
      a. New Facilities and Major Renovations: Familiarization training shall be provided for new equipment or systems. Training can include site familiarization training for VA technicians and administrative personnel. Training shall include general information on new system layout including closet locations, turnover of the completed system including all documentation, including manuals, software, key systems, and full system administration rights. Lesson plans and training manuals training shall be oriented to type of training to be provided.
      b. New Unit Control Room:
         1) Provide the security personnel with training in the use, operation, and maintenance of the entire control room system (Unit Control and Equipment Rooms). The training documentation must include the operation and maintenance. The first of the training sessions shall take place prior to system turnover and the second immediately after turnover. Coordinate the training sessions with the Owner. Completed classroom sessions will be witnessed and documented by the Architect/Engineer, and approved by the Resident Engineer. Instruction is not to begin until the system is operational as designed.
         2) The training documents will cover the operation and the maintenance manuals and the control console operators’ manuals and service manuals in detail, stressing all important operational and service diagnostic information

necessary for the maintenance and operations personnel to efficiently use and maintain all systems.

3) Provide an illustrated control console operator's manual and service manual. The operator's manual shall be written in laymen's language and printed so as to become a permanent reference document for the operators, describing all control panel switch operations, graphic symbol definitions and all indicating functions and a complete explanation of all software.

4) The service manual shall be written in laymen's language and printed so as to become a permanent reference document for maintenance personnel, describing how to run internal self diagnostic software programs, troubleshoot head end hardware and field devices with a complete scenario simulation of all possible system malfunctions and the appropriate corrective measures.

5) Provide a professional color DVD instructional recording of all the operational procedures described in the operator's manual. All charts used in the training session shall be clearly presented on the video. Any DVD found to be inferior in recording or material content shall be reproduced at no cost until an acceptable DVD is submitted. Provide four copies of the training DVD, one to the architect/engineer and three to the owner.

3. System Configuration and Data Entry:

a. The contractor is responsible for providing all system configuration and data entry for the SMS and subsystems (e.g., video matrix switch, intercom, digital video recorders, network video recorders). All data entry shall be performed per VA standards & guidelines. The Contractor is responsible for participating in all meetings with the client to compile the information needed for data entry. These meetings shall be established at the beginning of the project and incorporated in to the project schedule as a milestone task. The contractor shall be responsible for all data collection, data entry, and system configuration. The contractor shall collect, enter, & program and/or configure the following components:

1) Physical Access control system components,
2) All intrusion detection system components,
3) Video surveillance, control and recording systems,
4) Intercom systems components,
5) All other security subsystems shown in the contract documents.

b. The Contractor is responsible for compiling the card access database for the VA employees, including programming reader configurations, access shifts, schedules, exceptions, card classes and card enrollment databases.

c. Refer to Part 3 for system programming requirements and planning guidelines.

4. Graphics: Based on CAD as-built drawings developed for the construction project, create all map sets showing locations of all alarms and field devices. Graphical maps of all alarm points installed under this contract including perimeter and exterior alarm points shall be delivered with the system. The Contractor shall create and install all graphics needed to make the system operational. The Contractor shall utilize data from the contract documents, Contractor’s field surveys, and all other pertinent information in the Contractor’s possession to complete the graphics. The Contractor shall identify and request from the COR, any additional data needed to provide a complete graphics package. Graphics shall have sufficient level of detail for the system operator to assess the alarm. The Contractor shall supply hard copy, color examples at least 203.2 x 254 mm (8 x 10 in) of each type of graphic to be used for the completed Security system. The graphics examples shall be delivered to the Resident Engineer for review and approval at least 90 calendar days prior to the scheduled date the Contractor requires them.

J. Group V Technical Data Package: Final copies of the manuals shall be delivered to the Resident Engineer as part of the acceptance test. The draft copy used during site testing shall be updated with any changes required prior to final delivery of the manuals. Each manual’s

contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of each sub-contractor installing equipment or systems, as well as the nearest service representatives for each item of equipment for each system. The manuals shall include a table of contents and tab sheets. Tab sheets shall be placed at the beginning of each chapter or section and at the beginning of each appendix. The final copies delivered after completion of the endurance test shall include all modifications made during installation, checkout, and acceptance. Six (6) hard-copies and one (1) soft copy on CD of each item listed below shall be delivered as a part of final systems acceptance.

1. Functional Design Manual: The functional design manual shall identify the operational requirements for the entire system and explain the theory of operation, design philosophy, and specific functions. A description of hardware and software functions, interfaces, and requirements shall be included for all system operating modes. Manufacturer developed literature may be used; however, shall be produced to match the project requirements.
2. Equipment Manual: A manual describing all equipment furnished including:
    a. General description and specifications; installation and checkout procedures; equipment electrical schematics and layout drawings; system schematics and layout drawings; alignment and calibration procedures; manufacturer's repair list indicating sources of supply; and interface definition.
3. Software Manual: The software manual shall describe the functions of all software and include all other information necessary to enable proper loading, testing, and operation. The manual shall include:
    a. Definition of terms and functions; use of system and applications software; procedures for system initialization, start-up, and shutdown; alarm reports; reports generation, database format and data entry requirements; directory of all disk files; and description of all communications protocols including data formats, command characters, and a sample of each type of data transfer.
4. Operator's Manual: The operator's manual shall fully explain all procedures and instructions for the operation of the system, including:
    a. Computers and peripherals; system start-up and shutdown procedures; use of system, command, and applications software; recovery and restart procedures; graphic alarm presentation; use of report generator and generation of reports; data entry; operator commands' alarm messages, and printing formats; and system access requirements.
5. Maintenance Manual: The maintenance manual shall include descriptions of maintenance for all equipment including inspection, recommend schedules, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.
6. Spare Parts & Components Data: At the conclusion of the Contractor's work, the Contractor shall submit to the Resident Engineer a complete list of the manufacturer's recommended spare parts and components required to satisfactorily maintain and service the systems, as well as unit pricing for those parts and components.
7. Operation, Maintenance & Service Manuals: The Contractor shall provide two (2) complete sets of operating and maintenance manuals in the form of an instructional manual for use by the VA Security Guard Force personnel. The manuals shall be organized into suitable sets of manageable size. Where possible, assemble instructions for similar equipment into a single binder. If multiple volumes are required, each volume shall be fully indexed and coordinated.
8. Equipment and Systems Maintenance Manual: The Contractor shall provide the following descriptive information for each piece of equipment, operating system, and electronic system:
    a. Equipment and/or system function.
    b. Operating characteristics.
    c. Limiting conditions.
    d. Performance curves.
    e. Engineering data and test.

f. f. Complete nomenclature and number of replacement parts.
g. Provide operating and maintenance instructions including assembly drawings and diagrams required for maintenance and a list of items recommended to stock as spare parts.
h. Provide information detailing essential maintenance procedures including the following: routine operations, trouble shooting guide, disassembly, repair and re-assembly, alignment, adjusting, and checking.
i. Provide information on equipment and system operating procedures, including the following; start-up procedures, routine and normal operating instructions, regulation and control procedures, instructions on stopping, shut-down and emergency instructions, required sequences for electric and electronic systems, and special operating instructions.
j. Manufacturer equipment and systems maintenance manuals are permissible.

9. Project Redlines: During construction, the Contractor shall maintain an up-to-date set of construction redlines detailing current location and configuration of the project components. The redline documents shall be marked with the words 'Master Redlines' on the cover sheet and be maintained by the Contractor in the project office. The Contractor will provide access to redline documents anytime during the project for review and inspection by the Resident Engineer or authorized Office of Protection Services representative. Master redlines shall be neatly maintained throughout the project and secured under lock and key in the contractor's onsite project office. Any project component or assembly that is not installed in strict accordance with the drawings shall be so noted on the drawings. Prior to producing Record Construction Documents, the contractor will submit the Master Redline document to the Resident Engineer for review and approval of all changes or modifications to the documents. Each sheet shall have Resident Engineer initials indicating authorization to produce "As Built" documents. Field drawings shall be used for data gathering & field changes. These changes shall be made to the master redline documents daily. Field drawings shall not be considered "master redlines".
10. Record Specifications: The Contractor shall maintain one (1) copy of the Project Specifications, including addenda and modifications issued, for Project Record Documents. The Contractor shall mark the Specifications to indicate the actual installation where the installation varies substantially from that indicated in the Contract Specifications and modifications issued. (Note related Project Record Drawing information where applicable). The Contractor shall pay particular attention to substitutions, selection of product options, and information on concealed installations that would be difficult to identify or measure and record later. Upon completion of the mark ups, the Contractor shall submit record Specifications to the COR. As with master relines, Contractor shall maintain record specifications for Resident Engineer review and inspection at anytime.
11. Record Product Data: The Contractor shall maintain one (1) copy of each Product Data submittal for Project Record Document purposes. The Data shall be marked to indicate the actual product installed where the installation varies substantially from that indicated in the Product Data submitted. Significant changes in the product delivered to the site and changes in manufacturer's instructions and recommendations for installation shall be included. Particular attention will be given to information on concealed products and installations that cannot be readily identified or recorded later. Note related Change Orders and mark up of Record Construction Documents, where applicable. Upon completion of mark up, submit a complete set of Record Product Data to the COR.
12. Miscellaneous Records: The Contractor shall maintain one (1) copy of miscellaneous records for Project Record Document purposes. Refer to other Specifications for miscellaneous record-keeping requirements and submittals concerning various construction activities. Before substantial completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for use and reference. Categories of requirements resulting in miscellaneous records include a minimum of the following:

a. Certificates received instead of labels on bulk products.
b. Testing and qualification of tradesmen. (“Contractor’s Qualifications”)
c. Documented qualification of installation firms.
d. Load and performance testing.
e. Inspections and certifications.
f. Final inspection and correction procedures.
g. Project schedule

13. Record Construction Documents (Record As-Built)
    a. Upon project completion, the contractor shall submit the project master redlines to the Resident Engineer prior to development of Record construction documents. The Resident Engineer shall be given a minimum of a thirty (30) day review period to determine the adequacy of the master redlines. If the master redlines are found suitable by the Resident Engineer, the Resident Engineer will initial and date each sheet and turn redlines over to the contractor for as built development.
    b. The Contractor shall provide the Resident Engineer a complete set of "as-built" drawings and original master redlined marked "as-built" blue-line in the latest version of AutoCAD drawings unlocked on CD or DVD. The as-built drawing shall include security device number, security closet connection location, data gathering panel number, and input or output number as applicable. All corrective notations made by the Contractor shall be legible when submitted to the COR. If, in the opinion of the COR, any redlined notation is not legible, it shall be returned to the Contractor for re-submission at no extra cost to the Owner. The Contractor shall organize the Record Drawing sheets into manageable sets bound with durable paper cover sheets with suitable titles, dates, and other identifications printed on the cover. The submitted as built shall be in editable formats and the ownership of the drawings shall be fully relinquished to the owner.
    c. Where feasible, the individual or entity that obtained record data, whether the individual or entity is the installer, sub-contractor, or similar entity, is required to prepare the mark up on Record Drawings. Accurately record the information in a comprehensive drawing technique. Record the data when possible after it has been obtained. For concealed installations, record and check the mark up before concealment. At the time of substantial completion, submit the Record Construction Documents to the COR. The Contractor shall organize into bound and labeled sets for the COR's continued usage. Provide device, conduit, and cable lengths on the conduit drawings. Exact in-field conduit placement/routings shall be shown. All conduits shall be illustrated in their entire length from termination in security closets; no arrowed conduit runs shall be shown. Pull box and junction box sizes are to be shown if larger than 100mm (4 inch).

K. FIPS 201 Compliance Certificates
1. Provide Certificates for all software components and device types utilizing credential verification. Provide certificates for:
    a. Fingerprint Capture Station
    b. Card Readers
    c. Facial Image Capturing Camera
    d. PIV Middelware
    e. Template Matcher
    f. Electromagnetically Opaque Sleeve
    g. Certificate Management
        1) CAK Authentication System
        2) PIV Authentication System
        3) Certificate Validator
        4) Cryptographic Module

L. Approvals will be based on complete submission of manuals together with shop drawings.

M. After approval and prior to installation, furnish the Resident Engineer with one sample of each of the following:
   1. A 300 mm (12 inch) length of each type and size of wire and cable along with the tag from the coils of reels from which the samples were taken.
   2. Each type of conduit and pathway coupling, bushing and termination fitting.
   3. Conduit hangers, clamps and supports.
   4. Duct sealing compound.

N. Completed System Readiness Checklists provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 28 08 00 COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS.

O. In addition to the requirement of SUBMITTALS, the VA reserves the right to request the manufacturer to arrange for a VA representative to see typical active systems in operation, when there has been no prior experience with the manufacturer or the type of equipment being submitted.

1.7 APPLICABLE PUBLICATIONS

A. The publications listed below (including amendments, addenda, revisions, supplement, and errata) form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American National Standards Institute (ANSI)/ International Code Council (ICC):
   A117.1 ..... Standard on Accessible and Usable Buildings and Facilities

C. American National Standards Institute (ANSI)/ Security Industry Association (SIA):
   AC-03 ..... Access Control: Access Control Guideline Dye Sublimation Printing Practices for PVC Access Control Cards

   CP-01-00 ..... Control Panel Standard-Features for False Alarm Reduction

   PIR-01-00 ..... Passive Infrared Motion Detector Standard - Features for Enhancing False Alarm Immunity

   TVAC-01 ..... CCTV to Access Control Standard - Message Set for System Integration

D. American National Standards Institute (ANSI)/Electronic Industries Alliance (EIA):
   330-09 ..... Electrical Performance Standards for CCTV Cameras

   375A-76 ..... Electrical Performance Standards for CCTV Monitors

E. American National Standards Institute (ANSI):
   ANSI S3.2-99 ..... Method for measuring the Intelligibility of Speech over Communications Systems

F. American Society for Testing and Materials (ASTM)
   B1-07 ..... Standard Specification for Hard-Drawn Copper Wire

   B3-07 ..... Standard Specification for Soft or Annealed Copper Wire

   B8-04 ..... Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

   C1238-97 (R03) ..... Standard Guide for Installation of Walk-Through Metal Detectors

   D2301-04 ..... Standard Specification for Vinyl Chloride Plastic Pressure Sensitive Electrical Insulating Tape

G. Architectural Barriers Act (ABA), 1968

H. Department of Justice: American Disability Act (ADA)
   28 CFR Part 36-2010 ADA Standards for Accessible Design

I. Department of Veterans Affairs:
   1. VHA National CAD Standard Application Guide, 2006
   2. VA BIM Guide, V1.0 10

J. Federal Communications Commission (FCC):
   .....(47 CFR 15) Part 15 Limitations on the Use of Wireless Equipment/Systems

K. Federal Information Processing Standards (FIPS):
   FIPS-201-1 .....Personal Identity Verification (PIV) of Federal Employees and Contractors

L. Federal Specifications (Fed. Spec.):
   A-A-59544-08 .....Cable and Wire, Electrical (Power, Fixed Installation)

M. Government Accountability Office (GAO):
   GAO-03-8-02.....Security Responsibilities for Federally Owned and Leased Facilities

N. Homeland Security Presidential Directive (HSPD):
   HSPD-12 .....Policy for a Common Identification Standard for Federal Employees and Contractors

O. Institute of Electrical and Electronics Engineers (IEEE):
   81-1983 .....IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System

   802.3af-08 .....Power over Ethernet Standard

   802.3at-09 .....Power over Ethernet (PoE) Plus Standard

   C2-07.....National Electrical Safety Code

   C62.41-02.....IEEE Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits

   C95.1-05.....Standards for Safety Levels with Respect to Human Exposure in Radio Frequency Electromagnetic Fields

P. International Organization for Standardization (ISO):
   7810 .....Identification cards – Physical characteristics

   7811 .....Physical Characteristics for Magnetic Stripe Cards

   7816-1 .....Identification cards - Integrated circuit(s) cards with contacts - Part 1: Physical characteristics

   7816-2 .....Identification cards - Integrated circuit cards - Part 2: Cards with contacts -Dimensions and location of the contacts

   7816-3 .....Identification cards - Integrated circuit cards - Part 3: Cards with contacts - Electrical interface and transmission protocols

   7816-4 .....Identification cards - Integrated circuit cards - Part 11: Personal verification through biometric methods

   7816-10 .....Identification cards - Integrated circuit cards - Part 4: Organization, security and commands for interchange

   14443 .....Identification cards - Contactless integrated circuit cards; Contactless Proximity Cards Operating at 13.56 MHz in up to 5 inches distance

15693 ..... Identification cards -- Contactless integrated circuit cards - Vicinity cards; Contactless Vicinity Cards Operating at 13.56 MHz in up to 50 inches distance

19794 ..... Information technology - Biometric data interchange formats

Q. National Electrical Contractors Association
303-2005 ..... Installing Closed Circuit Television (CCTV) Systems

R. National Electrical Manufactures Association (NEMA):
250-08 ..... Enclosures for Electrical Equipment (1000 Volts Maximum)

TC-3-04 ..... PVC Fittings for Use with Rigid PVC Conduit and Tubing

FB1-07..... Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable

S. National Fire Protection Association (NFPA):
70-11 ..... National Electrical Code (NEC)

731-08 ..... Standards for the Installation of Electric Premises Security Systems

99-2005 ..... Health Care Facilities

T. National Institute of Justice (NIJ)
0601.02-03 ..... Standards for Walk-Through Metal Detectors for use in Weapons Detection

0602.02-03 ..... Hand-Held Metal Detectors for Use in Concealed Weapon and Contraband Detection

U. National Institute of Standards and Technology (NIST):
IR 6887 V2.1 ..... Government Smart Card Interoperability Specification (GSC-IS)

Special Pub 800-37 ..... Guide for Applying the Risk Management Framework to Federal Information Systems

Special Pub 800-63 ..... Electronic Authentication Guideline

Special Pub 800-73-3..... Interfaces for Personal Identity Verification (4 Parts)

..... Pt. 1- End Point PIV Card Application Namespace, Data Model & Representation

..... Pt. 2- PIV Card Application Card Command Interface

..... Pt. 3- PIV Client Application Programming Interface

..... Pt. 4- The PIV Transitional Interfaces & Data Model Specification

Special Pub 800-76-1..... Biometric Data Specification for Personal Identity Verification

Special Pub 800-78-2..... Cryptographic Algorithms and Key Sizes for Personal Identity Verification

Special Pub 800-79-1..... Guidelines for the Accreditation of Personal Identity Verification Card Issuers

Special Pub 800-85B-1 ..... DRAFTPIV Data Model Test Guidelines

Special Pub 800-85A-2 ..... PIV Card Application and Middleware Interface Test Guidelines (SP 800-73-3 compliance)

Special Pub 800-96 ..... PIV Card Reader Interoperability Guidelines

Special Pub 800-104A ..... Scheme for PIV Visual Card Topography

V. Occupational and Safety Health Administration (OSHA):
29 CFR 1910.97 ..... Nonionizing radiation

W. Section 508 of the Rehabilitation Act of 1973

X. Security Industry Association (SIA):
AG-01 ..... Security CAD Symbols Standards

Y. Underwriters Laboratories, Inc. (UL):
1-05 ..... Flexible Metal Conduit
5-04 ..... Surface Metal Raceway and Fittings
6-07 ..... Rigid Metal Conduit
44-05 ..... Thermoset-Insulated Wires and Cables
50-07 ..... Enclosures for Electrical Equipment
83-08 ..... Thermoplastic-Insulated Wires and Cables
294-99 ..... The Standard of Safety for Access Control System Units
305-08 ..... Standard for Panic Hardware
360-09 ..... Liquid-Tight Flexible Steel Conduit
444-08 ..... Safety Communications Cables
464-09 ..... Audible Signal Appliances
467-07 ..... Electrical Grounding and Bonding Equipment
486A-03 ..... Wire Connectors and Soldering Lugs for Use with Copper Conductors
486C-04 ..... Splicing Wire Connectors
486D-05 ..... Insulated Wire Connector Systems for Underground Use or in Damp or Wet Locations
486E-00 ..... Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
493-07 ..... Thermoplastic-Insulated Underground Feeder and Branch Circuit Cable
514A-04 ..... Metallic Outlet Boxes
514B-04 ..... Fittings for Cable and Conduit
51-05 ..... Schedule 40 and 80 Rigid PVC Conduit
609-96 ..... Local Burglar Alarm Units and Systems
634-07 ..... Standards for Connectors with Burglar-Alarm Systems
636-01 ..... Standard for Holdup Alarm Units and Systems
639-97 ..... Standard for Intrusion-Detection Units
651-05 ..... Schedule 40 and 80 Rigid PVC Conduit
651A-07 ..... Type EB and A Rigid PVC Conduit and HDPE Conduit
752-05 ..... Standard for Bullet-Resisting Equipment
797-07 ..... Electrical Metallic Tubing
827-08 ..... Central Station Alarm Services

1037-09 ..... Standard for Anti-theft Alarms and Devices

1635-10 ..... Digital Alarm Communicator System Units

1076-95 ..... Standards for Proprietary Burglar Alarm Units and Systems

1242-06 ..... Intermediate Metal Conduit

1479-03 ..... Fire Tests of Through-Penetration Fire Stops

1981-03 ..... Central Station Automation System

2058-05 ..... High Security Electronic Locks

60950 ..... Safety of Information Technology Equipment

60950-1 ..... Information Technology Equipment - Safety - Part 1: General Requirements

Z. Uniform Federal Accessibility Standards (UFAS) 1984

AA. United States Department of Commerce:
Special Pub 500-101 ..... Care and Handling of Computer Magnetic Storage Media

1.8 COORDINATION

A. Coordinate arrangement, mounting, and support of electronic safety and security equipment:
1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electronic safety and security items that are behind finished surfaces or otherwise concealed.

1.9 MAINTENANCE & SERVICE

A. General Requirements
1. The Contractor shall provide all services required and equipment necessary to maintain the entire integrated electronic security system in an operational state as specified for a period of one (1) year after formal written acceptance of the system. The Contractor shall provide all necessary material required for performing scheduled adjustments or other non-scheduled work. Impacts on facility operations shall be minimized when performing scheduled adjustments or other non-scheduled work. See also General Project Requirements.

B. Description of Work
1. The adjustment and repair of the security system includes all software updates, panel firmware, and the following new items computers equipment, communications transmission equipment and data transmission media (DTM), local processors, security system sensors, physical access control equipment, facility interface, signal transmission equipment, and video equipment.

C. Personnel
1. Service personnel shall be certified in the maintenance and repair of the selected type of equipment and qualified to accomplish all work promptly and satisfactorily. The Resident Engineer shall be advised in writing of the name of the designated service representative,

and of any change in personnel. The Resident Engineer shall be provided copies of system manufacturer certification for the designated service representative.

D. Schedule of Work
1. The work shall be performed during regular working hours, Monday through Friday, excluding federal holidays.

E. System Inspections
1. These inspections shall include:
a. The Contractor shall perform two (2) minor inspections at six (6) month intervals or more if required by the manufacturer, and two (2) major inspections offset equally between the minor inspections to effect quarterly inspection of alternating magnitude.
1) Minor Inspections shall include visual checks and operational tests of all console equipment, peripheral equipment, local processors, sensors, electrical and mechanical controls, and adjustments on printers.
2) Major Inspections shall include all work described for Minor Inspections and the following: clean all system equipment and local processors including interior and exterior surfaces; perform diagnostics on all equipment; operational tests of the CPU, switcher, peripheral equipment, recording devices, monitors, picture quality from each camera; check, walk test, and calibrate each sensor; run all system software diagnostics and correct all problems; and resolve any previous outstanding problems.

F. Emergency Service
1. The owner shall initiate service calls whenever the system is not functioning properly. The Contractor shall provide the Owner with an emergency service center telephone number. The emergency service center shall be staffed 24 hours a day 365 days a year. The Owner shall have sole authority for determining catastrophic and non-catastrophic system failures within parameters stated in General Project Requirements.
a. For catastrophic system failures, the Contractor shall provide same day four (4) hour service response with a defect correction time not to exceed eight (8) hours from notification. Catastrophic system failures are defined as any system failure that the Owner determines will place the facility(s) at increased risk.
b. For non-catastrophic failures, the Contractor within eight (8) hours with a defect correction time not to exceed 24 hours from notification.

G. Operation
1. Performance of scheduled adjustments and repair shall verify operation of the system as demonstrated by the applicable portions of the performance verification test.

H. Records & Logs
1. The Contractor shall maintain records and logs of each task and organize cumulative records for each component and for the complete system chronologically. A continuous log shall be submitted for all devices. The log shall contain all initial settings, calibration, repair, and programming data. Complete logs shall be maintained and available for inspection on site, demonstrating planned and systematic adjustments and repairs have been accomplished for the system.

I. Work Request
1. The Contractor shall separately record each service call request, as received. The record shall include the serial number identifying the component involved, its location, date and time the call was received, specific nature of trouble, names of service personnel assigned to the task, instructions describing the action taken, the amount and nature of the materials used, and the date and time of commencement and completion. The Contractor shall deliver a record of the work performed within five (5) working days after the work was completed.

J. System Modifications

1. The Contractor shall make any recommendations for system modification in writing to the Resident Engineer. No system modifications, including operating parameters and control settings, shall be made without prior written approval from the Resident Engineer. Any modifications made to the system shall be incorporated into the operation and maintenance manuals and other documentation affected.

K. Software
1. The Contractor shall provide all software updates when approved by the Owner from the manufacturer during the installation and 12-month warranty period and verify operation of the system. These updates shall be accomplished in a timely manner, fully coordinated with the system operators, and incorporated into the operations and maintenance manuals and software documentation. There shall be at least one (1) scheduled update near the end of the first year's warranty period, at which time the Contractor shall install and validate the latest released version of the Manufacturer's software. All software changes shall be recorded in a log maintained in the unit control room. An electronic copy of the software update shall be maintained within the log. At a minimum, the contractor shall provide a description of the modification, when the modification occurred, and name and contact information of the individual performing the modification. The log shall be maintained in a white 3 ring binder and the cover marked "SOFTWARE CHANGE LOG".

1.10 MINIMUM REQUIREMENTS

A. References to industry and trade association standards and codes are minimum installation requirement standards.

B. Drawings and other specification sections shall govern in those instances where requirements are greater than those specified in the above standards.

1.11 DELIVERY, STORAGE, & HANDLING

A. Equipment and materials shall be protected during shipment and storage against physical damage, dirt, moisture, cold and rain:
1. During installation, enclosures, equipment, controls, controllers, circuit protective devices, and other like items, shall be protected against entry of foreign matter; and be vacuum cleaned both inside and outside before testing and operating and repainting if required.
2. Damaged equipment shall be, as determined by the Resident Engineer, placed in first class operating condition or be returned to the source of supply for repair or replacement.
3. Painted surfaces shall be protected with factory installed removable heavy craft paper, sheet vinyl or equal.
4. Damaged paint on equipment and materials shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

B. Central Station, Workstations, and Controllers:
1. Store in temperature and humidity controlled environment in original manufacturer's sealed containers. Maintain ambient temperature between 10 to 30 deg C (50 to 85 deg F), and not more than 80 percent relative humidity, non-condensing.
2. Open each container; verify contents against packing list, and file copy of packing list, complete with container identification for inclusion in operation and maintenance data.
3. Mark packing list with designations which have been assigned to materials and equipment for recording in the system labeling schedules generated by cable and asset management system.
4. Save original manufacturer's containers and packing materials and deliver as directed under provisions covering extra materials.

1.12 PROJECT CONDITIONS

A. Environmental Conditions: System shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:

1. Interior, Controlled Environment: System components, except central-station control unit, installed in temperature-controlled interior environments shall be rated for continuous operation in ambient conditions of 2 to 50 deg C (36 to 122 deg F) dry bulb and 20 to 90 percent relative humidity, non-condensing. NEMA 250, Type 1 enclosure.
2. Interior, Uncontrolled Environment: System components installed in non-temperature-controlled interior environments shall be rated for continuous operation in ambient conditions of -18 to 50 deg C (0 to 122 deg F) dry bulb and 20 to 90 percent relative humidity, non-condensing. NEMA 250, Type 4X enclosures.
3. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambient conditions of -34 to 50 deg C (-30 to 122 deg F) dry bulb and 20 to 90 percent relative humidity, condensing. Rate for continuous operation where exposed to rain as specified in NEMA 250, winds up to 137 km/h (85 mph) and snow cover up to 610 mm (24 in) thick. NEMA 250, Type 4X enclosures.
4. Hazardous Environment: System components located in areas where fire or explosion hazards may exist because of flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers shall be rated, listed, and installed according to NFPA 70.
5. Corrosive Environment: For system components subjected to corrosive fumes, vapors, and wind-driven salt spray in coastal zones, provide NEMA 250, Type 4X enclosures.

B. Security Environment: Use vandal resistant enclosures in high-risk areas where equipment may be subject to damage.

C. Console: All console equipment shall, unless noted otherwise, be rated for continuous operation under ambient environmental conditions of 15.6 to 29.4 deg C (60 to 85 deg F) and a relative humidity of 20 to 80 percent.

1.13 EQUIPMENT AND MATERIALS

A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts shall be available.

B. When more than one unit of the same class of equipment is required, such units shall be the product of a single manufacturer.

C. Equipment Assemblies and Components:
1. Components of an assembled unit need not be products of the same manufacturer.
2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
3. Components shall be compatible with each other and with the total assembly for the intended service.
4. Constituent parts which are similar shall be the product of a single manufacturer.

D. Factory wiring shall be identified on the equipment being furnished and on all wiring diagrams.

E. When Factory Testing Is Specified:
1. The Government shall have the option of witnessing factory tests. The contractor shall notify the VA through the Resident Engineer a minimum of 15 working days prior to the manufacturers making the factory tests.
2. Four copies of certified test reports containing all test data shall be furnished to the Resident Engineer prior to final inspection and not more than 90 days after completion of the tests.
3. When equipment fails to meet factory test and re-inspection is required, the contractor shall be liable for all additional expenses, including expenses of the Government.

1.14 ELECTRICAL POWER

A. Electrical power of 120 Volts Alternating Current (VAC) shall be indicated on the Division 26 drawings. Additional locations requiring primary power required by the security system shall be shown as part of these contract documents. Primary power for the security system shall be

configured to switch to emergency backup sources automatically if interrupted without degradation of any critical system function. Alarms shall not be generated as a result of power switching, however, an indication of power switching on (on-line source) shall be provided to the alarm monitor. The Security Contractor shall provide an interface (dry contact closure) between the PACS and the Uninterruptible Power Supply (UPS) system so the UPS trouble signals and main power fail appear on the PACS operator terminal as alarms.

B. Failure of any on-line battery shall be detected and reported as a fault condition. Battery backed-up power supplies shall be provided sized for 8 hours of operation at actual connected load. Requirements for additional power or locations shall be included with the contract to support equipment and systems offered. The following minimum requirements shall be provided for power sources and equipment.
   1. Emergency Generator
      a. Report Printers: Unit Control Room
      b. Video Monitors: Unit Control Room
      c. Intercom Stations
      d. Radio System
      e. Lights: Unit Control Room, Equipment Rooms, & Security Offices
      f. Outlets: Security Outlets dedicated to security equipment racks or security enclosure assemblies.
      g. Security Device Power Supplies (DGP, VASS, Card Access, Lock Power, etc.) powered from the security closets or remotely: various locations
      h. Telephone/Radio Recording Equipment: Unit Control Room.
      i. VASS Camera Power Supplies: Security Closets
      j. VASS Pan/Tilt Units: Various Locations
      k. VASS Outdoor Housing Heaters and Blowers: Various Sites
      l. Intercom Master Control System
      m. Fiber Optic Receivers/Transmitters
      n. Security office Weapons Storage
      o. Outlets that charge handheld radios
   2. Uninterruptible Power Supply (UPS) on Emergency Power
      a. The following 120VAC circuits shall be provided by others. The Security Contractor shall coordinate exact locations with the Electrical Contractor:
         1) Security System Monitors and Keyboards: Control Room
         2) CPU: Control Equipment Room
         3) Communications equipment: Control Equipment Room and various sites.
         4) VASS Matrix Switcher: Control Equipment Room
         5) VASS: Control Equipment Room
         6) Digital Video Recorders, encoders & decoders: Control Room
         7) All equipment Room racked equipment.
         8) Network switches

1.15 TRANSIENT VOLTAGE SUPPRESSION, POWER SURGE SUPPLESION, & GROUNDING

A. Transient Voltage Surge Suppression: All cables and conductors extending beyond building façade, except fiber optic cables, which serve as communication, control, or signal lines shall be protected against Transient Voltage surges and have Transient Voltage Surge Suppression (TVSS) protection. The TVSS device shall be UL listed in accordance with Standard TIA 497B installed at each end. Lighting and surge suppression shall be a multi-strike variety and include a fault indicator. Protection shall be furnished at the equipment and additional triple solid state surge protectors rated for the application on each wire line circuit shall be installed within 914.4 mm (3 ft) of the building cable entrance. Fuses shall not be used for surge protection. The inputs and outputs shall be tested in both normal mode and common mode to verify there is no interference.
   1. A 10-microsecond rise time by 1000 microsecond pulse width waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.

2. An 8-microsecond rise time by 20-microsecond pulse width waveform with a peak voltage of 1000 volts and a peak current of 500 amperes.
3. Maximum series current: 2 AMPS. Provide units manufactured by Advanced Protection Technologies, model # TE/FA 10B or TE/FA 20B.
4. Operating Temperature and Humidity: -40 to 85 deg C (-40 to 185 deg F), 0 to 95 percent relative humidity.

B. Grounding and Surge Suppression
1. The Security Contractor shall provide grounding and surge suppression to stabilize the voltage under normal operating conditions. To ensure the operation of over current devices, such as fuses, circuit breakers, and relays, under ground-fault conditions.
2. Security Contractor shall engineer and provide proper grounding and surge suppression as required by local jurisdiction and prevailing codes and standards referenced in this document.
3. Principal grounding components and features. Include main grounding buses and grounding and bonding connections to service equipment.
4. Details of interconnection with other grounding systems. The lightning protection system shall be provided by the Security Contractor.
5. Locations and sizes of grounding conductors and grounding buses in electrical, data, and communication equipment rooms and closets.
6. AC power receptacles are not to be used as a ground reference point.
7. Any cable that is shielded shall require a ground in accordance with the best practices of the trade and manufactures installation instructions.
8. Protection should be provided at both ends of cabling.

1.16 COMPONENT ENCLOSURES

A. Construction of Enclosures
1. Consoles, power supply enclosures, detector control and terminal cabinets, control units, wiring gutters, and other component housings, collectively referred to as enclosures, shall be so formed and assembled as to be sturdy and rigid.
2. Thickness of metal in-cast and sheet metal enclosures of all types shall not be less than those in Tables I and II, UL 611. Sheet steel used in fabrication of enclosures shall be not less than 14 gauge. Consoles shall be 16-gauge.
3. Doors and covers shall be flanged. Enclosures shall not have pre-punched knockouts. Where doors are mounted on hinges with exposed pins, the hinges shall be of the tight pin type or the ends of hinge pins shall be tack welded to prevent removal. Doors having a latch edge length of less than 609.6 mm (24 in) shall be provided with a single construction core. Where the latch edge of a hinged door is more than 609.6 mm (24 in) or more in length, the door shall be provided with a three-point latching device with construction core; or alternatively with two, one located near each end.
4. Any ventilator openings in enclosures and cabinets shall conform to the requirements of UL 611. Unless otherwise indicated, sheet metal enclosures shall be designed for wall mounting with tip holes slotted. Mounting holes shall be in positions that remain accessible when all major operating components are in place and the door is open, but shall be in accessible when the door is closed.
5. Covers of pull and junction boxes provided to facilitate initial installation of the system shall be held in place by tamper proof Torx Center post security screws. Stenciled or painted labels shall be affixed to such boxes indicating they contain no connections. These labels shall not indicate the box is part of the Electronic Security System (ESS).

B. Consoles & Equipment Racks: All consoles and vertical equipment racks shall include a forced air-cooling system to be provided by others.
1. Vertical Equipment Racks:
   a. The forced air blowers shall be installed in the vented top of each cabinet and shall not reduce usable rack space.
   b. The forced air fan shall consist of one fan rated at 105 CFM per rack bay and noise level shall not exceed 55 decibels.

c. Vertical equipment racks are to be provided with full sized clear plastic locking doors and vented top panels as shown on contract drawings.

2. Console racks:
   a. Forced air fans shall be installed in the top rear of each console bay. The forced air fan shall consist of one fan rated at 105 CFM mounted to a 133mm vented blank panel the noise level of each fan shall not exceed 55 decibels. The fans shall be installed so air is pulled from the bottom of the rack or cabinet and exhausted out the top.
   b. Console racks are to be provided with flush mounted hinged rear doors with recessed locking latch on the bottom and middle sections of the consoles. Provide code access to support wiring for devices located on the work surfaces.

C. Tamper Provisions and Tamper Switches:
1. Enclosures, cabinets, housings, boxes and fittings or every product description having hinged doors or removable covers and which contain circuits, or the integrated security system and its power supplies shall be provided with cover operated, corrosion-resistant tamper switches.
2. Tamper switches shall be arranged to initiate an alarm signal that will report to the monitoring station when the door or cover is moved. Tamper switches shall be mechanically mounted to maximize the defeat time when enclosure covers are opened or removed. It shall take longer than 1 second to depress or defeat the tamper switch after opening or removing the cover. The enclosure and tamper switch shall function together in such a manner as to prohibit direct line of sign to any internal component before the switch activates.
3. Tamper switches shall be inaccessible until the switch is activated. Have mounting hardware concealed so the location of the switch cannot be observed from the exterior of the enclosure. Be connected to circuits which are under electrical supervision at all times, irrespective of the protection mode in which the circuit is operating. Be spring-loaded and held in the closed position by the door or cover and be wired so they break the circuit when the door cover is disturbed. Tamper circuits shall be adjustable type screw sets and shall be adjusted by the contractor to eliminate nuisance alarms associated with incorrectly mounted tamper device shall annunciate prior to the enclosure door opening (within 1/4 “ tolerance. The tamper device or its components shall not be visible or accessing with common tools to bypass when the enclosure is in the secured mode.
4. The single gang junction boxes for the portrait alarming and pull boxes with less than 102 square mm will not require tamper switches.
5. All enclosures over 305 square mm shall be hinged with an enclosure lock.
6. Control Enclosures: Maintenance/Safety switches on control enclosures, which must be opened to make routing maintenance adjustments to the system and to service the power supplies, shall be push/pull-set automatic reset type.
7. Provide one (1) enclosure tamper switch for each 609 linear mm of enclosure lock side opening evenly spaced.
8. All security screws shall be Torx-Post Security Screws.
9. The contractor shall provide the owner with two (2) torx-post screwdrivers.

1.17 ELECTRONIC COMPONENTS

A. All electronic components of the system shall be of the solid-state type, mounted on printed circuit boards conforming to UL 796. Boards shall be plug-in, quick-disconnect type. Circuitry shall not be so densely placed as to impede maintenance. All power-dissipating components shall incorporate safety margins of not less than 25 percent with respect to dissipation ratings, maximum voltages, and current-carrying capacity.

1.18 SUBSTITUTE MATERIALS & EQUIPMENT

A. Where variations from the contract requirements are requested in accordance with the GENERAL CONDITIONS and Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND

SAMPLES, the connecting work and related components shall include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.

B. In addition to this Section the Security Contractor shall also reference Section II, Products and associated divisions. The Resident Engineer shall have final authority on the authorization or refusal of substitutions. If there are no proposed substitutions, a statement in writing from the Contractor shall be submitted to the Resident Engineer stating same. In the preparation of a list of substitutions, the following information shall be included, as a minimum:
   1. Identity of the material or devices specified for which there is a proposed substitution.
   2. Description of the segment of the specification where the material or devices are referenced.
   3. Identity of the proposed substitute by manufacturer, brand name, catalog or model number and the manufacturer's product name.
   4. A technical statement of all operational characteristic expressing equivalence to items to be substituted and comparison, feature-by-feature, between specification requirements and the material or devices called for in the specification; and Price differential.

C. Materials Not Listed: Furnish all necessary hardware, software, programming materials, and supporting equipment required to place the specified major subsystems in full operation. Note that some supporting equipment, materials, and hardware may not be described herein. Depending on the manufacturers selected by the COR, some equipment, materials and hardware may not be contained in either the Contract Documents or these written specifications, but are required by the manufacturer for complete operation according to the intent of the design and these specifications. In such cases, the Resident Engineer shall be given the opportunity to approve the additional equipment, hardware and materials that shall be fully identified in the bid and in the equipment list submittal. The Resident Engineer shall be consulted in the event there is any question about which supporting equipment, materials, or hardware is intended to be included.

D. Response to Specification: The Contractor shall submit a point-by-point statement of compliance with each paragraph of the security specification. The statement of compliance shall list each paragraph by number and indicate "COMPLY" opposite the number for each paragraph where the Contractor fully complies with the specification. Where the proposed system cannot meet the requirements of the paragraph, and does not offer an equivalent solution, the offers shall indicate "DOES NOT COMPLY" opposite the paragraph number. Where the proposed system does not comply with the paragraph as written, but the bidder feels it will accomplish the intent of the paragraph in a manner different from that described, the offers shall indicate "COMPARABLE". The offers shall include a statement fully describing the "comparable" method of satisfying the requirement. Where a full and concise description is not provided, the offered system shall be considered as not complying with the specification. Any submission that does not include a point-by-point statement of compliance, as described above, shall be disqualified. Submittals for products shall be in precise order with the product section of the specification. Submittals not in proper sequence will be rejected.

1.19 LIKE ITEMS

A. Where two or more items of equipment performing the same function are required, they shall be exact duplicates produced by one manufacturer. All equipment provided shall be complete, new, and free of any defects.

1.20 WARRANTY

A. The Contractor shall, as a condition precedent to the final payment, execute a written guarantee (warranty) to the COR certifying all contract requirements have been completed according to the final specifications. Contract drawings and the warranty of all materials and equipment furnished under this contract are to remain in satisfactory operating condition (ordinary wear and tear, abuse and causes beyond his control for this work accepted) for one (1) year from the date the Contactor received written notification of final acceptance from the COR.

Demonstration and training shall be performed prior to system acceptance. All defects or damages due to faulty materials or workmanship shall be repaired or replaced without delay, to the COR's satisfaction, and at the Contractor's expense. The Contractor shall provide quarterly inspections during the warranty period. The contractor shall provide written documentation to the COR on conditions and findings of the system and device(s). In addition, the contractor shall provide written documentation of test results and stating what was done to correct any deficiencies. The first inspection shall occur 90 calendar days after the acceptance date. The last inspection shall occur 30 calendar days prior to the end of the warranty. The warranty period shall be extended until the last inspection and associated corrective actions are complete. When equipment and labor covered by the Contractor's warranty, or by a manufacturer's warranty, have been replaced or restored because of it's failure during the warranty period, the warranty period for the replaced or repaired equipment or restored work shall be reinstated for a period equal to the original warranty period, and commencing with the date of completion of the replacement or restoration work. In the event any manufacturer customarily provides a warranty period greater than one (1) year, the Contractor's warranty shall be for the same duration for that component.

1.21 SINGULAR NUMBER

A. Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the switch"), this reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. All equipment associated within the Security Control Room, Security Console and Security Equipment Room shall be UL 827, UL 1981, and UL 60950 compliant and rated for continuous operation. Environmental conditions (i.e. temperature, humidity, wind, and seismic activity) shall be taken under consideration at each facility and site location prior to installation of the equipment.

B. All equipment shall operate on a 120 or 240 volts alternating current (VAC); 50 Hz or 60 Hz AC power system unless documented otherwise in subsequent sections listed within this specification. All equipment shall have a back-up source of power that will provide a minimum of 8 hours of run time in the event of a loss of primary power to the facility.

C. The system shall be designed, installed, and programmed in a manner that will allow for ease of operation, programming, servicing, maintenance, testing, and upgrading of the system.

D. All equipment and materials for the system will be compatible to ensure correct operation.

2.2 EQUIPMENT ITEMS

A. The Security Management System shall provide full interface with all components of the security subsystem as follows:
   1. Shall allow for communication between the Physical Access Control System and Database Management and all subordinate work and monitoring stations, enrollment centers for badging and biometric devices as part of the PACS, local annunciation centers, the electronic Security Management System (SMS), and all other VA redundant or backup command center or other workstations locations.
   2. Shall provide automatic continuous communication with all systems that are monitored by the SMS, and shall automatically annunciate any communication failures or system alarms to the SMS operator providing identification of the system, nature of the alarm, and location of the alarm.
   3. Controlling devices shall be utilized to interface the SMS with all field devices.
   4. The Security control room and security console will be supported by an uninterrupted power supply (UPS) or dedicated backup generator power circuit.

5. The Security Equipment room, Security Control Room, and Security Operator Console shall house the following equipment i.e. refer to individual master specifications for each security subsystem's specific requirements:
   a. Security Console Bays and Equipment Racks
   b. Security Network Server and Workstation
   c. CCTV Monitoring, Controlling, and Recording Equipment
   d. PACS Monitoring and Controlling Equipment
   e. IDS Monitoring and Controlling Equipment
   f. Security Access Detection Monitoring Equipment
   g. EPPS Monitoring and Controlling Equipment
   h. Main Panels for all Security Systems
   i. Power Supply Units (PSU) for all field devices
   j. Life safety and power monitoring equipment
   k. All other building systems deemed necessary by the VA to include, but not limited to, heating, ventilation and air conditioning (HVAC), elevator control, portable radio, fire alarm monitoring, and other potential systems.
   l. Police two-way radio control consoles/units.

B. Security Console Bays - shall be EIA 310D compliant and:
1. Utilize stand-up, sit-down, and vertical equipment racks in any combination to monitor and control the security subsystems.
2. Shall be wide enough for equipment that requires a minimum 19 inch (47.5 cm) mounting area.
3. Shall be made of metal, furnished with wire ways, a power strip, a thermostatic controlled bottom or top mounted fan units, a hinge mounted rear door, a hinge mounted front door made of Plexiglas, and a louvered top. When possible, pre-fabricated (standard off-the-shelf) security console equipment shall be used in place of customized designed consoles.
4. A wire management system shall be designed and installed so that all cables are mounted in a manner that they do not interfere with day-to-day operations, are labeled for quick identification, and so that high voltage power cables do not cause signal interference with low voltage and data carrying cables.
5. Shall be mounted on lockable casters.
6. Shall be ergonomically designed so that all devices requiring repetitive interaction with by the operator can be easily accessed, observed, and accomplished.
7. Controls and displays shall be located so that they are not obscured during normal operation. Control and display units installed with a work bench shall be a minimum of 3 in. (7.5 cm) from all edges of the work bench area.
8. All security subsystem controls shall be installed within the same operating console bay of their associated equipment.
9. Video monitors shall be mounted above all controls within a console bay and positioned in a manner that minimum strain is placed on the operator viewing them at the console.
10. At least one workbench for every three (3) console bays shall be provided free of control equipment to allow for appropriate operator workspace.
11. All console devices shall be labeled and marked with a minimum of quarter inch bold print.
12. All non-security related equipment that is required to be monitored shall be installed in a console bay separate from the security subsystem equipment and clearing be identified as such.
13. Console bays and related equipment shall be arranged in priority order and sequenced based upon their pre-defined security subsystem operations criticality established by the Contracting Officer.
14. The following minimum console technical characteristics shall be taken into consideration when designing for and installing the security console and equipment racks:

	Stand-Up	Sit-Down	Vertical Equipment Rack

Workstation Height	No Greater than 84 in. (210 cm)	No greater than 72 in. (150 cm)	No greater than 96 in. (240 cm)
Bench board Slope	21 in. (52.5 cm)	25 in. (62.5 cm)	N/A
Bench board Angle	15 degrees	15 degrees	N/A
Depth of Console	24 in. (60 cm)	24 in. (60 cm)	N/A
Leg and Feet Clearance	6 sq. ft. from center of Console Slope front	6 sq. ft. from center of Console Slope front	6 sq. ft. from center of Console Slope front
Distance Between Console Rows	96 in. (240 cm)	96 in. (240 cm)	96 in. (240 cm)
Distance Between Console and Wall	36 in. (90 cm) from the rear and/or side of console or rack	36 in. (90 cm) from the rear and/or side of console or rack	36 in. (90 cm) from the rear and/or side of console or rack

C. Security Console Configuration:
1. The size shall be defined by the number of console bays required to house and operate the security subsystems, as well as any other factors that may influence the overall design of the space. A small Access Control System and Database Management shall contain no more than four (4) security console bays. A large Access Control System and Database Management shall contain no less than five (5) and no more than eight (8) security console bays.
2. Shall meet the following minimum spacing requirements to ensure that a Access Control System and Database Management is provided to house existing and future security subsystems and other equipment listed in paragraph 2.3.C:
   a. 500 square feet for a large Access Control System and Database Management.
   b. 300 square feet for a small Access Control System and Database Management.
   c. If office, training room and conference space, is a processing area as well as holding cell space is to be located adjacent to the Access Control System and Database Management, these space requirements also need to be considered.
3. Shall be located in an area within, at a minimum, the first level/line of security defense defined by the VA. If the Access Control System and Database Management is to be located outside the first level of security, then the area shall be constructed or retrofit to meet or exceed those requirements outlined in associated VA Master Specifications.
4. Shall not be located within or near an area with little to no blast mitigation standoff space protection, adjacent to an outside wall exposed to vehicle parking and traffic, within a basement or potential flood zone area, in close approximately to major utility areas, or near an exposed air intake(s).
5. Access shall meet UFAS and ADA accessibility requirements.
6. Construction shall be slab to slab and free of windows, with the exception of a service window. All penetrations into the room shall be sealed with fire stopping materials. This material shall apply in accordance with Section 07 84 00, FIRESTOPPING.
7. A service window shall be installed in the wall next to the main entrance of the Access Control System and Database Management or where it best can be monitored and accessed by the security console operator. The window shall meet all requirements set

forth in UL 752, to include at a minimum, Class III ballistic level protection. The windows shall be set in a minimum or four (4) inches (100 mm) solid concrete units to ceiling height with either masonry or gypsum wall board to the underside of the slab above. It shall also contain a service tray constructed in a manner that only objects no larger than 3 inches (7.5 cm) in width may pass through it.

8. The walls making up or surrounding the Access Control System and Database Management shall be made of materials that at a minimum offer Class III ballistic level protection for the security console operator(s).
9. There will be a main power cut-off button/switch located inside the Access Control System and Database Management in the event of an electrical fire or related event occurs.
10. Shall have a fire alarm detection unit that is tied into the main building fire alarm system and have at least two fire extinguishers located within it.
11. Shall utilize a fire suppression system similar to that used by the VA's computer and telecommunications room operating areas.
12. The floor shall be raised a minimum of 4 inches (10 cm) from the concrete floor base. Wire ways shall be utilized under the raised floor for separation of signal and power wires and cables.
13. Access shall be monitored and controlled by the PACS via card reader and fixed camera that utilizes a wide angle lens. A 1 in. (2.5 cm) deadbolt shall be utilized as a mechanical override for the door in the event of electrical failure of the PACS, card reader, or locking mechanism.
14. There shall only be one point of ingress and egress to and from the Security Control Room. The door shall be made of solid core wood or better. If a window is required for the door, then the window shall be ballistic resistant with a Millar covering.
15. A two-way intercom shall be placed at the point of entry into the Security Control Room for access-communication control purposes.
16. A remote push-button door unlocking device shall not be installed for the electronic PACS locking mechanism providing access control into the Security Control Room.
17. All controlling equipment and power supplies that must be wall mounted shall be mounted in a manner that maximizes usability of the Security Control Room wall space. All equipment shall be mounted to three quarter inch fire retardant plywood. The plywood shall be fastened to the wall from slab to slab and fixed to the existing walls supports.

D. Security Control Room Ventilation

1. Shall meet or exceed all requirements laid out in VA Master Specification listed in Division 23, HEATING, VENTILATION, AND AIR CONDITIONING.
2. Controls shall be via a separate air handling system that provides an isolated supply and return system. The Security Control Room shall have a dedicated thermostat control unit and cut-off switch to be able to shut off ventilation to the control room in the event of a chemical, biological, or radiological (CBR) event or other related emergency.
3. There shall be a louver installed in the control room door to assist with ventilation of the room. The louver shall be exactly 12 x 12 inches (30 x 30 cm) and closeable.

E. Security Control Room and Security Console Lighting:

1. The following factors shall be taken into consideration for lighting of the Security Control Room and console area:
   a. Shadows: To reduce eye strain and fatigue, shadows shall be avoided.
   b. Glare: The readability of all display panels, labels, and equipment shall not be interfered with or create visibility problems.
2. The following table shall provide guidance on the amount of footcandles required per work area and type of task performed:

Work Area/Type of Task	Footcandles
Main Operating Panels	50
Secondary Display Panels	50
Seated Workstations	100

Reading	Handwriting	100
	Typed Documents	50
	Visual Display Units	10
Logbook Recording		100
Maintenance Area		50
Emergency/Back-up Lighting		10

F. Remote security console access: For facilities that have a remote, secondary back-up control console or workstation shall apply the following requirements:
1. The secondary stations shall the requirements outlined in Sections 2.2.A-G.
2. Installation of an intercom station or telephone line shall be installed and provide direct one touch call-up for communications between the primary Security Control Console and secondary Security Control Console.
3. Secondary stations shall not have priority over a primary Security Control Console.
4. The primary Access Control System and Database Management shall have the ability to shut off power and a signal to a secondary control station in the event the area has been compromised.

G. Wires and Cables:
1. Shall meet or exceed the manufactures recommendation for power and signals.
2. Shall be carried in an enclosed conduit system, utilizing electromagnetic tubing (EMT) to include the equivalent in flexible metal, rigid galvanized steel (RGS) to include the equivalent of liquid tight, polyvinylchloride (PVC) schedule 40 or 80.
3. All conduits will be sized and installed per the NEC. All security system signal and power cables that traverse or originate in a high security office space will contained in either EMT or RGS conduit.
4. All conduit, pull boxes, and junction boxes shall be marked with colored permanent tape or paint that will allow it to be distinguished from all other infrastructure conduit.
5. Conduit fills shall not exceed 50 percent unless otherwise documented.
6. A pull string shall be pulled along and provided with signal and power cables to assist in future installations.
7. At all locations where there is a wall penetration or core drilling is conducted to allow for conduit to be installed, fire stopping materials shall be applied to that area.
8. High voltage and signal cables shall not share the same conduit and shall be kept separate up to the point of connection. High voltage for the security subsystems shall be any cable or sets of cables carrying 30 VDC/VAC or higher.
9. For all equipment that is carrying digital data between the Security Control Room, Security Equipment Room, Security Console, or at a remote monitoring station, it shall not be less that 20 AWG and stranded copper wire for each conductor. The cable or each individual conductor within the cable shall have a shield that provides 100% coverage. Cables with a single overall shield shall have a tinned copper shield drain wire.

2.3 FIBER OPTIC EQUIPMENT

A. 8 Channel Fiber Optic Transcievers (Video&PTZ Control)
1. The field-located and central-located fiber optic transceivers shall utilize wave division multiplexing to transmit and receive video and data pan-tilt-zoom control signals over two standard 62.5/125 multimode fibers.
2. The units shall be capable of operating over a range of 2 km.
3. The units shall be NTSC color compatible.
4. The units shall support data rates up to 64 Kbps.
5. The units shall be surface or rack mountable.
6. The units shall be UL listed.
7. The units shall meet or exceed the following specifications:

a. Video
1) Input/Output: 1 volt pk-pk (75 ohms)
2) Input/Output Channels: 8
3) Bandwidth: 10 Hz - 6.5 MHZ per channel
4) Differential Gain: 2%
5) Differential Phase: 0.7°
6) Tilt: 1%
7) Signal to Noise Ratio: 60 dB

b. Data (Control)
1) Data Channels: 2
2) Data Format: RS-232, RS-422, 2 wire or 4 wire RS-485 with Tri-State Manchester Bi-Phase and Sensornet
3) Data Rate: DC - 100 kbps (NRZ)
4) Bit Error Rate: 1 in 10-9 @ Maximum Optical Loss Budget
5) Operating Mode: Simplex or Full-Duplex
6) Wavelength: 1310/1550 nm, Multimode or Singlemode
7) Optical Emitter: Laser Diode
8) Number of Fibers: 1

c. Connectors
1) Optical: ST
2) Power and Data: Terminal Block with Screw Clamps
3) Video: BNC (Gold Plated Center-Pin)

d. Electrical and Mechanical
1) Power: 12 VDC @ 500 mA (stand-alone)
3) Current Protection: Automatic Resettable Solid-State Current Limiters

e. Environmental
1) MTBF: 100,000 hours
2) Operating Temp: -40 to 74 deg C (-40 to 165 deg F)
3) Storage Temp: -40 to 85 deg C (-40 to 185 deg F)
4) Relative Humidity: 0% to 95% (non-condensing)

B. Fiber Optic Transmitters: The central-located fiber optic transmitters shall utilize wave division multiplexing to transmit video and signals over standard 62.5/125 multimode fibers.

1. The units shall be capable of operating over a range of 4.8 km.
2. The units shall be NTSC color compatible.
3. The units shall support data rates up to 64 Kbps.
4. The units shall be surface or rack mountable.
5. The units shall be UL listed.
6. The units shall meet or exceed the following specifications:

a. Video
1) Input: 1 volt pk-pk (75 ohms)
2) Bandwidth: 5H2 - 10 MHZ
3) Differential Gain: 5%
4) Tilt: 1%
5) Signal-Noise: 60db
6) Wavelength: 850nm
7) Number of Fibers: 1
8) Operating Temp: -20 to 70 deg C (-4 to 158 deg F)
9) Connectors:
a) Power: Female plug with screw clamps
b) Video: BNC
c) Optical: ST
10) Power: 12 VDC

C. Fiber Optic Receivers: The field-located fiber optic receivers shall utilize wave division multiplexing to receive video signals over standard 62.5/125 multimode fiber.

1. The units shall be capable of operating over a range of 4.8 km.
2. The units shall be NTSC color compatible.
3. The units shall support data rates up to 64 Kbps.
4. The units shall be surface or rack mountable.
5. The units shall be UL listed.
6. The units shall meet or exceed the following specifications:
   a. Video
      1) Output: 1 volt pk-pk (75 ohms)
      2) Bandwidth: 5H2 - 10 MHZ
      3) Differential Gain: 5%
      4) Tilt: 1%
      5) Signal-Noise: 60dB
      6) Wavelength: 850nm
      7) Number of Fibers: 1
      8) Surface Mount: 106.7 x 88.9 x 25.4 mm (4.2 x 3.5 x 1 in)
      9) Operating Temp: -20 to 70 deg C (-4 to 158 deg F)
      10) Connectors:
      11) Power: Female plug block with screw clamps
      12) Video: BNC
      13) Optical: ST
      14) Power: 12 VAC8 Channel Fiber Optic Transcievers (Video&PTZ Control)

D. Fiber Optic Sub Rack with Power Supply
1. The Card Cage Rack shall provide high-density racking for fiber-optic modules. The unit shall be designed to mount in standard 483 mm (19 in) instrument racks and to accommodate the equivalent of 15 1-inch modules.
   a. Specifications
      1) Card Orientation: Vertical
      2) Construction: Aluminum
      3) Current Consumption: 0.99 A
      4) Humidity: 95.0 % RH
      5) Input Power: 100-240 VAC, 60/50 Hz
      6) Mounting: Mounts in standard 483 mm (19 in) rack using four (4) screws (optional wall brackets purchased separately)
      7) Number of Outputs: 1.0
      8) Number of Slots15.0
      9) Operating Temperature: -40 to +75 deg C (-40.0 to 167.0 deg F)
      10) Ouput Voltage: 13.5 V
      11) Output Current 6.0 A
      12) Power Dissipation: 28.0 W
      13) Power Factor: 48.0
      14) Power Supply: (built-in)
      15) Rack Units: 3RU
      16) Redundant Capability: Yes
      17) Weight: 2.43 kg (5.35 lb)
      18) Width: 483 mm (19.0 in)

2.4 TRANSIENT VOLTAGE SURGE SUPPRESSION DEVICES (TVSS) AND SURGE SUPPRESION

A. Transient Voltage Surge Suppression
1. All cables and conductors extending beyond building perimeter, except fiber optic cables, which serve as communication, control, or signal lines shall be protected against Transient Voltage surges and have Transient Voltage surge suppression protection (TVSS) UL listed in accordance with Standard 497B installed at each end. Lighting and surge suppression shall be a multi-strike variety and include a fault indicator. Protection shall be furnished at the equipment and additional triple solid state surge protectors rated

for the application on each wire line circuit shall be installed within 915 mm (36 in) of the building cable entrance. Fuses shall not be used for surge protection. The inputs and outputs shall be tested in both normal mode and common mode using the following waveforms:

a. A 10-microsecond rise time by 1000 microsecond pulse width waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.
b. An 8-microsecond rise time by 20-microsecond pulse width waveform with a peak voltage of 1000 volts and a peak current of 500 amperes.
c. Maximum series current: 2 AMPS. Provide units manufactured by Advanced Protection Technologies, model # TE/FA 10B or TE/FA 20B or approved equivalent.
d. Operating Temperature and Humidity: -40 to + 85 deg C (-40 to 185 deg F), and 0 to 95 percent relative humidity, non-condensing.

B. Physical Access Control Systems

1. Suppressors shall be installed on AC power at the point of service and shall meet the following criteria:
   a. UL1449 2nd Edition, 2007, listed
   b. UL1449 S.V.R. of 400 Volts or lower
   c. Status Indicator Light(s)
   d. Minimum Surge Current Capacity: 40,000 Amps (8 x 20 µsec)
   e. Maximum Continuous Current: 15 Amps
   f. MCOV: 125 VAC
   g. Service Voltage: 110-120 VAC
2. Suppressors shall be installed on the Low Voltage circuit at both the point of entrance and exit of the building. Suppressors shall meet the following criteria:
   a. UL 497B
   b. Minimum Surge Current Capacity: 2,000 Amps per pair
   c. Maximum Continuous Current: 5 Amps
   d. MCOV: 33 Volts
   e. Service Voltage: 24Volts
3. Suppressors shall be installed on the communication circuit between the access controller and card reader at both the entrance and exit of the building. Suppressors shall meet the following criteria:
   a. Conforms with UL497B standards (where applicable)
   b. Clamp level for 12 and 24V power: 18VDC / 38VDC
   c. Clamp level for Data/LED: 6.8VDC
   d. Service Voltage for Power: 12VDC/24VDC
   e. Service Voltage for Data/LED: 5VDC
   f. Clamp level – PoE Access Power: 72V
   g. Clamp level – PoE Access Data: 7.9V
   h. Service Voltage – PoE Access: 48VAC – 54VAC
   i. Service Voltage – PoE Data: 5VDC

C. Intercom Systems

1. Suppressors shall be installed on the AC power at the point of service and shall meet the following criteria:
   a. UL 1449 Listed
   b. UL 1449 S.V.R. of 400 Volts or lower
   c. Diagnostic Indicator Light(s)
   d. Integrated ground terminating post (where case/chassis ground exists)
   e. Minimum Surge Current Capacity of 13,000 Amps (8 x 20 µSec)
2. Suppressors shall be installed on incoming central office lines and shall meet the following criteria:
   a. UL 497A Listed
   b. Multi Stage protection design
   c. Auto-reset current protection not to exceed 2 Amps per pair

d. Minimum Surge Current of 500 Amps per pair (8 x 20 µSec)

3. Suppressors shall be installed on all telephone/intercom circuits that enter or leave separate buildings and shall meet the following criteria:
   a. UL 497A Listed (where applicable)
   b. UL 497B Listed (horns, strobes, speakers or communication circuits over 300 feet)
   c. Multi Stage protection design
   d. Auto-reset over-current protection not to exceed 5 Amps per pair
   e. Minimum Surge Current of 1000 Amps per pair (8 x 20 µSec)

D. Intrusion Detection Systems

1. Suppressors shall be installed on AC at the point of service and shall meet the following criteria:
   a. UL 1449, 2nd Edition 2007, listed
   b. UL 1449 S.V.R. of 400 Volts or lower
   c. Status Indicator Lights
   d. Center screw for terminating Class II transformers
   e. Minimum Surge Current Capacity of 32,000 Amps (8 x 20 µSec)

2. Suppressors shall be installed on all Telephone Communication Interface circuits and shall meet the following criteria:
   a. UL 497A Listed
   b. Multi Stage protection design
   c. Surge Current Capacity: 9,000 Amps (8x20 µSec)
   d. Clamp Voltage: 130Vrms
   e. Auto reset current protection not to exceed 150 milliAmps

3. Suppressors shall be installed on all burglar alarm initiating and signaling loops and addressable circuits which enter or leave separate buildings. The following criteria shall be met:
   a. UL 497B for data communications or annunciation (powered loops)
   b. Fail-short/fail-safe mode.
   c. Surge Current Capacity: 9,000 Amps (8x20 µSec)
   d. Clamp Voltage: 15 Vrms
   e. Joule Rating: 76 Joules per pair (10x1000 µSec)
   f. Auto-reset current protection not to exceed 150 milliAmps for UL 497A devices.

E. Video Surveillance System

1. Protectors shall be installed on coaxial cable systems on points of entry and exit from separate buildings. Suppressors shall be installed at each exterior camera location and include protection for 12 and/or 24 volt power, data signal and motor controls (for Pan, Tilt and Zoom systems). SPDs shall protect all modes herein mentioned and contain all modes in a single unit system. Protection for all systems mentioned above shall be incorporated at the head end equipment. Additionally a minimum 450VA battery back up shall be used to protect the DVR or VCR and monitor. Protectors shall meet the following criteria:
   a. Head-End Power
      1) UL 1778, cUL (Battery Back Up)
      2) Minimum Surge Current Capacity: 65,000 Amps (8x20µsec)
      3) Minimum of two (2) NEMA 5-15R Receptacles (one (1) AC power only, one (1) with UPS)
      4) All modes protected (L-N, L-G, N-G)
      5) EMI/RFI Filtering
      6) Maximum Continuous Current: 12 Amps
   b. Camera Power
      1) Minimum Surge Current Capacity: 1,000 Amps (8X20µsec); 240 Amps for IP Video/PoE cameras
      2) Screw Terminal Connection

3) All protection modes L-G (all Lines)
4) MCOV 40VAC

c. Video And Data
1) Surge Current Capacity 1,000 Amps per conductor
2) “BNC” Connection (Coax)
3) Protection modes: L-G (Data), Center Pin-G, Shield-G (Coax)
4) Band Pass 0-2GHz
5) Insertion Loss 0.3dB

F. Grounding and Surge Suppression

1. The Security Contractor shall provide grounding and surge suppression to stabilize the voltage under normal operating conditions. This is to ensure the operation of over current devices, such as fuses, circuit breakers, and relays, underground-fault conditions.
2. The Contractor shall engineer, provide, ad install proper grounding and surge suppression as required by local jurisdiction and prevailing codes and standards, referenced in this document.
3. Principal grounding components and features shall include: main grounding buses, grounding, and bonding connections to service equipment.
4. The Contractor shall provide detail drawings of interconnection with other grounding systems including lightning protection systems.
5. The Contractor shall provide details of locations and sizes of grounding conductors and grounding buses in electrical, data, and communication equipment rooms and closets.
6. AC power receptacles are not to be used as a ground reference point.
7. Any cable that is shielded shall require a ground in accordance with applicable codes, the best practices of the trade, and all manufactures’ installation instructions.

G. 120 VAC Surge Suppression

1. Continuous Current: Unlimited (parallel connection)
2. Max Surge Current: 13,500 Amps
3. Protection Modes: L - N, L - G, N - G
4. Warranty: Ten Year Limited Warranty
5. Dimension: 73.7 x 41.1 x 52.1 mm (2.90 x 1.62 x 2.05 in)
6. Weight: 2.88 g (0.18 lbs)
7. Housing: ABS

2.5 INSTALLATION KIT

A. General:

1. The kit shall be provided that, at a minimum, includes all connectors and terminals, labeling systems, audio spade lugs, barrier strips, punch blocks or wire wrap terminals, heat shrink tubing, cable ties, solder, hangers, clamps, bolts, conduit, cable duct, and/or cable tray, etc., required to accomplish a neat and secure installation. All wires shall terminate in a spade lug and barrier strip, wire wrap terminal or punch block. Unfinished or unlabeled wire connections shall not be allowed. All unused and partially opened installation kit boxes, coaxial, fiber-optic, and twisted pair cable reels, conduit, cable tray, and/or cable duct bundles, wire rolls, physical installation hardware shall be turned over to the Contracting Officer. The following sections outline the minimum required installation sub-kits to be used:
2. System Grounding:
   a. The grounding kit shall include all cable and installation hardware required. All head end equipment and power supplies shall be connected to earth ground via internal building wiring, according to the NEC.
   b. This includes, but is not limited to:
      1) Coaxial Cable Shields
      2) Control Cable Shields
      3) Data Cable Shields

4) Equipment Racks
5) Equipment Cabinets
6) Conduits
7) Cable Duct blocks
8) Cable Trays
9) Power Panels
10) Grounding
11) Connector Panels

3. Coaxial Cable: The coaxial cable kit shall include all coaxial connectors, cable tying straps, heat shrink tabbing, hangers, clamps, etc., required to accomplish a neat and secure installation.
4. Wire and Cable: The wire and cable kit shall include all connectors and terminals, audio spade lugs, barrier straps, punch blocks, wire wrap strips, heat shrink tubing, tie wraps, solder, hangers, clamps, labels etc., required to accomplish a neat and orderly installation.
5. Conduit, Cable Duct, and Cable Tray: The kit shall include all conduit, duct, trays, junction boxes, back boxes, cover plates, feed through nipples, hangers, clamps, other hardware required to accomplish a neat and secure conduit, cable duct, and/or cable tray installation in accordance with the NEC and this document.
6. Equipment Interface: The equipment kit shall include any item or quantity of equipment, cable, mounting hardware and materials needed to interface the systems with the identified sub-system(s) according to the OEM requirements and this document.
7. Labels: The labeling kit shall include any item or quantity of labels, tools, stencils, and materials needed to label each subsystem according to the OEM requirements, as-installed drawings, and this document.
8. Documentation: The documentation kit shall include any item or quantity of items, computer discs, as installed drawings, equipment, maintenance, and operation manuals, and OEM materials needed to provide the system documentation as required by this document and explained herein.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electronic safety and security equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

F. Equipment location shall be as close as practical to locations shown on the drawings.

G. Inaccessible Equipment:
1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Government.
2. "Conveniently accessible" is defined as being capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.

3.2 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electronic safety and security installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section 07 84 00 "Firestopping."

3.3 COMMISIONING

A. Provide commissioning documentation in accordance with the requirements of Section 28 08 00 – COMMISIONIN OF ELECTRONIC SAFETY AND SECURITY SYSTEMS for all inspection, start up, and contractor testing required above and required by the System Readiness Checklist provided by the Commissioning Agent.

B. Components provided under this section of the specification will be tested as part of a larger system. Refer to section 28 08 00 – COMMISIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS and related sections for contractor responsibilities for system commissioning.

3.4 DEMONSTRATION AND TRAINING

A. Training shall be provided in accordance with Article, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.

B. Training shall be provided for the particular equipment or system as required in each associated specification.

C. A training schedule shall be developed and submitted by the contractor and approved by the Resident Engineer at least 30 days prior to the planned training.

D. Provide services of manufacturer's technical representative for 2 hours to instruct VA personnel in operation and maintenance of units.

E. Submit training plans and instructor qualifications in accordance with the requirements of Section 28 08 00 – COMMISIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS.

3.5 WORK PERFORMANCE

A. Job site safety and worker safety is the responsibility of the contractor.

B. For work on existing stations, arrange, phase and perform work to assure electronic safety and security service for other buildings at all times. Refer to Article OPERATIONS AND STORAGE AREAS under Section 01 00 00, GENERAL REQUIREMENTS.

C. New work shall be installed and connected to existing work neatly and carefully. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required by Section 01 00 00, GENERAL REQUIREMENTS.

D. Coordinate location of equipment and conduit with other trades to minimize interferences. See the GENERAL CONDITIONS.

3.6 SYSTEM PROGRAMMING

A. General Programming Requirements
   1. This following section shall be used by the contractor to identify the anticipated level of effort (LOE) required setup, program, and configure the Electronic Security System (ESS). The contractor shall be responsible for providing all setup, configuration, and programming to include data entry for the Security Management System (SMS) and subsystems (e.g., video matrix switch, intercoms, digital video recorders, intrusion devices, including integration of subsystems to the SMS (e.g., camera call up, time synchronization, intercoms). System programming for existing or new SMS servers shall not be conducted at the project site.

B. Level of Effort for Programming

1. The Contractor shall perform and complete system programming (including all data entry) at an offsite location using the Contractor's own copy of the SMS software. The Contractor's copy of the SMS software shall be of the Owners current version. Once system programming has been completed, the Contractor shall deliver the data to the Resident Engineer on data entry forms and an approved electronic medium, utilizing data from the contract documents. The completed forms shall be delivered to the Resident Engineer for review and approval at least 90 calendar days prior to the scheduled date the Contractor requires it. The Contractor shall not upload system programming until the Resident Engineer has provided written approval. The Contractor is responsible for backing up the system prior to uploading new programming data. Additional programming requirements are provided as follows:
   a. Programming for New SMS Server: The contractor shall provide all other system related programming. The contractor will be responsible for uploading personnel information (e.g., ID Cards backgrounds, names, access privileges, personnel photos, access schedules, personnel groupings) along with coordinating with Resident Engineer for device configurations, standards, and groupings. VA shall provide database to support Contractor's data entry tasks. The contractor shall anticipate a weekly coordination meeting and working with Resident Engineer to ensure data uploading is performed without incident of loss of function or data loss.
   b. Programming for Existing SMS Servers: The contractor shall perform all related system programming except for personnel data as noted. The contractor will not be responsible for uploading personnel information (e.g., ID Cards backgrounds, names, access privileges, access schedules, personnel groupings). The contractor shall anticipate a weekly coordination meeting and working alongside of Resident Engineer to ensure data uploading is performed without incident of loss of function or data loss. System programming for SMS servers shall be performed by using the Contractor's own server and software. These servers shall not be connected to existing devices or systems at any time.
2. The Contractor shall identify and request from the Resident Engineer, any additional data needed to provide a complete and operational system as described in the contract documents.
3. Contractor and Resident Engineer coordination on programming requires a high level of coordination to ensure programming is performed in accordance with VA requirements and programming uploads do not disrupt existing systems functionality. The contractor shall anticipate a minimum a weekly coordination meeting. Contractor shall ensure data uploading is performed without incident of loss of function or data loss. The following Level of Effort Chart is provided to communicate the expected level of effort required by contractors on VA ESS projects. Calculations to determine actual levels of effort shall be confirmed by the contractor before project award.

C.

	Description of Tasks						
Description of Systems	Develop System Loading Sheets	Coordination	Initial Set-up Configuration	Graphic Maps	System Programming	Final Checks	Level of Effort (Typical Tasks)

SMS Setup & Configuration	e.g., program monitoring stations, programming networks, interconnections between CCTV, intercoms, time synchronization	e.g., retrieve IP addresses, naming conventions, standard event descriptions, programming templates, coordinate special system needs	e.g., Load system Operating System and Application software, general system configurations	e.g., develop naming conventions, develop file folders, confirming accuracy of AutoCAD Floor Plans, convert file into jpeg file	e.g., program monitoring stations, programming networks, interconnections between CCTV, intercoms, time synchronization	e.g., check all system diagnostics (e.g., clients, panels)	Load and set-up 4-6 CDs and configure servers (to configure Loading and Configuring software Administrative account, audit log, Keystrokes, mouse clicks, multi-screen configuration
Electronic Entry Control Systems	e.g., setup of device, door groups & schedules, REX, Locks, link graphics	e.g., confirming device configurations, naming conventions, event description and narratives	e.g., enter data from loading sheets; configure components, link events, cameras, and graphics		e.g., setup of device, door groups & schedules, REX, Locks, link graphics	e.g., performing entry testing to confirm correct set-up and configuration	e.g., creating a door, door configuration, adding request to exit, door monitors and relays, door timers, door related events (e.g., access, access denied, forced open, held open), linkages, controlled areas, advanced door monitoring, time zones, sequence of operations

Intrusion Detection Systems	e.g., enter door groups & schedules, link devices - REX, lock, & graphics	e.g., confirming device configurations, naming conventions, event description and narratives	e.g., enter data from loading sheets; configure components, link events, cameras, and graphics		e.g., enter door groups & schedules, link devices - REX, lock, & graphics	e.g., walk test, device position, and masking	e.g., setting up monitoring and control points (e.g., motion sensors, glassbreaks, vibration sensor, strobes, sounders) creating intrusion zones, creating arm/disarm panel, timed sequences, time zones, icon placements on graphic maps, clearance levels, events (e.g., armed, disarmed, zone violation, device alarm activations), LCD reader messages,
CCTV Systems	e.g., programming call-ups recording	e.g., confirming device configurations, naming conventions	e.g., enter data from loading sheets; camera naming convention, sequences, configure components)		e.g., programming call-ups recording	e.g., confirm area of coverage, call-up per event generated and recording rates	e.g., setting up cameras points, recording ratios (e.g., normal, alarm event) timed recording, linkages, maps placements, call-ups

Intercoms Systems	e.g., programming events & call-ups	e.g., confirming device configurations, naming conventions, event description and narratives	e.g., enter data from loading sheets; configure components, link events, cameras, and graphics		e.g., programming events & call-ups	e.g., confirm operation, SMS event generation and camera call-up	e.g., setup linkages, events for activations, device troubles, land devices on graphic maps
Console Monitoring Components	N/A	per monitor	per monitor	per graphic map	N/A	per monitor	N/A
Note: Programming tasks are supported through the contractor's development of the Technical Data Package Submittals.							

Table 1 Contractor Level of Effort

3.7 TESTING AND ACCEPTANCE

A. Performance Requirements
   1. General:
      a. The Contractor shall perform contract field, performance verification, and endurance testing and make adjustments of the completed security system when permitted. The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all testing. Written notification of planned testing shall be given to the Resident Engineer at least 60 calendar days prior to the test and after the Contractor has received written approval of the specific test procedures.
      b. The COR shall witness all testing and system adjustments during testing. Written permission shall be obtained from the Resident Engineer before proceeding with the next phase of testing. Original copies of all data produced during performance verification and endurance testing shall be turned over to the Resident Engineer at the conclusion of each phase of testing and prior to Resident Engineer approval of the test.
   2. Test Procedures and Reports: The test procedures, compliant w/ VA standard test procedures, shall explain in detail, step-by-step actions and expected results demonstrating compliance with the requirements of the specification. The test reports shall be used to document results of the tests. The reports shall be delivered to the Resident Engineer within seven (7) calendar days after completion of each test.

B. Pre-Delivery Testing
   1. The purpose of the pre-delivery test is to establish that a system is suitable for installation. As such, pre-delivery test shall be a mock-up of the system as planned in the contract documents. The Contractor shall assemble the Security Test System at the Contractors local project within 50-miles of the project site, and perform tests to demonstrate the performance of the system complies with the contract requirements in accordance with the approved pre-delivery test procedures. The tests shall take place during regular daytime working hours on weekdays. Model numbers of equipment tested shall be identical to those to be delivered to the site. Original copies of all data produced during pre-delivery testing, including results of each test procedure, shall be documented and delivered to the Resident Engineer at the conclusion of pre-delivery testing and prior to Resident Engineer's approval of the test. The test report shall be arranged so all commands, stimuli, and responses are correlated to allow logical interpretation. For Existing System modifications, the contractor shall provide their own server with loaded applicable software to support PDT.
   2. Test Setup: The pre-delivery test setup shall include the following:
      a. All console equipment.
         1) At least one of each type of data transmission media (DTM) and associated equipment to provide a fully integrated PACS.
         2) The number of local processors shall equal the amount required by the site design.
         3) Enough sensor simulators to provide alarm signal inputs to the system equal to the number of sensors required by the design. The alarm signals shall be manually or software generated.
         4) Contractor to prove to owner all systems are appropriately sized and configured as sized.
         5) Integration of VASS, intercom systems, other subsystems.
   3. During the bidding process the contractor shall submit a request for information to the Owner to determine if a pre-delivery test will be required. If a pre-delivery test is not required, the contractor shall provide a written notification that the Pre-delivery Test is not required in their shop drawings submission.

C. The inspection and test will be conducted by a factory-certified contractor representative and witnessed by a Government Representative. The results of the inspection will be officially

recorded by a designated Government Representative and maintained on file by the Resident Engineer (RE), until completion of the entire project. The results will be compared to the Acceptance Test results.

D. Contractor's Field Testing (CFT)
   1. The Contractor shall calibrate and test all equipment, verify DTM operation, place the integrated system in service, and test the integrated system. Ground rods installed by this Contractor within the base of camera poles shall be tested as specified in IEEE STD 142. The Contractor shall test all security systems and equipment, and provide written proof of a 100% operational system before a date is established for the system acceptance test. Documentation package for CFT shall include completed (fully annotated details of test details) for each device and system tested, and annotated loading sheets documenting complete testing to Resident Engineer approval. CFT test documentation package shall conform to submittal requirements outlined in this Section. The Contractor's field testing procedures shall be identical to the Resident Engineer's acceptance testing procedures. The Contractor shall provide the Resident Engineer with a written listing of all equipment and software indicating all equipment and components have been tested and passed. The Contractor shall deliver a written report to theResident Engineer stating the installed complete system has been calibrated, tested, and is ready to begin performance verification testing; describing the results of the functional tests, diagnostics, and calibrations; and the report shall also include a copy of the approved acceptance test procedure. Performance verification testing shall not take place until written notice by contractor is received certifying that a contractors field test was successful.

E. Performance Verification Test (PVT)
   1. Test team:
      a. After the system has been pretested and the Contractor has submitted the pretest results and certification to the Resident Engineer, then the Contractor shall schedule an acceptance test to date and give the Resident Engineer written, notice as described herein, prior to the date the acceptance test is expected to begin. The system shall be tested in the presence of a Government Representative, an OEM certified representative, representative of the Contractor and other approved by the Resident Engineer. The system shall be tested utilizing the approved test equipment to certify proof of performance, FCC, UL and Emergency Service compliance. The test shall verify that the total system meets all the requirements of this specification. The notification of the acceptance test shall include the expected length (in time) of the test.
   2. The Contractor shall demonstrate the completed Physical Access Control System PACS complies with the contract requirements. In addition, the Contractor shall provide written certification that the system is 100% operational prior to establishing a date for starting PVT. Using approved test procedures, all physical and functional requirements of the project shall be demonstrated and shown. The PVT will be stopped and aborted as soon as 10 technical deficiencies are found requiring correction. The Contractor shall be responsible for all travel and lodging expenses incurred for out-of-town personnel required to be present for resumption of the PVT. If the acceptance test is aborted, the re-test will commence from the beginning with a retest of components previously tested and accepted.
   3. The PVT, as specified, shall not begin until receipt of written certification that the Contractors Field Testing was successful. This shall include certification of successful completion of testing as specified in paragraph "Contractor's Field Testing", and upon successful completion of testing at any time when the system fails to perform as specified. Upon termination of testing by the Resident Engineer or Contractor, the Contractor shall commence an assessment period as described for Endurance Testing Phase II.

Upon successful completion of the acceptance test, the Contractor shall deliver test reports and other documentation, as specified, to the Resident Engineer prior to commencing the endurance test.

4. Additional Components of the PVT shall include:
   System Inventory
   1) All Device equipment
   2) All Software
   3) All Logon and Passwords
   4) All Cabling System Matrices
   5) All Cable Testing Documents
   6) All System and Cabinet Keys
   b. Inspection
      1) Contractor shall record an inspection punch list noting all system deficiencies. The contractor shall prepare an inspection punch list format for Resident Engineers approval.
      2) As a minimum the punch list shall include a listing of punch list items, punch list item location, description of item problem, date noted, date corrected, and details of how item was corrected.
5. Partial PVT - At the discretion of Resident engineer, the Performance Verification Test may be performed in part should a 100% compliant CFT be performed. In the event that a partial PVT will be performed instead of a complete PVT; the partial PVT shall be performed by testing 10% of the system. The contractor shall perform a test of each procedure on select devices or equipment.

F. Endurance Test
1. The Contractor shall demonstrate the specified probability of detection and false alarm rate requirements of the completed system. The endurance test shall be conducted in phases as specified below. The endurance test shall not be started until the Resident Engineer notifies the Contractor, in writing, that the performance verification test is satisfactorily completed, training as specified has been completed, and correction of all outstanding deficiencies has been satisfactorily completed. VA shall operate the system 24 hours per day, including weekends and holidays, during Phase I and Phase III endurance testing. VA will maintain a log of all system deficiencies. The Resident Engineer may terminate testing at any time the system fails to perform as specified. Upon termination of testing, the Contractor shall commence an assessment period as described for Phase II. During the last day of the test, the Contractor shall verify the appropriate operation of the system. Upon successful completion of the endurance test, the Contractor shall deliver test reports and other documentation as specified to the Resident Engineer prior to acceptance of the system.
2. Phase I (Testing): The test shall be conducted 24 hours per day for 15 consecutive calendar days, including holidays, and the system shall operate as specified. The Contractor shall make no repairs during this phase of testing unless authorized in writing by the Resident Engineer. If the system experiences no failures, the Contractor may proceed directly to Phase III testing after receiving written permission from the Resident Engineer.
3. Phase II (Assessment):
   a. After the conclusion of Phase I, the Contractor shall identify all failures, determine causes of all failures, repair all failures, and deliver a written report to the Resident Engineer. The report shall explain in detail the nature of each failure, corrective action taken, results of tests performed, and recommend the point at which testing should be resumed.
   b. After delivering the written report, the Contractor shall convene a test review meeting at the job site to present the results and recommendations to the Resident Engineer. The meeting shall not be scheduled earlier than five (5) business days after the Resident Engineer receives the report. As part of this test review meeting, the Contractor shall demonstrate all failures have been corrected by

performing appropriate portions of the performance verification test. Based on the Contractor's report and the test review meeting, the Resident Engineer will provide a written determine of either the restart date or require Phase I be repeated.

4. Phase III (Testing): The test shall be conducted 24 hours per day for 15 consecutive calendar days, including holidays, and the system shall operate as specified. The Contractor shall make no repairs during this phase of testing unless authorized in writing by the COR.
5. Phase IV (Assessment):
   a. After the conclusion of Phase III, the Contractor shall identify all failures, determine causes of all failures, repair all failures, and deliver a written report to the COR. The report shall explain in detail the nature of each failure, corrective action taken, results of tests performed, and recommend the point at which testing should be resumed.
   b. After delivering the written report, the Contractor shall convene a test review meeting at the job site to present the results and recommendations to the COR. The meeting shall not be scheduled earlier than five (5) business days after receipt of the report by the COR. As a part of this test review meeting, the Contractor shall demonstrate that all failures have been corrected by repeating appropriate portions for the performance verification test. Based on the review meeting the test should not be scheduled earlier than five (5) business days after the Resident Engineer receives the report. As a part of this test review meeting, the Contractor shall demonstrate all failures have been corrected by repeating appropriate portions of the performance verification test. Based on the Contractor's report and the test review meeting, the Resident Engineer will provide a written determine of either the restart date or require Phase III be repeated. After the conclusion of any re-testing which the Resident Engineer may require, the Phase IV assessment shall be repeated as if Phase III had just been completed.

G. Exclusions

The Contractor will not be held responsible for failures in system performance resulting from the following:

a. An outage of the main power in excess of the capability of any backup power source provided the automatic initiation of all backup sources was accomplished and that automatic shutdown and restart of the PACS performed as specified. Failure of an Owner furnished equipment or communications link, provided the failure was not due to Contractor furnished equipment, installation, or software.
b. Failure of existing Owner owned equipment, provided the failure was not due to Contractor furnished equipment, installation, or software.

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SECTION 28 05 13

CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the finishing, installation, connection, testing and certification the conductors and cables required for a fully functional for electronic safety and security (ESS) system.

1.2 RELATED WORK

A. Section 01 00 00 - GENERAL REQUIREMENTS. For General Requirements.

B. Section 07 84 00 - FIRESTOPPING. Requirements for firestopping application and use.

C. Section 28 05 00 – COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY. Requirements for general requirements that are common to more than one section in Division 28.

D. Section 28 05 26 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY. Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

E. Section 28 05 28.33 - CONDUITS AND BOXES FOR ELECTRONIC SECURITY AND SAFETY. Requirements for infrastructure.

F. Section 28 08 00 - COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS. Requirements for commissioning.

1.3 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. EMI: Electromagnetic interference.

C. IDC: Insulation displacement connector.

D. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).

E. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.

F. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).

G. RCDD: Registered Communications Distribution Designer.

H. Solid-Bottom or Nonventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal side rails, and a bottom without ventilation openings.

I. Trough or Ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal rails and a bottom having openings sufficient for the passage of air and using 75 percent or less of the plan area of the surface to support cables.

J. UTP: Unshielded twisted pair.

1.4 QUALITY ASSURANCE

A. See section 28 05 00, Paragraph 1.4.

1.5 SUBMITTALS

A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:
   1. Manufacturer's Literature and Data: Showing each cable type and rating.
   2. Certificates: Two weeks prior to final inspection, deliver to the Resident Engineer/COTR four copies of the certification that the material is in accordance with the drawings and specifications and diagrams for cable management system.
   3. Shop Drawings: Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:
      a. Vertical and horizontal offsets and transitions.
      b. Clearances for access above and to side of cable trays.
      c. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
      d. Load calculations to show dead and live loads as not exceeding manufacturer's rating for tray and its support elements.
      e. System labeling schedules, including electronic copy of labeling schedules that are part of the cable and asset identification system of the software specified in Parts 2 and 3.
   4. Wiring Diagrams. Show typical wiring schematics including the following:
      a. Workstation outlets, jacks, and jack assemblies.
      b. Patch cords.
      c. Patch panels.
   5. Cable Administration Drawings: As specified in Part 3 "Identification" Article.
   6. Project planning documents as specified in Part 3.
   7. Maintenance Data: For wire and cable to include in maintenance manuals.

1.6 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are reference in the text by the basic designation only.

B. American Society of Testing Material (ASTM):
   D2301-04.....Standard Specification for Vinyl Chloride Plastic Pressure Sensitive Electrical Insulating Tape

C. Federal Specifications (Fed. Spec.):
   A-A-59544-08.....Cable and Wire, Electrical (Power, Fixed Installation)

D. National Fire Protection Association (NFPA):
   70-11 .....National Electrical Code (NEC)

E. Underwriters Laboratories, Inc. (UL):
   44-05 .....Thermoset-Insulated Wires and Cables
   83-08 .....Thermoplastic-Insulated Wires and Cables
   467-07 .....Electrical Grounding and Bonding Equipment
   486A-03.....Wire Connectors and Soldering Lugs for Use with Copper Conductors
   486C-04.....Splicing Wire Connectors
   486D-05.....Insulated Wire Connector Systems for Underground Use or in Damp or Wet Locations
   486E-00.....Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors

493-07 ..... Thermoplastic-Insulated Underground Feeder and Branch Circuit Cable

514B-04 ..... Fittings for Cable and Conduit

1479-03 ..... Fire Tests of Through-Penetration Fire Stops

1.7 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.
   1. Test optical fiber cable to determine the continuity of the strand end to end. Use optical-fiber flashlight or optical loss test set.
   2. Test optical fiber cable on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector; include the loss value of each. Retain test data and include the record in maintenance data.
   3. Test each pair of UTP cable for open and short circuits.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install UTP, optical fiber, and coaxial cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 GENERAL

A. General: All cabling locations shall be in conduit systems as outlined in Division 28 unless a waiver is granted in writing or an exception is noted on the construction drawings.

B. Support of Open Cabling: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
   1. Support brackets with cable tie slots for fastening cable ties to brackets.
   2. Lacing bars and spools.
   3. Straps and other devices.

C. Cable Trays:
   1. Cable Tray Materials: Metal, suitable for indoors, and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1, not less than 0.000472 inch (0.012 mm) thick.
   2. Basket Cable Trays: 6 inches (150 mm) wide and 2 inches (50 mm) deep. Wire mesh spacing shall not exceed 2 by 4 inches (50 by 100 mm).
   3. Trough Cable Trays: Nominally 6 inches (150 mm) wide.
   4. Ladder Cable Trays: Nominally 18 inches (455 mm) wide, and a rung spacing of 12 inches (305 mm).
   5. Channel Cable Trays: One-piece construction, nominally 4 inches (100 mm) wide. Slot spacing shall not exceed 4-1/2 inches (115 mm) o.c.
   6. Solid-Bottom Cable Trays: One-piece construction, nominally 12 inches (305 mm) wide. Provide with solid covers.

D. Conduit and Boxes: Comply with requirements in Division 28 Section "Conduits and Backboxes for Electrical Systems. "Flexible metal conduit shall not be used.
   1. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

2.2 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements for plywood backing panels in Division 06 Section "Rough Carpentry".

2.3 UTP CABLE

A. Description: 100-ohm, 4-pair UTP, formed into 25-pair binder groups covered with a blue thermoplastic jacket.
   1. Comply with ICEA S-90-661 for mechanical properties.
   2. Comply with TIA/EIA-568-B.1 for performance specifications.
   3. Comply with TIA/EIA-568-B.2, Category 6.
   4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
      a. Communications, General Purpose: Type CM or CMG ; or MPP, CMP, MPR, CMR, MP, or MPG.
      b. Communications, Plenum Rated: Type CMP ; or MPP, complying with NFPA 262.
      c. Communications, Riser Rated: Type CMR ; or MPP, CMP, or MPR, complying with UL 1666.
      d. Communications, Limited Purpose: Type CMX; or MPP, CMP, MPR, CMR, MP, MPG, CM, or CMG.
      e. Multipurpose: Type MP or MPG ; or MPP or MPR.
      f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
      g. Multipurpose, Riser Rated: Type MPR or MPP, complying with UL 1666.

2.4 UTP CABLE HARDWARE

A. UTP Cable Connecting Hardware: IDC type, using modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of the same category or higher.

B. Connecting Blocks: 110-style for Category 6. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.

2.5 OPTICAL FIBER CABLE

A. Description: Multimode, 62.5/125-micrometer, 24-fiber, nonconductive, tight buffer, optical fiber cable.
   1. Comply with ICEA S-83-596 for mechanical properties.
   2. Comply with TIA/EIA-568-B.3 for performance specifications.
   3. Comply with TIA/EIA-492AAAA-A for detailed specifications.
   4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
      a. General Purpose, Nonconductive: Type OFN or OFNG , or OFNR, OFNP.
      b. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
      c. Riser Rated, Nonconductive: Type OFNR or OFNP, complying with UL 1666.
      d. General Purpose, Conductive: Type OFC or OFCG ; or OFNG, OFN, OFCR, OFNR, OFCP, or OFNP.
      e. Plenum Rated, Conductive: Type OFCP or OFNP, complying with NFPA 262.
      f. Riser Rated, Conductive: Type OFCR ; or OFNR, OFCP, or OFNP, complying with UL 1666.
   5. Conductive cable shall be aluminum armored type.
   6. Maximum Attenuation: 3.50 dB/km at 850 nm; 1.5 dB/km at 1300 nm.
   7. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.

B. Jacket:
   1. Jacket Color: Orange for 62.5/125-micrometer cable.
   2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA/EIA-598-B.

3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).

2.6 OPTICAL FIBER CABLE HARDWARE

A. Cable Connecting Hardware: Meet the Optical Fiber Connector Intermateability Standards (FOCIS) specifications of TIA/EIA-604-2, TIA/EIA-604-3-A, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.
   1. Quick-connect, simplex and duplex, Type SC connectors. Insertion loss shall be not more than 0.75 dB.
   2. Type SFF connectors may be used in termination racks, panels, and equipment packages.

2.7 COAXIAL CABLE

A. General Coaxial Cable Requirements: Broadband type, recommended by cable manufacturer specifically for broadband data transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB maximum from 7 to 806 MHz.

B. RG-11/U: NFPA 70, Type CATV.
   1. No. 14 AWG, solid, copper-covered steel conductor.
   2. Gas-injected, foam-PE insulation.
   3. Double shielded with 100 percent aluminum polyester tape and 60 percent aluminum braid.
   4. Jacketed with sunlight-resistant, black PVC or PE.
   5. Suitable for outdoor installations in ambient temperatures ranging from minus 40 to plus 85 deg C.

C. RG59/U: NFPA 70, Type CATVR.
   1. No. 20 AWG, solid, silver-plated, copper-covered steel conductor.
   2. Gas-injected, foam-PE insulation.
   3. Triple shielded with 100 percent aluminum polyester tape and 95 percent aluminum braid; covered by aluminum foil with grounding strip.
   4. Color-coded PVC jacket.

D. RG-6/U: NFPA 70, Type CATV or CM.
   1. No. 16 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
   2. Double shielded with 100 percent aluminum-foil shield and 60 percent aluminum braid.
   3. Jacketed with black PVC or PE.
   4. Suitable for indoor installations.

E. RG59/U: NFPA 70, Type CATV.
   1. No. 20 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
   2. Double shielded with 100 percent aluminum polyester tape and 40 percent aluminum braid.
   3. PVC jacket.

F. RG59/U (Plenum Rated): NFPA 70, Type CMP.
   1. No. 20 AWG, solid, copper-covered steel conductor; foam fluorinated ethylene propylene insulation.
   2. Double shielded with 100 percent aluminum-foil shield and 65 percent aluminum braid.
   3. Copolymer jacket.

G. NFPA and UL compliance, listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655, and with NFPA 70 "Radio and Television Equipment" and "Community Antenna Television and Radio Distribution" Articles. Types are as follows:
   1. CATV Cable: Type CATV, or CATVP or CATVR.
   2. CATV Plenum Rated: Type CATVP, complying with NFPA 262.
   3. CATV Riser Rated: Type CATVR; or CATVP, CATVR, or CATV, complying with UL 1666.

4. CATV Limited Rating: Type CATVX.

2.8 COAXIAL CABLE HARDWARE

A. Coaxial-Cable Connectors: Type BNC, 75 ohms.

2.9 RS-232 CABLE

A. Standard Cable: NFPA 70, Type CM.
1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. Polypropylene insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. PVC jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
6. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated Cable: NFPA 70, Type CMP.
1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. Plastic insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. Plastic jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
6. Flame Resistance: Comply with NFPA 262.

2.10 RS-485 CABLE

A. Standard Cable: NFPA 70, Type CM or CMG.
1. Paired, 2 pairs, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated Cable: NFPA 70, Type CMP.
1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. Fluorinated ethylene propylene insulation.
3. Unshielded.
4. Fluorinated ethylene propylene jacket.
5. Flame Resistance: NFPA 262, Flame Test.

2.11 LOW-VOLTAGE CONTROL CABLE

A. Paired Lock Cable: NFPA 70, Type CMG.
1. 1 pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated, Paired Lock Cable: NFPA 70, Type CMP.
1. 1 pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with NFPA 262.

C. Paired Lock Cable: NFPA 70, Type CMG.
1. 1 pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors.
2. PVC insulation.

3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

D. Plenum-Rated, Paired Lock Cable: NFPA 70, Type CMP.
1. 1 pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors.
2. Fluorinated ethylene propylene insulation.
3. Unshielded.
4. Plastic jacket.
5. Flame Resistance: NFPA 262, Flame Test.

2.12 CONTROL-CIRCUIT CONDUCTORS

A. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, in raceway complying with UL 83.

B. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, in raceway complying with UL 83.

C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or TF, complying with UL 83.

2.13 FIRE ALARM WIRE AND CABLE

A. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.

B. Signaling Line Circuits: Twisted, shielded pair, not less than No. 18 AWG size as recommended by system manufacturer.
1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a 2-hour rating.

C. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.
1. Low-Voltage Circuits: No. 16 AWG, minimum.
2. Line-Voltage Circuits: No. 12 AWG, minimum.
3. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor with outer jacket with red identifier stripe, NTRL listed for fire alarm and cable tray installation, plenum rated, and complying with requirements in UL 2196 for a 2-hour rating.

2.14 IDENTIFICATION PRODUCTS

A. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.15 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-B.1.

C. Factory test UTP cables according to TIA/EIA-568-B.2.

D. Factory test multimode optical fiber cables according to TIA/EIA-526-14-A and TIA/EIA-568-B.3.

E. Factory sweep test coaxial cables at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response, or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results.

F. Cable will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

2.16 WIRE LUBRICATING COMPOUND

A. Suitable for the wire insulation and conduit it is used with, and shall not harden or become adhesive.

B. Shall not be used on wire for isolated type electrical power systems.

2.17 FIREPROOFING TAPE

A. The tape shall consist of a flexible, conformable fabric of organic composition coated one side with flame-retardant elastomer.

B. The tape shall be self-extinguishing and shall not support combustion. It shall be arc-proof and fireproof.

C. The tape shall not deteriorate when subjected to water, gases, salt water, sewage, or fungus and be resistant to sunlight and ultraviolet light.

D. The finished application shall withstand a 200-ampere arc for not less than 30 seconds.

E. Securing tape: Glass cloth electrical tape not less than 0.18 mm (7 mils) thick, and 19 mm (3/4 inch) wide.

PART 3 - EXECUTION

3.1 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:
   1. Comply with TIA/EIA-568-B.1.
   2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
   3. Install 110-style IDC termination hardware unless otherwise indicated.
   4. Terminate all conductors; no cable shall contain un-terminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
   5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
   6. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
   7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
   8. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
   9. Pulling Cable:
      a. Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
      b. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling of cables.
      c. Use ropes made of nonmetallic material for pulling feeders.
      d. Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached directly to the conductors, as approved by the COR.
      e. Pull in multiple cables together in a single conduit.

C. Splice cables and wires where necessary only in outlet boxes, junction boxes, or pull boxes.
   1. Splices and terminations shall be mechanically and electrically secure.
   2. Where the Government determines that unsatisfactory splices or terminations have been installed, remove the devices and install approved devices at no additional cost to the Government.

D. Seal cable and wire entering a building from underground, between the wire and conduit where the cable exits the conduit, with a non-hardening approved compound.

E. Unless otherwise specified in other sections install wiring and connect to equipment/devices to perform the required functions as shown and specified.

F. Except where otherwise required, install a separate power supply circuit for each system so that malfunctions in any system will not affect other systems.

G. Where separate power supply circuits are not shown, connect the systems to the nearest panel boards of suitable voltages, which are intended to supply such systems and have suitable spare circuit breakers or space for installation.

H. Install a red warning indicator on the handle of the branch circuit breaker for the power supply circuit for each system to prevent accidental de-energizing of the systems.

I. System voltages shall be 120 volts or lower where shown on the drawings or as required by the NEC.

J. UTP Cable Installation:
   1. Comply with TIA/EIA-568-B.2.
   2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.

K. Optical Fiber Cable Installation:
   1. Comply with TIA/EIA-568-B.3.
   2. Cable shall be terminated on connecting hardware that is rack or cabinet mounted.

L. Open-Cable Installation:
   1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
   2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1525 mm) apart.
   3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

M. Installation of Cable Routed Exposed under Raised Floors:
   1. Install plenum-rated cable only.
   2. Install cabling after the flooring system has been installed in raised floor areas. Coil cable 72 inches (1830 mm) long shall be neatly coiled not less than 12 inches (300 mm) in diameter below each feed point.

N. Outdoor Coaxial Cable Installation:
   1. Install outdoor connections in enclosures complying with NEMA 250, Type 4X. Install corrosion-resistant connectors to keep out moisture.
   2. Attach antenna lead-in cable to support structure at intervals not exceeding 36 inches (915 mm).

O. Separation from EMI Sources:
   1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
   2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
      a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
      b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
      c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (600 mm).
   3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
   a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (75 mm).
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
5. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
6. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.2 FIRE ALARM WIRING INSTALLATION

A. Comply with NECA 1 and NFPA 72.

B. Wiring Method: Install wiring in metal raceway according to Division 28 Section CONDUITS AND BACKBOXES FOR ELECTRICAL SYSTEMS."
   1. Install plenum cable in environmental air spaces, including plenum ceilings.
   2. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.

C. Wiring Method:
   1. Cables and raceways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.
   2. Fire-Rated Cables: Use of 2-hour, fire-rated fire alarm cables, NFPA 70, Types MI and CI, is not permitted.
   3. Signaling Line Circuits: Power-limited fire alarm cables may be installed in the same cable or raceway as signaling line circuits but with separator.

D. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

E. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

F. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

G. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signals from other floors or zones.

H. Wiring to Remote Alarm Transmitting Device: 1-inch (25-mm) conduit between the fire alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.3 CONTROL CIRCUIT CONDUCTORS

A. Minimum Conductor Sizes:
   1. Class 1 remote-control and signal circuits, No. 14 AWG.
   2. Class 2 low-energy, remote-control and signal circuits, No. 16 AWG.
   3. Class 3 low-energy, remote-control, alarm and signal circuits, No. 12 AWG.

3.4 CONNECTIONS

A. Comply with requirements in Division 28 Section, PHYSICAL ACCESS CONTROL for connecting, terminating, and identifying wires and cables.

B. Comply with requirements in Division 28 Section "INTRUSION DETECTION" for connecting, terminating, and identifying wires and cables.

C. Comply with requirements in Division 28 Section "VIDEO SURVEILLANCE" for connecting, terminating, and identifying wires and cables.

D. Comply with requirements in Division 28 Section "ELECTRONIC PERSONAL PROTECTION SYSTEMS" for connecting, terminating, and identifying wires and cables.

E. Comply with requirements in Division 28 Section "FIRE DETECTION AND ALARM" for connecting, terminating, and identifying wires and cables.

3.5 FIRESTOPPING

A. Comply with requirements in Division 07 Section "PENETRATION FIRESTOPPING."

B. Comply with TIA/EIA-569-A, "Firestopping" Annex A.

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.6 GROUNDING

A. For communications wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. For low-voltage wiring and cabling, comply with requirements in Division 28 Section "GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY."

3.7 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A.

B. Install a permanent wire marker on each wire at each termination.

C. Identifying numbers and letters on the wire markers shall correspond to those on the wiring diagrams used for installing the systems.

D. Wire markers shall retain their markings after cleaning.

E. In each handhole, install embossed brass tags to identify the system served and function.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:
   1. Visually inspect UTP and optical fiber cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA/EIA-568-B.1.
   2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

3. Test UTP cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross connection.
   a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
4. Optical Fiber Cable Tests:
   a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
   b. Link End-to-End Attenuation Tests:
      1) Multimode Link Measurements: Test at 850 or 1300 nm in 1 direction according to TIA/EIA-526-14-A, Method B, One Reference Jumper.
      2) Attenuation test results for links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.
5. Coaxial Cable Tests: Comply with requirements in Division 27 Section "Master Antenna Television System."

D. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.

E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.9 EXISTING WIRING

A. Unless specifically indicated on the plans, existing wiring shall not be reused for the new installation. Only wiring that conforms to the specifications and applicable codes may be reused. If existing wiring does not meet these requirements, existing wiring may not be reused and new wires shall be installed.

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SECTION 28 05 26

GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the finishing, installation, connection, testing and certification of the grounding and bonding required for a fully functional Electronic Safety and Security (ESS) system.

B. “Grounding electrode system” refers to all electrodes required by NEC, as well as including made, supplementary, grounding electrodes.

C. The terms “connect” and “bond” are used interchangeably in this specification and have the same meaning

1.2 RELATED WORK

A. Section 01 00 00 - GENERAL REQUIREMENTS. For General Requirements.

B. Section 28 05 00 - REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATIONS. For general electrical requirements, quality assurance, coordination, and project conditions that are common to more than one section in Division 28.

C. Section 28 05 13 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for low voltage power and lighting wiring.

D. Section 28 08 00 - COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS. Requirements for commissioning.

1.3 SUBMITTALS

A. Submit in accordance with Section 28 05 00, COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY.

B. Shop Drawings:
   1. Clearly present enough information to determine compliance with drawings and specifications.
   2. Include the location of system grounding electrode connections and the routing of aboveground and underground grounding electrode conductors.

C. Test Reports: Provide certified test reports of ground resistance.

D. Certifications: Two weeks prior to final inspection, submit four copies of the following to the COR:
   1. Certification that the materials and installation are in accordance with the drawings and specifications.
   2. Certification by the contractor that the complete installation has been properly installed and tested.

1.4 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. American Society for Testing and Materials (ASTM):
   B1-07 ..... Standard Specification for Hard-Drawn Copper Wire

   B3-07 ..... Standard Specification for Soft or Annealed Copper Wire

B8-04 ..... Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

C. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
81-1983 ..... IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System

C2-07 ..... National Electrical Safety Code

D. National Fire Protection Association (NFPA):
70-11 ..... National Electrical Code (NEC)

99-2005 ..... Health Care Facilities

E. Underwriters Laboratories, Inc. (UL):
44-05 ..... Thermoset-Insulated Wires and Cables

83-08 ..... Thermoplastic-Insulated Wires and Cables

467-07 ..... Grounding and Bonding Equipment

486A-486B-03 ..... Wire Connectors

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING CONDUCTORS

A. Equipment grounding conductors shall be UL 83 insulated stranded copper, except that sizes 6 mm² (10 AWG) and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes 25 mm² (4 AWG) and larger shall be permitted to be identified per NEC.

B. Bonding conductors shall be ASTM B8 bare stranded copper, except that sizes 6 mm² (10 AWG) and smaller shall be ASTM B1 solid bare copper wire.

2.2 GROUND RODS

A. Copper clad steel, 19 mm (3/4-inch) diameter by 3000 mm (10 feet) long, conforming to UL 467.

B. Quantity of rods shall be as required to obtain the specified ground resistance.

2.3 SPLICES AND TERMINATION COMPONENTS

A. Components shall meet or exceed UL 467 and be clearly marked with the manufacturer, catalog number, and permitted conductor size(s).2.4 ground connections

B. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

C. Below Grade: Exothermic-welded type connectors.

D. Above Grade:
1. Bonding Jumpers: Compression-type connectors, using zinc-plated fasteners and external tooth lockwashers.
2. Connection to Building Steel: Exothermic-welded type connectors.
3. Ground Busbars: Two-hole compression type lugs, using tin-plated copper or copper alloy bolts and nuts.
4. Rack and Cabinet Ground Bars: One-hole compression-type lugs, using zinc-plated or copper alloy fasteners.

5. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.
   a. Pipe Connectors: Clamp type, sized for pipe.
6. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.4 EQUIPMENT RACK AND CABINET GROUND BARS

A. Provide solid copper ground bars designed for mounting on the framework of open or cabinet-enclosed equipment racks with minimum dimensions of 4 mm thick by 19 mm wide (3/8 inch x ¾ inch).

2.5 GROUND TERMINAL BLOCKS

A. At any equipment mounting location (e.g., backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted, provide screw lug-type terminal blocks.

2.6 SPLICE CASE GROUND ACCESSORIES

A. Splice case grounding and bonding accessories shall be supplied by the splice case manufacturer when available. Otherwise, use 16 mm² (6 AWG) insulated ground wire with shield bonding connectors.

2.7 COMPUTER ROOM GROUND

A. Provide 50mm2 (1/0 AWG) bare copper grounding conductors bolted at mesh intersections to form an equipotential grounding grid. The equipotential grounding grid shall form a 600mm (24 inch) mesh pattern. The grid shall be bonded to each of the access floor pedestals.

2.8 SECURITY CONTROL ROOM GROUND

A. Provide 50mm2 (1/0 AWG) stranded copper grounding conductor(s) color coded with a green jacket, bolted at the Room's Communications System Grounding Electrode Cooper Plate and circulate to each equipment rack ground buss bar through the wire management system. Connect each equipment rack, wire management system's cable tray, ladder, etc. to the circulating ground wire with a minimum 25mm2 (4AWG) stranded Cooper Wire, color coded with a green jacket.
   1. Connect each equipment rack ground buss bar to the circulating ground wire a indicated in 2.9.A, and
   2. Connect each additional room item to the circulating ground wire as indicated in 2.9.A.

PART 3 - EXECUTION

3.1 GENERAL

A. Ground in accordance with the NEC, as shown on drawings, and as specified herein.

B. System Grounding:
   1. Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformers.
   2. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.

C. Equipment Grounding: Metallic structures, including ductwork and building steel, enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits, shall be bonded and grounded.

3.2 INACCESSIBLE GROUNDING CONNECTIONS

A. Make grounding connections, which are buried or otherwise normally inaccessible (except connections for which periodic testing access is required) by exothermic weld.

3.3 CORROSION INHIBITORS

A. When making ground and ground bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.

3.4 CONDUCTIVE PIPING

A. Bond all conductive piping systems, interior and exterior, to the building to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.

3.5 COMPUTER ROOM/SECURITY EQUIPMENT ROOM GROUNDING

A. Conduit: Ground and bond metallic conduit systems as follows:
   1. Ground metallic service conduit and any pipes entering or being routed within the computer room at each end using 16 mm² (6AWG) bonding jumpers.
   2. Bond at all intermediate metallic enclosures and across all joints using 16 mm² (6 AWG) bonding jumpers.

3.6 WIREWAY GROUNDING

A. Ground and Bond Metallic Wireway Systems as follows:
   1. Bond the metallic structures of wireway to provide 100 percent electrical continuity throughout the wireway system by connecting a 16 mm² (6 AWG) bonding jumper at all intermediate metallic enclosures and across all section junctions.
   2. Install insulated 16 mm² (6 AWG) bonding jumpers between the wireway system bonded as required in paragraph 1 above, and the closest building ground at each end and approximately every 16 meters (50 feet).
   3. Use insulated 16 mm² (6 AWG) bonding jumpers to ground or bond metallic wireway at each end at all intermediate metallic enclosures and cross all section junctions.
   4. Use insulated 16 mm² (6 AWG) bonding jumpers to ground cable tray to column-mounted building ground plates (pads) at each end and approximately every 15 meters.

3.7 GROUND RESISTANCE

A. Grounding system resistance to ground shall not exceed 5 ohms. Make any modifications or additions to the grounding electrode system necessary for compliance without additional cost to the Government. Final tests shall ensure that this requirement is met.

B. Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not fewer than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

C. Services at power company interface points shall comply with the power company ground resistance requirements.

D. Below-grade connections shall be visually inspected by the COR prior to backfilling. The contractor shall notify the COR 24 hours before the connections are ready for inspection.

3.8 GROUND ROD INSTALLATION

A. Drive each rod vertically in the earth, not less than 3000 mm (10 feet) in depth.

B. Where permanently concealed ground connections are required, make the connections by the exothermic process to form solid metal joints. Make accessible ground connections with mechanical pressure type ground connectors.

C. Where rock prevents the driving of vertical ground rods, install angled ground rods or grounding electrodes in horizontal trenches to achieve the specified resistance.

3.9 LABELING

A. Comply with requirements in Division 26 Section "ELECTRICAL IDENTIFICATION" Article for instruction signs. The label or its text shall be green.

B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.
   1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.10 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:
   1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
   2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
   3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal at individual ground rods. Make tests at ground rods before any conductors are connected.
      a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
      b. Perform tests by fall-of-potential method according to IEEE 81.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Report measured ground resistances that exceed the following values:
   1. Power Distribution Units or Panel boards Serving Electronic Equipment: 3 ohm(s).
   2. Manhole Grounds: 10 ohms.

F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

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SECTION 28 05 28.33

CONDUITS AND BACKBOXES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the finishing, installation, connection, testing certification of the conduit, fittings, and boxes to form a complete, coordinated, raceway system(s). Conduits and when approved separate UL Certified and Listed partitioned telecommunications raceways are required for a fully functional Electronic Safety and Security (ESS) system. Raceways are required for all electronic safety and security cabling unless shown or specified otherwise.

B. Definitions: The term conduit, as used in this specification, shall mean any or all of the raceway types specified.

1.2 RELATED WORK

A. Section 01 00 00 - GENERAL REQUIREMENTS. For General Requirements.

B. Section 06 10 00 - ROUGH CARPENTRY. Requirements for mounting board for communication closets.

C. Section 07 84 00 - FIRESTOPPING. Requirements for sealing around penetrations to maintain the integrity of fire rated construction.

D. Section 07 60 00 - FLASHING AND SHEET METAL. Requirements for fabrications for the deflection of water away from the building envelope at penetrations.

E. Section 07 92 00 - JOINT SEALANTS. Requirements for sealing around conduit penetrations through the building envelope to prevent moisture migration into the building.

F. Section 09 91 00 - PAINTING. Requirements for identification and painting of conduit and other devices.

G. Section 28 05 00 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY. For general electrical requirements, general arrangement of the contract documents, coordination, quality assurance, project conditions, equipment and materials, and items that is common to more than one section of Division 28.

H. Section 28 05 26 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY. Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

I. Section 28 08 00 - COMMISIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS. Requirements for commissioning - systems readiness checklists, and training.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. ENT: Electrical nonmetallic tubing.

C. EPDM: Ethylene-propylene-diene terpolymer rubber.

D. FMC: Flexible metal conduit.

E. IMC: Intermediate metal conduit.

F. LFMC: Liquidtight flexible metal conduit.

G. LFNC: Liquidtight flexible nonmetallic conduit.

H. NBR: Acrylonitrile-butadiene rubber.

I. RNC: Rigid nonmetallic conduit.

1.4 QUALITY ASSURANCE

A. Refer to Paragraph 1.4 Quality Assurance, in Section 28 05 00, COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY.

1.5 SUBMITTALS

A. Submit in accordance with Section 28 05 00, COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY and Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Furnish the following:

B. Shop Drawings:
   1. Size and location of main feeders;
   2. Size and location of panels and pull boxes
   3. Layout of required conduit penetrations through structural elements.
   4. The specific item proposed and its area of application shall be identified on the catalog cuts.

C. Certification: Prior to final inspection, deliver to the COR four copies of the certification that the material is in accordance with the drawings and specifications and has been properly installed.

D. Completed System Readiness Checklists provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 28 08 00 COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS.

E. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

F. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
   1. Custom enclosures and cabinets.
   2. Handholes and boxes for underground wiring, including the following:
      a. Duct entry provisions, including locations and duct sizes.
      b. Frame and cover design.
      c. Grounding details.
      d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
      e. Joint details.

G. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
   1. Structural members in the paths of conduit groups with common supports.
   2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.

H. Manufacturer Seismic Qualification Certification: Submit certification that enclosures and cabinets and their mounting provisions, including those for internal components, will withstand seismic forces defined in Division 16 Section "Electrical Supports and Seismic Restraints." Include the following:
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
      a. The term "withstand" means "the cabinet or enclosure will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will retain its enclosure characteristics, including its interior accessibility, after the seismic event."
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

I. Source quality-control test reports.

1.6 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. National Electrical Manufacturers Association (NEMA):
TC-3-04 ..... PVC Fittings for Use with Rigid PVC Conduit and Tubing
FB1-07 ..... Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable

C. National Fire Protection Association (NFPA):
70-11 ..... National Electrical Code (NEC)

D. Underwriters Laboratories, Inc. (UL):
1-05 ..... Flexible Metal Conduit
5-04 ..... Surface Metal Raceway and Fittings
6-07 ..... Rigid Metal Conduit
50-07 ..... Enclosures for Electrical Equipment
360-09 ..... Liquid-Tight Flexible Steel Conduit
467-07 ..... Grounding and Bonding Equipment
514A-04 ..... Metallic Outlet Boxes
514B-04 ..... Fittings for Cable and Conduit
514C-02 ..... Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers
651-05 ..... Schedule 40 and 80 Rigid PVC Conduit
651A-07 ..... Type EB and A Rigid PVC Conduit and HDPE Conduit
797-07 ..... Electrical Metallic Tubing
1242-06 ..... Intermediate Metal Conduit

PART 2 - PRODUCTS

2.1 GENERAL

A. Conduit Size: In accordance with the NEC, but not less than 20 mm (3/4 inch) unless otherwise shown.

2.2 CONDUIT

A. Rigid galvanized steel: Shall Conform to UL 6, ANSI C80.1.

B. Rigid aluminum: Shall Conform to UL 6A, ANSI C80.5.

C. Rigid intermediate steel conduit (IMC): Shall Conform to UL 1242, ANSI C80.6.

D. Electrical metallic tubing (EMT): Shall Conform to UL 797, ANSI C80.3. Maximum size not to exceed 105 mm (4 inches) and shall be permitted only with cable rated 600 volts or less.

E. Flexible galvanized steel conduit: Shall Conform to UL 1.

F. Liquid-tight flexible metal conduit: Shall Conform to UL 360.

G. Direct burial plastic conduit: Shall conform to UL 651 and UL 651A, heavy wall PVC or high density polyethylene (PE).

2.3 WIREWAYS AND RACEWAYS

A. Surface metal raceway: Shall Conform to UL 5.

2.4 CONDUIT FITTINGS

A. Rigid steel and IMC conduit fittings:
   1. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
   2. Standard threaded couplings, locknuts, bushings, and elbows: Only steel or malleable iron materials are acceptable. Integral retractable type IMC couplings are also acceptable.
   3. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.
   4. Bushings: Metallic insulating type, consisting of an insulating insert molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.
   5. Erickson (union-type) and set screw type couplings: Approved for use in concrete are permitted for use to complete a conduit run where conduit is installed in concrete. Use set screws of case hardened steel with hex head and cup point to firmly seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.
   6. Sealing fittings: Threaded cast iron type. Use continuous drain type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank cover plates having the same finishes as that of other electrical plates in the room.

B. Rigid aluminum conduit fittings:
   1. Standard threaded couplings, locknuts, bushings, and elbows: Malleable iron, steel or aluminum alloy materials; Zinc or cadmium plate iron or steel fittings. Aluminum fittings containing more than 0.4 percent copper are prohibited.
   2. Locknuts and bushings: As specified for rigid steel and IMC conduit.
   3. Set screw fittings: Not permitted for use with aluminum conduit.

C. Electrical metallic tubing fittings:
   1. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
   2. Only steel or malleable iron materials are acceptable.
   3. Couplings and connectors: Concrete tight and rain tight, with connectors having insulated throats. Use gland and ring compression type couplings and connectors for conduit sizes 50 mm (2 inches) and smaller. Use set screw type couplings with four set screws each for conduit sizes over 50 mm (2 inches). Use set screws of case-hardened steel with hex head and cup point to firmly seat in wall of conduit for positive grounding.
   4. Indent type connectors or couplings are prohibited.
   5. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.

D. Flexible steel conduit fittings:
   1. Conform to UL 514B. Only steel or malleable iron materials are acceptable.
   2. Clamp type, with insulated throat.

E. Liquid-tight flexible metal conduit fittings:
   1. Fittings shall meet the requirements of UL 514B and ANSI/ NEMA FB1.
   2. Only steel or malleable iron materials are acceptable.
   3. Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.

F. Direct burial plastic conduit fittings:
   1. Fittings shall meet the requirements of UL 514C and NEMA TC3.

2. As recommended by the conduit manufacturer.

G. Surface metal raceway fittings: As recommended by the raceway manufacturer.

H. Expansion and deflection couplings:
1. Conform to UL 467 and UL 514B.
2. Accommodate, 19 mm (0.75 inch) deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.
3. Include internal flexible metal braid sized to guarantee conduit ground continuity and fault currents in accordance with UL 467, and the NEC code tables for ground conductors.
4. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber material with stainless steel jacket clamps.

2.5 CONDUIT SUPPORTS

A. Parts and hardware: Zinc-coat or provide equivalent corrosion protection.

B. Individual Conduit Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.

C. Multiple conduit (trapeze) hangers: Not less than 38 mm by 38 mm (1-1/2 by 1-1/2 inch), 12 gage steel, cold formed, lipped channels; with not less than 9 mm (3/8 inch) diameter steel hanger rods.

D. Solid Masonry and Concrete Anchors: Self-drilling expansion shields, or machine bolt expansion.

2.6 OUTLET, JUNCTION, AND PULL BOXES

A. UL-50 and UL-514A.

B. Cast metal where required by the NEC or shown, and equipped with rustproof boxes.

C. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

D. Metal Floor Boxes: Cast or sheet metal, semi-adjustable, rectangular.

E. Sheet metal boxes: Galvanized steel, except where otherwise shown.

F. Flush mounted wall or ceiling boxes shall be installed with raised covers so that front face of raised cover is flush with the wall. Surface mounted wall or ceiling boxes shall be installed with surface style flat or raised covers.

2.7 CABINETS

A. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.

B. Hinged door in front cover with flush latch and concealed hinge.

C. Key latch to match panelboards.

D. Metal barriers to separate wiring of different systems and voltage.

E. Accessory feet where required for freestanding equipment.

2.8 WIREWAYS

A. Equip with hinged covers, except where removable covers are shown.

2.9 WARNING TAPE

A. Standard, 4-Mil polyethylene 76 mm (3 inches) wide tape non-detectable type, red with black letters, and imprinted with “CAUTION BURIED ELECTRONIC SAFETY AND SECURITY CABLE BELOW”.

2.10 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. Description: Comply with SCTE 77.
   1. Color of Frame and Cover: Gray.
   2. Configuration: Units shall be designed for flush burial and have closed bottom, unless otherwise indicated.
   3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
   4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
   5. Cover Legend: Molded lettering, as indicated for each service.
   6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
   7. Handholes 300 mm wide by 600 mm long (2 inches wide by 24 inches long) and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.

C. Fiberglass Handholes and Boxes with Polymer-Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester-resin enclosure joined to polymer-concrete top ring or frame.

D. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with covers of reinforced concrete.

2.11 SLEEVES FOR RACEWAYS

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch (1.3- or 3.5-mm) thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 84 00 "FIRESTOPPING."

2.12 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
   1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
   2. Pressure Plates: Stainless steel. Include two for each sealing element.
   3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.13 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time. WIRELINE DATA TRANSMISSION MEDIA FOR SECURITY SYSTEMS

PART 3 - EXECUTION

3.1 PENETRATIONS

A. Cutting or Holes:
   1. Locate holes in advance where they are proposed in the structural sections such as ribs or beams. Obtain the approval of the COR prior to drilling through structural sections.
   2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not allowed, except where permitted by the COR as required by limited working space.

B. Fire Stop: Where conduits, wireways, and other electronic safety and security raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING, with rock wool fiber or silicone foam sealant only. Completely fill and seal clearances between raceways and openings with the fire stop material.

C. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight as specified in Section 07 92 00, “JOINT SEALANTS”.

3.2 INSTALLATION, GENERAL

A. Install conduit as follows:
   1. In complete runs before pulling in cables or wires.
   2. Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new undamaged material.
   3. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.
   4. Cut square with a hacksaw, ream, remove burrs, and draw up tight.
   5. Mechanically continuous.
   6. Independently support conduit at 2.4 m (8 foot) on center. Do not use other supports i.e., (suspended ceilings, suspended ceiling supporting members, lighting fixtures, conduits, mechanical piping, or mechanical ducts).
   7. Support within 300 mm (12 inches) of changes of direction, and within 300 mm (12 inches) of each enclosure to which connected.
   8. Close ends of empty conduit with plugs or caps at the rough-in stage to prevent entry of debris, until wires are pulled in.
   9. Conduit installations under fume and vent hoods are prohibited.
   10. Secure conduits to cabinets, junction boxes, pull boxes and outlet boxes with bonding type locknuts. For rigid and IMC conduit installations, provide a locknut on the inside of the enclosure, made up wrench tight. Do not make conduit connections to junction box covers.
   11. Flashing of penetrations of the roof membrane is specified in Section 07 60 00, “FLASHING AND SHEET METAL”.
   12. Do not use aluminum conduits in wet locations.
   13. Unless otherwise indicated on the drawings or specified herein, all conduits shall be installed concealed within finished walls, floors and ceilings.

B. Conduit Bends:
   1. Make bends with standard conduit bending machines.
   2. Conduit hickey may be used for slight offsets, and for straightening stubbed out conduits.
   3. Bending of conduits with a pipe tee or vise is prohibited.

C. Layout and Homeruns:
   1. Install conduit with wiring, including homeruns, as shown.
   2. Deviations: Make only where necessary to avoid interferences and only after drawings showing the proposed deviations have been submitted approved by the COR.

D. Fire Alarm:
   1. Fire alarm conduit shall be painted red (a red “top-coated” conduit from the conduit manufacturer may be used in lieu of painted conduit) in accordance with the requirements of Section 28 31 00, “FIRE DETECTION AND ALARM”.

3.3 CONCEALED WORK INSTALLATION

A. In Concrete:
   1. Conduit: Rigid steel, IMC or EMT. Do not install EMT in concrete slabs that are in contact with soil, gravel or vapor barriers.
   2. Align and run conduit in direct lines.
   3. Install conduit through concrete beams only when the following occurs:
      a. Where shown on the structural drawings.
      b. As approved by the COR prior to construction, and after submittal of drawing showing location, size, and position of each penetration.
   4. Installation of conduit in concrete that is less than 75 mm (3 inch) thick is prohibited.
      a. Conduit outside diameter larger than 1/3 of the slab thickness is prohibited.
      b. Space between conduits in slabs: Approximately six conduit diameters apart, except one conduit diameter at conduit crossings.
      c. Install conduits approximately in the center of the slab so that there will be a minimum of 19 mm (3/4 inch) of concrete around the conduits.
   5. Make couplings and connections watertight. Use thread compounds that are UL approved conductive type to insure low resistance ground continuity through the conduits. Tightening set screws with pliers is prohibited.

B. Furred or Suspended Ceilings and in Walls:
   1. Conduit for conductors above 600 volts:
      a. Rigid steel or rigid aluminum.
      b. Aluminum conduit mixed indiscriminately with other types in the same system is prohibited.
   2. Conduit for conductors 600 volts and below:
      a. Rigid steel, IMC, rigid aluminum, or EMT. Different type conduits mixed indiscriminately in the same system is prohibited.
   3. Align and run conduit parallel or perpendicular to the building lines.
   4. Connect recessed lighting fixtures to conduit runs with maximum 1800 mm (6 feet) of flexible metal conduit extending from a junction box to the fixture.
   5. Tightening set screws with pliers is prohibited.

3.4 EXPOSED WORK INSTALLATION

A. Unless otherwise indicated on the drawings, exposed conduit is only permitted in mechanical and electrical rooms.

B. Conduit for Conductors 600 volts and below:
   1. Rigid steel, IMC, rigid aluminum, or EMT. Different type of conduits mixed indiscriminately in the system is prohibited.

C. Align and run conduit parallel or perpendicular to the building lines.

D. Install horizontal runs close to the ceiling or beams and secure with conduit straps.

E. Support horizontal or vertical runs at not over 2400 mm (eight foot) intervals.

F. Surface metal raceways: Use only where shown.

G. Painting:
   1. Paint exposed conduit as specified in Section09 91 00, “PAINTING”.
   2. Paint all conduits containing cables rated over 600 volts safety orange. Refer to Section 09 91 00, “PAINTING” for preparation, paint type, and exact color. In addition, paint legends, using 50 mm (two inch) high black numerals and letters, showing the cable

voltage rating. Provide legends where conduits pass through walls and floors and at maximum 6000 mm (20 foot) intervals in between.

3.5 EXPANSION JOINTS

A. Conduits 75 mm (3 inches) and larger, that are secured to the building structure on opposite sides of a building expansion joint, require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.

B. Provide conduits smaller than 75 mm (3 inches) with junction boxes on both sides of the expansion joint. Connect conduits to junction boxes with sufficient slack of flexible conduit to produce 125 mm (5 inch) vertical drop midway between the ends. Flexible conduit shall have a copper green ground bonding jumper installed. In lieu of this flexible conduit, expansion and deflection couplings as specified above for 375 mm (15 inches) and larger conduits are acceptable.

C. Install expansion and deflection couplings where shown.

3.6 CONDUIT SUPPORTS, INSTALLATION

A. Safe working load shall not exceed 1/4 of proof test load of fastening devices.

B. Use pipe straps or individual conduit hangers for supporting individual conduits. Maximum distance between supports is 2.5 m (8 foot) on center.

C. Support multiple conduit runs with trapeze hangers. Use trapeze hangers that are designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and 90 kg (200 pounds). Attach each conduit with U-bolts or other approved fasteners.

D. Support conduit independently of junction boxes, pull boxes, fixtures, suspended ceiling T-bars, angle supports, and similar items.

E. Fasteners and Supports in Solid Masonry and Concrete:
   1. New Construction: Use steel or malleable iron concrete inserts set in place prior to placing the concrete.
   2. Existing Construction:
      a. Steel expansion anchors not less than 6 mm (1/4 inch) bolt size and not less than 28 mm (1-1/8 inch) embedment.
      b. Power set fasteners not less than 6 mm (1/4 inch) diameter with depth of penetration not less than 75 mm (3 inches).
      c. Use vibration and shock resistant anchors and fasteners for attaching to concrete ceilings.

F. Hollow Masonry: Toggle bolts are permitted.

G. Bolts supported only by plaster or gypsum wallboard are not acceptable.

H. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.

I. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.

J. Chain, wire, or perforated strap shall not be used to support or fasten conduit.

K. Spring steel type supports or fasteners are prohibited for all uses except: Horizontal and vertical supports/fasteners within walls.

L. Vertical Supports: Vertical conduit runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

3.7 BOX INSTALLATION

A. Boxes for Concealed Conduits:
   1. Flush mounted.
   2. Provide raised covers for boxes to suit the wall or ceiling, construction and finish.

B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling in operations.

C. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.

D. Outlet boxes in the same wall mounted back-to-back are prohibited. A minimum 600 mm (24 inch), center-to-center lateral spacing shall be maintained between boxes).

E. Minimum size of outlet boxes for ground fault interrupter (GFI) receptacles is 100 mm (4 inches) square by 55 mm (2-1/8 inches) deep, with device covers for the wall material and thickness involved.

F. Stencil or install phenolic nameplates on covers of the boxes identified on riser diagrams; for example "SIG-FA JB No. 1".

G. On all Branch Circuit junction box covers, identify the circuits with black marker.

3.8 ELECTRONIC SAFETY AND SECURITY CONDUIT

A. Install the electronic safety and security raceway system as shown on drawings.

B. Minimum conduit size of 19 mm (3/4 inch), but not less than the size shown on the drawings.

C. All conduit ends shall be equipped with insulated bushings.

D. All 100 mm (four inch) conduits within buildings shall include pull boxes after every two 90 degree bends. Size boxes per the NEC.

E. Vertical conduits/sleeves through closets floors shall terminate not less than 75 mm (3 inches) below the floor and not less than 75 mm (3 inches) below the ceiling of the floor below.

F. Terminate conduit runs to/from a backboard in a closet or interstitial space at the top or bottom of the backboard. Conduits shall enter communication closets next to the wall and be flush with the backboard.

G. Where drilling is necessary for vertical conduits, locate holes so as not to affect structural sections such as ribs or beams.

H. All empty conduits located in communications closets or on backboards shall be sealed with a standard non-hardening duct seal compound to prevent the entrance of moisture and gases and to meet fire resistance requirements.

I. Conduit runs shall contain no more than four quarter turns (90 degree bends) between pull boxes/backboards. Minimum radius of communication conduit bends shall be as follows (special long radius):

J.

Sizes of Conduit Trade Size	Radius of Conduit Bends mm, Inches
¾	150 (6)
1	230 (9)
1-1/4	350 (14)
1-1/2	430 (17)
2	525 (21)
2-1/2	635 (25)
3	775 (31)
3-1/2	900 (36)
4	1125 (45)

K.

L. Furnish and install 19 mm (3/4 inch) thick fire retardant plywood specified in on the wall of communication closets where shown on drawings . Mount the plywood with the bottom edge 300 mm (one foot) above the finished floor.

M. Furnish and pull wire in all empty conduits. (Sleeves through floor are exceptions).

3.9 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 28 08 00 – “COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS” for all inspection, start up, and contractor testing required above and required by the System Readiness Checklist provided by the Commissioning Agent.

B. Components provided under this section of the specification will be tested as part of a larger system. Refer to Section 28 08 00, “COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS” and related sections for contractor responsibilities for system commissioning.

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SECTION 28 08 00

COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. The requirements of this Section apply to all sections of Division 28.

B. This project will have selected building systems commissioned. The complete list of equipment and systems to be commissioned is specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS. The commissioning process, which the Contractor is responsible to execute, is defined in Section 01 91 00 GENERAL COMMISSIONING REQUIRMENTS. A Commissioning Agent (CxA) appointed by the VA will manage the commissioning process.

1.2 RELATED WORK

A. Section 01 00 00 GENERAL REQUIREMENTS.

B. Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

C. Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

1.3 SUMMARY

A. This Section includes requirements for commissioning the Facility electronic safety and security systems, related subsystems and related equipment. This Section supplements the general requirements specified in Section 01 91 00 General Commissioning Requirements.

B. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for more details regarding processes and procedures as well as roles and responsibilities for all Commissioning Team members.

1.4 DEFINITIONS

A. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for definitions.

1.5 COMMISSIONED SYSTEMS

A. Commissioning of a system or systems specified in Division 28 is part of the construction process. Documentation and testing of these systems, as well as training of the VA's Operation and Maintenance personnel in accordance with the requirements of Section 01 91 00 and of Division 28, is required in cooperation with the VA and the Commissioning Agent.

B. The Facility exterior closure systems commissioning will include the systems listed in Section 01 91 00 General Commissioning Requirements:

1.6 SUBMITTALS

A. The commissioning process requires review of selected Submittals that pertain to the systems to be commissioned. The Commissioning Agent will provide a list of submittals that will be reviewed by the Commissioning Agent. This list will be reviewed and approved by the VA prior to forwarding to the Contractor. Refer to Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, and SAMPLES for further details.

B. The commissioning process requires Submittal review simultaneously with engineering review. Specific submittal requirements related to the commissioning process are specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 CONSTRUCTION INSPECTIONS

A. Commissioning of Electronic Safety and Security systems will require inspection of individual elements of the electronic safety and security systems throughout the construction period. The Contractor shall coordinate with the Commissioning Agent in accordance with Section 01 91 00 and the Commissioning plan to schedule electronic safety and security systems inspections as required to support the Commissioning Process.

3.2 PRE-FUNCTIONAL CHECKLISTS

A. The Contractor shall complete Pre-Functional Checklists to verify systems, subsystems, and equipment installation is complete and systems are ready for Systems Functional Performance Testing. The Commissioning Agent will prepare Pre-Functional Checklists to be used to document equipment installation. The Contractor shall complete the checklists. Completed checklists shall be submitted to the VA and to the Commissioning Agent for review. The Commissioning Agent may spot check a sample of completed checklists. If the Commissioning Agent determines that the information provided on the checklist is not accurate, the Commissioning Agent will return the marked-up checklist to the Contractor for correction and resubmission. If the Commissioning Agent determines that a significant number of completed checklists for similar equipment are not accurate, the Commissioning Agent will select a broader sample of checklists for review. If the Commissioning Agent determines that a significant number of the broader sample of checklists is also inaccurate, all the checklists for the type of equipment will be returned to the Contractor for correction and resubmission. Refer to SECTION 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for submittal requirements for Pre-Functional Checklists, Equipment Startup Reports, and other commissioning documents.

3.3 CONTRACTORS TESTS

A. Contractor tests as required by other sections of Division 28 shall be scheduled and documented in accordance with Section 01 00 00 GENERAL REQUIREMENTS. All testing shall be incorporated into the project schedule. Contractor shall provide no less than 7 calendar days' notice of testing. The Commissioning Agent will witness selected Contractor tests at the sole discretion of the Commissioning Agent. Contractor tests shall be completed prior to scheduling Systems Functional Performance Testing.

3.4 SYSTEMS FUNCTIONAL PERFORMANCE TESTING

A. The Commissioning Process includes Systems Functional Performance Testing that is intended to test systems functional performance under steady state conditions, to test system reaction to changes in operating conditions, and system performance under emergency conditions. The Commissioning Agent will prepare detailed Systems Functional Performance Test procedures for review and approval by the Resident Engineer. The Contractor shall review and comment on the tests prior to approval. The Contractor shall provide the required labor, materials, and test equipment identified in the test procedure to perform the tests. The Commissioning Agent will witness and document the testing. The Contractor shall sign the test reports to verify tests were performed. See Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS, for additional details.

3.5 TRAINING OF VA PERSONNEL

A. Training of the VA operation and maintenance personnel is required in cooperation with the Resident Engineer and Commissioning Agent. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems. Contractor shall submit training agendas and trainer resumes in accordance with the requirements of Section 01 91 00.

The instruction shall be scheduled in coordination with the VA Resident Engineer after submission and approval of formal training plans. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS and Division 28 Sections for additional Contractor training requirements.

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SECTION 28 13 00

PHYSICAL ACCESS CONTROL SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the finishing, installation, connection, testing and certification of a complete and fully operating Physical Access Control System, hereinafter referred to as the PACS. This facility utilizes C-CURE 9000 by Software House as the access control and event management platform. The system is serviced by Johnson Controls Security Solutions LLC. Point of contact is Mike Scott (Michael.4.scott@JCI.com) 781-206-9079. Contractor shall use the same provider in base bid. Substitutes shall NOT be permitted by the facility.

B. This Section includes a Physical Access Control System consisting of a system server, one or more networked workstation computers, operating system and application software, and field-installed Controllers connected by a high-speed electronic data transmission network. The PACS shall have the following:
   1. Physical Access Control:
      a. Regulating access through doors , gates
      b. Anti-passback
      c. Visitor assignment
      d. Surge and tamper protection
      e. Secondary alarm annunciator
      f. Credential cards and readers
      g. Biometric identity verification equipment
      h. Push-button switches
      i. RS-232 ASCII interface
      j. Credential creation and credential holder database and management
      k. Monitoring of field-installed devices
      l. Interface with paging systems.
      m. Reporting
   2. Security:
      a. Real-time guard tour.
      b. Time and attendance.
      c. Key tracking.
      d. Video and camera control.
      e. Time and attendance

C. System Architecture:
   1. Criticality, operational requirements, and/or limiting points of failure may dictate the development of an enterprise and regional server architecture as opposed to system capacity. Provide server and workstation configurations with all necessary connectors, interfaces and accessories as shown.

D. PACS shall provide secure and reliable identification of Federal employees and contractors by utilizing credential authentication per FIPS-201.

E. Physical Access Control System (PACS) shall consist of:
   1. Head-End equipment server,
   2. One or more networked PC-based workstations,
   3. Physical Access Control System and Database Management Software,
   4. Credential validation software/hardware,
   5. Field installed controllers,
   6. PIV Middelware,
   7. Card readers,

8. Biometric identification devices,
9. PIV, PIV-I, Legacy CAC cards,
10. Supportive information system,
11. Door locks and sensors,
12. Power supplies,
13. Interfaces with:
    a. Video Surveillance and Assessment System,
    b. Gate, turnstile, and traffic arm controls,
    c. Automatic door operators,
    d. Intrusion Detection System,
    e. Intercommunication System
    f. Fire Protection System,
    g. HVAC,
    h. Building Management System,
    i. Elevator Controls,

F. Head-End equipment server, workstations and controllers shall be connected by a high-speed electronic data transmission network.

G. Information system supporting PACS , Head-End equipment server, workstations, network switches, routers and controllers shall comply with FIPS 200 requirements (Minimum Security Requirements for Federal Information and Information Systems)and NIST Special Publication 800-53 (Recommended Security Controls for Federal Information Systems).

H. PACS system shall support:
1. Multiple credential authentication modes,
2. Bidirectional communication with the reader,
3. Incident response policy implementation capability; system shall have capability to automatically change access privileges for certain user groups to high security areas in case of incident/emergency.
4. Visitor management,

I. All security relevant decisions shall be made on “secure side of the door”. Secure side processing shall include;
1. Challenge/response management,
2. PKI path discovery and validation,
3. Credential identifier processing,
4. Authorization decisions.

J. For locations where secure side processing is not applicable the tamper switches and certified cryptographic processing shall be provided per FIPS-140-2.

K. System Software: Based on central-station, workstation operating system, server operating system, and application software.

L. Software and controllers shall be capable of matching full 56 bit FASC-N plus minimum of 32 bits of public key certificate data.

M. Software shall have the following capabilities:
1. Multiuser multitasking to allow for independent activities and monitoring to occur simultaneously at different workstations.
2. Support authentication and enrolment;
    a. PIV verification,
    b. Expiration date check,
    c. Biometric check,
    d. Digital photo display/check,
    e. Validate digital signatures of data objects (Objects are signed by the Trusted Authority
    f. Private key challenge (CAK & PAK to verify private key public key pairs exist and card is not a clone)

3. Support CRL validation via OCSP or SCVP on a scheduled basis and automatically deny access to any revoked credential in the system.
4. Graphical user interface to show pull-down menus and a menu tree format that complies with interface guidelines of Microsoft Windows operating system.
5. System license shall be for the entire system and shall include capability for future additions that are within the indicated system size limits specified in this Section.
6. System shall have open architecture that allows importing and exporting of data and interfacing with other systems that are compatible with OIT's operating system.
7. Operator login and access shall be utilized via integrated smart card reader and password protection.

N. Systems Networks:
1. A standalone system network shall interconnect all components of the system. This network shall include communications between a central station and any peer or subordinate workstations, enrollment stations, local annunciation stations, portal control stations or redundant central stations.

O. Security Management System Server Redundancy:
1. The SMS shall support multiple levels of fault tolerance and SMS redundancy listed and described below:
   a. Hot Standby Servers
   b. Clustering
   c. Disk Mirroring
   d. RAID Level 10
   e. Distributed Intelligence

P. Number of points:
1. PACS shall support multiple autonomous regional servers that can connect to a master command and controller server.
2. Unlimited number of access control readers, unlimited number of inputs or outputs, unlimited number of client workstations, unlimited number of cardholders.
3. Total system solution to enable enterprise-wide, networked, multi-user access to all system resources via a wide range of options for connectivity with the customer's existing LAN and WAN.

Q. Console Network:
1. Console network, if required, shall provide communication between a central station and any subordinate or separate stations of the system. Where redundant central or parallel stations are required, the console network shall allow the configuration of stations as master and slave. The console network may be a part of the field device network or may be separate depending upon the manufacturer's system configuration.

R. Network(s) connecting PCs and Controllers shall comply with NIST Special Publication 800-53 (Recommended Security Controls for Federal Information Systems) and consist of one or more of the following:
1. Local area, IEEE 802.3 Fast Ethernet 100 BASE-TX, star topology network based on TCP/IP.
2. Direct-connected, RS-232 cable from the COM port of the Central Station to the first Controller, then RS-485 to interconnect the remainder of the Controllers at that Location.

1.2 RELATED WORK

A. Section 01 00 00 - GENERAL REQUIREMENTS. For General Requirements.

B. Section 07 84 00 - FIRESTOPPING. Requirements for firestopping application and use.

C. Section 08 71 00 - DOOR HARDWARE. Requirements for door installation.

D. Section 10 14 00 - SIGNAGE. Requirements for labeling and signs.

E. Section 26 05 11 - REQUIREMENTS FOR ELECTRICAL INSTALLATIONS. Requirements for connection of high voltage.

F. Section 26 05 19 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW). Requirements for power cables.

G. Section 26 05 33 – RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS. Requirements for infrastructure.

H. Section 28 05 00 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY. For general requirements that are common to more than one section in Division 28.

I. Section 28 05 13 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for conductors and cables.

J. Section 28 05 26 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY. Requirements for grounding of equipment.

K. Section 28 05 28.33 - CONDUITS AND BOXES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for infrastructure.

L. Section 28 08 00 - COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY. For requirements for commissioning, systems readiness checklists, and training.

M. Section 28 23 00 - VIDEO SURVEILLANCE. Requirements for security camera systems.

N. Section 28 31 00 - FIRE DETECTION AND ALARM. Requirements for integration with fire detection and alarm system.

1.3 QUALITY ASSURANCE

A. The Contractor shall be responsible for providing, installing, and the operation of the PACS as shown. The Contractor shall also provide certification as required.

B. The security system will be installed and tested to ensure all components are fully compatible as a system and can be integrated with all associated security subsystems, whether the security system is stand-alone or a part of a complete Information Technology (IT) computer network.

C. Manufacturers Qualifications: The manufacturer shall regularly and presently produce, as one of the manufacturer's principal products, the equipment and material specified for this project, and shall have manufactured the item for at least three years.

D. Product Qualifications:
   1. Manufacturer's product shall have been in satisfactory operation, on three installations of similar size and type as this project, for approximately three years.
   2. The Government reserves the right to require the Contractor to submit a list of installations where the products have been in operation before approval.

E. Contractor Qualifications:
   1. The Contractor or security sub-contractor shall be a licensed security Contractor with a minimum of five (5) years experience installing and servicing systems of similar scope and complexity. The Contractor shall be an authorized regional representative of the Security Management System's (PACS) manufacturer. The Contractor shall provide four (4) current references from clients with systems of similar scope and complexity which became operational in the past three (3) years. At least three (3) of the references shall be utilizing the same system components, in a similar configuration as the proposed system. The references must include a current point of contact, company or agency name, address, telephone number, complete system description, date of completion, and approximate cost of the project. The owner reserves the option to visit the reference sites, with the site owner's permission and representative, to verify the quality of installation and the references' level of satisfaction with the system. The Contractor shall provide copies of system manufacturer certification for all technicians. The Contractor shall only utilize factory-trained technicians to install, program, and service the PACS.

The Contractor shall only utilize factory-trained technicians to install, terminate and service controller/field panels and reader modules. The technicians shall have a minimum of five (5) continuous years of technical experience in electronic security systems. The Contractor shall have a local service facility. The facility shall be located within 60 miles of the project site. The local facility shall include sufficient spare parts inventory to support the service requirements associated with this contract. The facility shall also include appropriate diagnostic equipment to perform diagnostic procedures. The Resident Engineer reserves the option of surveying the company's facility to verify the service inventory and presence of a local service organization.

a. The Contractor shall provide proof project superintendent with BICSI Certified Commercial Installer Level 1, Level 2, or Technician to provide oversight of the project.
b. Cable installer must have on staff a Registered Communication Distribution Designer (RCDD) certified by Building Industry Consulting Service International. The staff member shall provide consistent oversight of the project cabling throughout design, layout, installation, termination and testing.

F. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within four hours of receipt of notification that service is needed. Submit name and address of service organizations.

1.4 SUBMITTALS

A. Submit below items in conjunction with Master Specification Sections 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, Section 02 41 00, DEMOLITION, and Section 28 05 00 COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY.

B. Provide certificates of compliance with Section 1.3, Quality Assurance.

C. Provide a complete and thorough pre-installation and as-built design package in both electronic format and on paper, minimum size 48 x 48 inches (1220 x 1220 millimeters); drawing submittals shall be per the established project schedule.

D. Shop drawing and as-built packages shall include, but not be limited to:
1. Index Sheet that shall:
   a. Define each page of the design package to include facility name, building name, floor, and sheet number.
   b. Provide a complete list of all security abbreviations and symbols.
   c. Reference all general notes that are utilized within the design package.
   d. Specification and scope of work pages for all individual security systems that are applicable to the design package that will:
      1) Outline all general and job specific work required within the design package.
      2) Provide a detailed device identification table outlining device Identification (ID) and use for all security systems equipment utilized in the design package.
2. Drawing sheets that will be plotted on the individual floor plans or site plans shall:
   a. Include a title block as defined above.
   b. Clearly define the drawings scale in both standard and metric measurements.
   c. Provide device identification and location.
   d. Address all signal and power conduit runs and sizes that are associated with the design of the electronic security system and other security elements (e.g., barriers, etc.).
   e. Identify all pull box and conduit locations, sizes, and fill capacities.
   f. Address all general and drawing specific notes for a particular drawing sheet.
3. A detailed riser drawing for each applicable security subsystem shall:
   a. Indicate the sequence of operation.
   b. Relationship of integrated components on one diagram.

c. Include the number, size, identification, and maximum lengths of interconnecting wires.
d. Wire/cable types shall be defined by a wire and cable schedule. The schedule shall utilize a lettering system that will correspond to the wire/cable it represents (example: A = 18 AWG/1 Pair Twisted, Unshielded). This schedule shall also provide the manufacturer's name and part number for the wire/cable being installed.

4. A detailed system drawing for each applicable security system shall:
   a. Clearly identify how all equipment within the system, from main panel to device, shall be laid out and connected.
   b. Provide full detail of all system components wiring from point-to-point.
   c. Identify wire types utilized for connection, interconnection with associate security subsystems.
   d. Show device locations that correspond to the floor plans.
   e. All general and drawing specific notes shall be included with the system drawings.
5. A detailed schedule for all of the applicable security subsystems shall be included. All schedules shall provide the following information:
   a. Device ID.
   b. Device Location (e.g. site, building, floor, room number, location, and description).
   c. Mounting type (e.g. flush, wall, surface, etc.).
   d. Power supply or circuit breaker and power panel number.
   e. In addition, for the PACS, provide the door ID, door type (e.g. wood or metal), locking mechanism (e.g. strike or electromagnetic lock) and control device (e.g. card reader or biometrics).
6. Detail and elevation drawings for all devices that define how they were installed and mounted.

E. Pre-installation design packages shall go through a full review process conducted by the Contractor along with a VA representative to ensure all work has been clearly defined and completed. All reviews shall be conducted in accordance with the project schedule. There shall be four (4) stages to the review process:
   1. 35 percent
   2. 65 percent
   3. 90 percent
   4. 100 percent

F. Provide manufacturer security system product cut-sheets. Submit for approval at least 30 days prior to commencement of formal testing, a Security System Operational Test Plan. Include procedures for operational testing of each component and security subsystem, to include performance of an integrated system test.

G. Submit manufacture's certification of Underwriters Laboratories, Inc. (UL) listing as specified. Provide all maintenance and operating manuals per Section 01 00 00, GENERAL REQUIREMENTS, and Section 28 05 00 COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY.

H. Completed System Readiness Checklists provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 28 08 00 COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS.

I. General: Submittals shall be in full compliance of the Contract Documents. All submittals shall be provided in accordance with this section. Submittals lacking the breath or depth these requirements will be considered incomplete and rejected. Submissions are considered multidisciplinary and shall require coordination with applicable divisions to provide a complete and comprehensive submission package. Additional general provisions are as follows:
   1. The Contractor shall schedule submittals in order to maintain the project schedule. For coordination drawings refer to Specification Section 01 33 23 - DESIGN SUBMITTAL

PROCEDURES, which outline basic submittal requirements and coordination. Section 01 33 23 shall be used in conjunction with this section.

2. The Contractor shall identify variations from requirements of Contract Documents and state product and system limitations, which may be detrimental to successful performance of the completed work or system.
3. Each package shall be submitted at one (1) time for each review and include components from applicable disciplines (e.g., electrical work, architectural finishes, door hardware, etc.) which are required to produce an accurate and detailed depiction of the project.
4. Manufacturer's information used for submittal shall have pages with items for approval tagged, items on pages shall be identified, and capacities and performance parameters for review shall be clearly marked through use of an arrow or highlighting. Provide space for Resident Engineer and Contractor review stamps.
5. Technical Data Drawings shall be in the latest version of AutoCAD®, drawn accurately, and in accordance with VA CAD Standards. FREEHAND SKETCHES OR COPIED VERSIONS OF THE CONSTRUCTION DOCUMENTS WILL NOT BE ACCEPTED. The Contractor shall not reproduce Contract Documents or copy standard information as the basis of the Technical Data Drawings. If departures from the technical data drawings are subsequently deemed necessary by the Contractor, details of such departures and the reasons thereof shall be submitted in writing to the Resident Engineer for approval before the initiation of work.
6. Packaging: The Contractor shall organize the submissions according to the following packaging requirements.
    a. Binders: For each manual, provide heavy duty, commercial quality, durable three (3) ring vinyl covered loose leaf binders, sized to receive 8.5 x 11 in paper, and appropriate capacity to accommodate the contents. Provide a clear plastic sleeve on the spine to hold labels describing the contents. Provide pockets in the covers to receive folded sheets.
        1) Where two (2) or more binders are necessary to accommodate data, correlate data in each binder into related groupings according to the Project Manual table of contents. Cross-referencing other binders where necessary to provide essential information for communication of proper operation and or maintenance of the component or system.
        2) Identify each binder on the front and spine with printed binder title, Project title or name, and subject matter covered. Indicate the volume number if applicable.
    b. Dividers: Provide heavy paper dividers with celluloid tabs for each Section. Mark each tab to indicate contents.
    c. Protective Plastic Jackets: Provide protective transparent plastic jackets designed to enclose diagnostic software for computerized electronic equipment.
    d. Text Material: Where written material is required as part of the manual use the manufacturer's standard printed material, or if not available, specially prepared data, neatly typewritten on 8.5 inches by 11 inches 20 pound white bond paper.
    e. Drawings: Where drawings and/or diagrams are required as part of the manual, provide reinforced punched binder tabs on the drawings and bind them with the text.
        1) Where oversized drawings are necessary, fold the drawings to the same size as the text pages and use as a foldout.
        2) If drawings are too large to be used practically as a foldout, place the drawing, neatly folded, in the front or rear pocket of the binder. Insert a type written page indicating the drawing title, description of contents and drawing location at the appropriate location of the manual.
        3) Drawings shall be sized to ensure details and text is of legible size. Text shall be no less than 1/16" tall.
    f. Manual Content: In each manual include information specified in the individual Specification section, and the following information for each major component of building equipment and controls:

1) General system or equipment description.
2) Design factors and assumptions.
3) Copies of applicable Shop Drawings and Product Data.
4) System or equipment identification including: manufacturer, model and serial numbers of each component, operating instructions, emergency instructions, wiring diagrams, inspection and test procedures, maintenance procedures and schedules, precautions against improper use and maintenance, repair instructions, sources of required maintenance materials and related services, and a manual index.

g. Binder Organization: Organize each manual into separate sections for each piece of related equipment. At a minimum, each manual shall contain a title page, table of contents, copies of Product Data supplemented by drawings and written text, and copies of each warranty, bond, certifications, and service Contract issued. Refer to Group I through V Technical Data Package Submittal requirements for required section content.

h. Title Page: Provide a title page as the first sheet of each manual to include the following information; project name and address, subject matter covered by the manual, name and address of the Project, date of the submittal, name, address, and telephone number of the Contractor, and cross references to related systems in other operating and/or maintenance manuals.

i. Table of Contents: After the title page, include a type written table of contents for each volume, arranged systematically according to the Project Manual format. Provide a list of each product included, identified by product name or other appropriate identifying symbols and indexed to the content of the volume. Where more than one (1) volume is required to hold data for a particular system, provide a comprehensive table of contents for all volumes in each volume of the set.

j. General Information Section: Provide a general information section immediately following the table of contents, listing each product included in the manual, identified by product name. Under each product, list the name, address, and telephone number of the installer and maintenance Contractor. In addition, list a local source for replacement parts and equipment.

k. Drawings: Provide specially prepared drawings where necessary to supplement the manufacturers printed data to illustrate the relationship between components of equipment or systems, or provide control or flow diagrams. Coordinate these drawings with information contained in Project Record Drawings to assure correct illustration of the completed installation.

l. Manufacturer’s Data: Where manufacturer's standard printed data is included in the manuals, include only those sheets that are pertinent to the part or product installed. Mark each sheet to identify each part or product included in the installation. Where more than one (1) item in tabular format is included, identify each item, using appropriate references from the Contract Documents. Identify data that is applicable to the installation and delete references to information which is not applicable.

m. Where manufacturer's standard printed data is not available and the information is necessary for proper operation and maintenance of equipment or systems, or it is necessary to provide additional information to supplement the data included in the manual, prepare written text to provide the necessary information. Organize the text in a consistent format under a separate heading for different procedures. Where necessary, provide a logical sequence of instruction for each operating or maintenance procedure. Where similar or more than one product is listed on the submittal the Contractor shall differentiate by highlighting the specific product to be utilized.

n. Calculations: Provide a section for circuit and panel calculations.

o. Loading Sheets: Provide a section for DGP Loading Sheets.

p. Certifications: Provide section for Contractor’s manufacturer certifications.

7. Contractor Review: Review submittals prior to transmittal. Determine and verify field measurements and field construction criteria. Verify manufacturer's catalog numbers and conformance of submittal with requirements of contract documents. Return non-conforming or incomplete submittals with requirements of the work and contract documents. Apply Contractor's stamp with signature certifying the review and verification of products occurred, and the field dimensions, adjacent construction, and coordination of information is in accordance with the requirements of the contract documents.
8. Resubmission: Revise and resubmit submittals as required within 15 calendar days of return of submittal. Make resubmissions under procedures specified for initial submittals. Identify all changes made since previous submittal.
9. Product Data: Within 15 calendar days after execution of the contract, the Contractor shall submit for approval a complete list of all of major products proposed for use. The data shall include name of manufacturer, trade name, model number, the associated contract document section number, paragraph number, and the referenced standards for each listed product.

J. Group 1 Technical Data Package: Group I Technical Data Package shall be one submittal consisting of the following content and organization. Refer to VA Special Conditions Document for drawing format and content requirements. The data package shall include the following:
1. Section I - Drawings:
   a. General – Drawings shall conform to VA Special Conditions and CAD Standards Documents. All text associated with security details shall be 1/8" tall and meet VA text standard for AutoCAD™ drawings.
   b. Cover Sheet – Cover sheet shall consist of Project Title and Address, Project Number, Area and Vicinity Maps.
   c. General Information Sheets – General Information Sheets shall consist of General Notes, Abbreviations, Symbols, Wire and Cable Schedule, Project Phasing, and Sheet Index.
   d. Floor Plans – Floor plans shall be produced from the Architectural backgrounds issued in the Construction Documents. The contractor shall receive floor plans from the prime A/E to develop these drawing sets. Security devices shall be placed on drawings in scale. All text associated with security details shall be 1/8" tall and meet VA text standard for AutoCAD™ drawings. Floor plans shall identify the following:
      1) security devices by symbol,
      2) the associated device point number (derived from the loading sheets),
      3) wire & cable types and counts
      4) conduit sizing and routing
      5) conduit riser systems
      6) device and area detail call outs
   e. Architectural details – Architectural details shall be produced for each device mounting type (door details for doors with physical access control, reader pedestals and mounts, security panel and power supply details).
   f. Riser Diagrams – Contractor shall provide a riser diagram indicating riser architecture and distribution of the physical access control system throughout the facility (or area in scope).
   g. Block Diagrams – Contractor shall provide a block diagram for the entire system architecture and interconnections with SMS subsystems. Block diagram shall identify SMS subsystem (e.g., physical access control, intrusion detection, closed circuit television, intercom, and other associated subsystems) integration; and data transmission and media conversion methodologies.
   h. Interconnection Diagrams – Contractor shall provide interconnection diagram for each sensor, and device component. Interconnection diagram shall identify termination locations, standard wire detail to include termination schedule. Diagram shall also identify interfaces to other systems such as elevator control, fire alarm systems, and security management systems.

i. Security Details:
   1) Panel Assembly Detail – For each panel assembly, a panel assembly details shall be provided identifying individual panel component size and content.
   2) Panel Details – Provide security panel details identify general arrangement of the security system components, backboard size, wire through size and location, and power circuit requirements.
   3) Device Mounting Details – Provide mounting detailed drawing for each security device (physical access control system, intrusion detection, video surveillance and assessment, and intercom systems) for each type of wall and ceiling configuration in project. Device details shall include device, mounting detail, wiring and conduit routing.
   4) Details of connections to power supplies and grounding
   5) Details of surge protection device installation
   6) Sensor detection patterns – Each system sensor shall have associated detection patterns.
   7) Equipment Rack Detail – For each equipment rack, provide a scaled detail of the equipment rack location and rack space utilization. Use of BISCI wire management standards shall be employed to identify wire management methodology. Transitions between equipment racks shall be shown to include use vertical and horizontal latter rack system.
   8) Security Control Room – The contractor shall provide a layout plan for the Security Control Room. The layout plan shall identify all equipment and details associated with the installation.
   9) Operator Console – The contractor shall provide a layout plan for the Operator Console. The layout plan shall identify all equipment and details associated with the installation. Equipment room - the contractor shall provide a layout plan for the equipment room. The layout plan shall identify all equipment and details associated with the installation.
   10) Equipment Room – Equipment room details shall provide architectural, electrical, mechanical, plumbing, IT/Data and associated equipment and device placements both vertical and horizontally.

j. Electrical Panel Schedule – Electrical Panel Details shall be provided for all SMS systems electrical power circuits. Panel details shall be provided identifying panel type (Standard, Emergency Power, Emergency/Uninterrupted Power Source, and Uninterrupted Power Source Only), panel location, circuit number, and circuit amperage rating.

k. Door Schedule – A door schedule shall be developed for each door equipped with electronic security components. At a minimum, the door schedule shall be coordinated with Division 08 work and include the following information:
   1) Item Number
   2) Door Number (Derived from A/E Drawings)
   3) Floor Plan Sheet Number
   4) Standard Detail Number
   5) Door Description (Derived from Loading Sheets)
   6) Data Gathering Panel Input Number
   7) Door Position or Monitoring Device Type & Model Number
   8) Lock Type, Model Number & Power Input/Draw (standby/active)
   9) Card Reader Type & Model Number
   10) Shunting Device Type & Model Number
   11) Sounder Type & Model Number
   12) Manufacturer
   13) Misc. devices as required
      a) Delayed Egress Type & Model Number
      b) Intercom
      c) Camera
      d) Electric Transfer Hinge

e) Electric Pass-through device

14) Remarks column indicating special notes or door configurations

2. Camera Schedule - A camera schedule shall be developed for each camera. Contractors shall coordinate with the Resident Engineer to determine camera starting numbers and naming conventions. All drawings shall identify wire and cable standardization methodology. Color coding of all wiring conductors and jackets is required and shall be communicated consistently throughout the drawings package submittal. At a minimum, the camera schedule shall include the following information:
   a. Item Number
   b. Camera Number
   c. Naming Conventions
   d. Description of Camera Coverage
   e. Camera Location
   f. Floor Plan Sheet Number
   g. Camera Type
   h. Mounting Type
   i. Standard Detail Reference
   j. Power Input & Draw
   k. Power Panel Location
   l. Remarks Column for Camera
3. Section II – Data Gathering Panel Documentation Package
   a. Contractor shall provide Data Gathering Panel (DGP) input and output documentation packages for review at the Shop Drawing submittal stage and also with the as-built documentation package. The documentation packages shall be provided in both printed and magnetic form at both review stages.
   b. The Contractor shall provide loading sheet documentation package for the associated DGP, including input and output boards for all field panels associated with the project. Documentation shall be provided in current version Microsoft Excel spreadsheets following the format currently utilized by VA. A separate spreadsheet file shall be generated for each DGP and associated field panels.
   c. The spreadsheet names shall follow a sequence that shall display the spreadsheets in numerical order according to the DGP system number. The spreadsheet shall include the prefix in the file name that uniquely identifies the project site. The spreadsheet shall detail all connected items such as card readers, alarm inputs, and relay output connections. The spreadsheet shall include an individual section (row) for each panel input, output and card reader. The spreadsheet shall automatically calculate the system numbers for card readers, inputs, and outputs based upon data entered in initialization fields.
   d. All entries must be verified against the field devices. Copies of the floor plans shall be forwarded under separate cover.
   e. The DGP spreadsheet shall include an entry section for the following information:
      1) DGP number
      2) First Reader Number
      3) First Monitor Point Number
      4) First Relay Number
      5) DGP, input or output Location
      6) DGP Chain Number
      7) DGP Cabinet Tamper Input Number
      8) DGP Power Fail Input Number
      9) Number of Monitor Points Reserved For Expansion Boards
      10) Number of Control Points (Relays) Reserved For Expansion Boards
   f. The DGP, input module and output module spreadsheets shall automatically calculate the following information based upon the associated entries in the above fields:
      1) System Numbers for Card Readers
      2) System Numbers for Monitor Point Inputs

3) System Numbers for Control Points (Relays)
4) Next DGP or input module First Monitor Point Number
5) Next DGP or output module First Control Point Number

g. The DGP spreadsheet shall provide the following information for each card reader:
1) DGP Reader Number
2) System Reader Number
3) Cable ID Number
4) Description Field (Room Number)
5) Description Field (Device Type i.e.: In Reader, Out Reader, etc.)
6) Description Field
7) DGP Input Location
8) Date Test
9) Date Passed
10) Cable Type
11) Camera Numbers (of cameras viewing the reader location)

h. The DGP and input module spreadsheet shall provide the following information for each monitor point (alarm input).
1) DGP Monitor Point Input Number
2) System Monitor Point Number
3) Cable ID Number
4) Description Field (Room Number)
5) Description Field (Device Type i.e.: Door Contact, Motion Detector, etc.)
6) DGP or input module Input Location
7) Date Test
8) Date Passed
9) Cable Type
10) Camera Numbers (of associated alarm event preset call-ups)

i. The DGP and output module spreadsheet shall provide the following information for each control point (output relay).
1) DGP Control Point (Relay) Number
2) System (Control Point) Number
3) Cable ID Number
4) Description Field (Room Number)
5) Description Field (Device: Lock Control, Local Sounder, etc.)
6) Description Field
7) DGP or OUTPUT MODULE Output Location
8) Date Test
9) Date Passed Cable Type
10) Camera Number (of associated alarm event preset call-ups)

j. The DGP, input module and output module spreadsheet shall include the following information or directions in the header and footer:
1) Header
a) DGP Input and Output Worksheet
b) Enter Beginning Reader, Input, and Output Starting Numbers and Sheet Will Automatically Calculate the Remaining System Numbers.
2) Footer
a) File Name
b) Date Printed
c) Page Number

4. Section III - Construction Mock-up: In areas with exposed EMT/Conduit Raceways, contractor shall conceal raceway as much as practical and unobtrusively. In addition, historic significance must be considered to determine installation means and methods for approval by the owner.

5. Section IV - Manufacturers' Data: The data package shall include manufacturers' data for all materials and equipment, including sensors, local processors and console equipment provided under this specification.

6. Section V - System Description and Analysis: The data package shall include system descriptions, analysis, and calculations used in sizing equipment required by these specifications. Descriptions and calculations shall show how the equipment will operate as a system to meet the performance requirements of this specification. The data package shall include the following:
   a. Central processor memory size; communication speed and protocol description; rigid disk system size and configuration; flexible disk system size and configuration; back-up media size and configuration; alarm response time calculations; command response time calculations; start-up operations; expansion capability and method of implementation; sample copy of each report specified; and color photographs representative of typical graphics.
   b. Software Data: The data package shall consist of descriptions of the operation and capability of the system, and application software as specified.
   c. Overall System Reliability Calculations: The data package shall include all manufacturers' reliability data and calculations required to show compliance with the specified reliability.
7. Section VI – Certifications & References: All specified manufacturer's certifications shall be included with the data package. Contractor shall provide Project references as outlined in Paragraph 1.4 "Quality Assurance".

K. Group II Technical Data Package
1. The Contractor shall prepare a report of "Current Site Conditions" and submit a report to the Resident Engineer documenting changes to the site, particularly those conditions that affect performance of the system to be installed. The Contractor shall provide specification sheets, or written functional requirements to support the findings, and a cost estimate to correct those site changes or conditions which affect the installation of the system or its performance. The Contractor shall not correct any deficiency without written permission from the COTR.
2. System Configuration and Functionality: The contractor shall provide the results of the meeting with VA to develop system requirements and functionality including but not limited to:
   a. Baseline configuration
   b. Access levels
   c. Schedules (intrusion detection, physical access control, holidays, etc.)
   d. Badge database
   e. System monitoring and reporting (unit level and central control)
   f. Naming conventions and descriptors

L. Group III Technical Data Package
1. Development of Test Procedures: The Contractor will prepare performance test procedures for the system testing. The test procedures shall follow the format of the VA Testing procedures and be customized to the contract requirements. The Contractor will deliver the test procedures to the Resident Engineer for approval at least 60 calendar days prior to the requested test date.

M. Group IV Technical Data Package
1. Performance Verification Test
   a. Based on the successful completion of the pre-delivery test, the Contractor shall finalize the test procedures and report forms for the performance verification test (PVT) and the endurance test. The PVT shall follow the format, layout and content of the pre-delivery test. The Contractor shall deliver the PVT and endurance test procedures to the Resident Engineer for approval. The Contractor may schedule the PVT after receiving written approval of the test procedures. The Contractor shall deliver the final PVT and endurance test reports within 14 calendar days from completion of the tests. Refer to Part 3 of this section for System Testing and Acceptance requirements.
2. Training Documentation

a. New Facilities and Major Renovations: Familiarization training shall be provided for new equipment or systems. Training can include site familiarization training for VA technicians and administrative personnel. Training shall include general information on new system layout including closet locations, turnover of the completed system including all documentation, including manuals, software, key systems, and full system administration rights. Lesson plans and training manuals training shall be oriented to type of training to be provided.

b. New Unit Control Room:

1) Provide the security personnel with training in the use, operation, and maintenance of the entire control room system (Unit Control and Equipment Rooms). The training documentation must include the operation and maintenance. The first of the training sessions shall take place prior to system turnover and the second immediately after turnover. Coordinate the training sessions with the Owner. Completed classroom sessions will be witnessed and documented by the Architect/Engineer, and approved by the Resident Engineer. Instruction is not to begin until the system is operational as designed.

2) The training documents will cover the operation and the maintenance manuals and the control console operators' manuals and service manuals in detail, stressing all important operational and service diagnostic information necessary for the maintenance and operations personnel to efficiently use and maintain all systems.

3) Provide an illustrated control console operator's manual and service manual. The operator's manual shall be written in laymen's language and printed so as to become a permanent reference document for the operators, describing all control panel switch operations, graphic symbol definitions and all indicating functions and a complete explanation of all software.

4) The service manual shall be written in laymen's language and printed so as to become a permanent reference document for maintenance personnel, describing how to run internal self diagnostic software programs, troubleshoot head end hardware and field devices with a complete scenario simulation of all possible system malfunctions and the appropriate corrective measures.

5) Provide a professional color DVD instructional recording of all the operational procedures described in the operator's manual. All charts used in the training session shall be clearly presented on the video. Any DVD found to be inferior in recording or material content shall be reproduced at no cost until an acceptable DVD is submitted. Provide four copies of the training DVD, one to the architect/engineer and three to the owner.

3. System Configuration and Data Entry:

a. The contractor is responsible for providing all system configuration and data entry for the SMS and subsystems (e.g., video matrix switch, intercom, digital video recorders, network video recorders). All data entry shall be performed per VA standards & guidelines. The Contractor is responsible for participating in all meetings with the client to compile the information needed for data entry. These meetings shall be established at the beginning of the project and incorporated in to the project schedule as a milestone task. The contractor shall be responsible for all data collection, data entry, and system configuration. The contractor shall collect, enter, & program and/or configure the following components:

1) Physical Access control system components,
2) All intrusion detection system components,
3) Video surveillance, control and recording systems,
4) Intercom systems components,
5) All other security subsystems shown in the contract documents.

b. The Contractor is responsible for compiling the card access database for the VA employees, including programming reader configurations, access shifts, schedules, exceptions, card classes and card enrollment databases.
c. Refer to Part 3 for system programming requirements and planning guidelines.

4. Graphics: Based on CAD as-built drawings developed for the construction project, create all map sets showing locations of all alarms and field devices. Graphical maps of all alarm points installed under this contract including perimeter and exterior alarm points shall be delivered with the system. The Contractor shall create and install all graphics needed to make the system operational. The Contractor shall utilize data from the contract documents, Contractor's field surveys, and all other pertinent information in the Contractor's possession to complete the graphics. The Contractor shall identify and request from the COTR, any additional data needed to provide a complete graphics package. Graphics shall have sufficient level of detail for the system operator to assess the alarm. The Contractor shall supply hard copy, color examples at least 203.2 x 254 mm (8 x 10 in) of each type of graphic to be used for the completed Security system. The graphics examples shall be delivered to the Resident Engineer for review and approval at least 90 calendar days prior to the scheduled date the Contractor requires them.

N. Group V Technical Data Package: Final copies of the manuals shall be delivered to the Resident Engineer as part of the acceptance test. The draft copy used during site testing shall be updated with any changes required prior to final delivery of the manuals. Each manual's contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of each sub-contractor installing equipment or systems, as well as the nearest service representatives for each item of equipment for each system. The manuals shall include a table of contents and tab sheets. Tab sheets shall be placed at the beginning of each chapter or section and at the beginning of each appendix. The final copies delivered after completion of the endurance test shall include all modifications made during installation, checkout, and acceptance. Six (6) hard-copies and one (1) soft copy on CD of each item listed below shall be delivered as a part of final systems acceptance.

1. Functional Design Manual: The functional design manual shall identify the operational requirements for the entire system and explain the theory of operation, design philosophy, and specific functions. A description of hardware and software functions, interfaces, and requirements shall be included for all system operating modes. Manufacturer developed literature may be used; however, shall be produced to match the project requirements.
2. Equipment Manual: A manual describing all equipment furnished including:
   a. General description and specifications; installation and checkout procedures; equipment electrical schematics and layout drawings; system schematics and layout drawings; alignment and calibration procedures; manufacturer's repair list indicating sources of supply; and interface definition.
3. Software Manual: The software manual shall describe the functions of all software and include all other information necessary to enable proper loading, testing, and operation. The manual shall include:
   a. Definition of terms and functions; use of system and applications software; procedures for system initialization, start-up, and shutdown; alarm reports; reports generation, database format and data entry requirements; directory of all disk files; and description of all communications protocols including data formats, command characters, and a sample of each type of data transfer.
4. Operator's Manual: The operator's manual shall fully explain all procedures and instructions for the operation of the system, including:
   a. Computers and peripherals; system start-up and shutdown procedures; use of system, command, and applications software; recovery and restart procedures; graphic alarm presentation; use of report generator and generation of reports; data entry; operator commands' alarm messages, and printing formats; and system access requirements.

5. Maintenance Manual: The maintenance manual shall include descriptions of maintenance for all equipment including inspection, recommend schedules, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.
6. Spare Parts & Components Data: At the conclusion of the Contractor's work, the Contractor shall submit to the Resident Engineer a complete list of the manufacturer's recommended spare parts and components required to satisfactorily maintain and service the systems, as well as unit pricing for those parts and components.
7. Operation, Maintenance & Service Manuals: The Contractor shall provide two (2) complete sets of operating and maintenance manuals in the form of an instructional manual for use by the VA Security Guard Force personnel. The manuals shall be organized into suitable sets of manageable size. Where possible, assemble instructions for similar equipment into a single binder. If multiple volumes are required, each volume shall be fully indexed and coordinated.
8. 8. Equipment and Systems Maintenance Manual: The Contractor shall provide the following descriptive information for each piece of equipment, operating system, and electronic system:
   a. Equipment and/or system function.
   b. Operating characteristics.
   c. Limiting conditions.
   d. Performance curves.
   e. Engineering data and test.
   f. Complete nomenclature and number of replacement parts.
   g. Provide operating and maintenance instructions including assembly drawings and diagrams required for maintenance and a list of items recommended to stock as spare parts.
   h. Provide information detailing essential maintenance procedures including the following: routine operations, trouble shooting guide, disassembly, repair and re-assembly, alignment, adjusting, and checking.
   i. Provide information on equipment and system operating procedures, including the following; start-up procedures, routine and normal operating instructions, regulation and control procedures, instructions on stopping, shut-down and emergency instructions, required sequences for electric and electronic systems, and special operating instructions.
   j. Manufacturer equipment and systems maintenance manuals are permissible.
9. Project Redlines: During construction, the Contractor shall maintain an up-to-date set of construction redlines detailing current location and configuration of the project components. The redline documents shall be marked with the words ‘Master Redlines’ on the cover sheet and be maintained by the Contractor in the project office. The Contractor will provide access to redline documents anytime during the project for review and inspection by the Resident Engineer or authorized Office of Protection Services representative. Master redlines shall be neatly maintained throughout the project and secured under lock and key in the contractor’s onsite project office. Any project component or assembly that is not installed in strict accordance with the drawings shall be so noted on the drawings. Prior to producing Record Construction Documents, the contractor will submit the Master Redline document to the Resident Engineer for review and approval of all changes or modifications to the documents. Each sheet shall have Resident Engineer initials indicating authorization to produce “As Built” documents. Field drawings shall be used for data gathering & field changes. These changes shall be made to the master redline documents daily. Field drawings shall not be considered “master redlines”.
10. Record Specifications: The Contractor shall maintain one (1) copy of the Project Specifications, including addenda and modifications issued, for Project Record Documents. The Contractor shall mark the Specifications to indicate the actual installation where the installation varies substantially from that indicated in the Contract Specifications and modifications issued. (Note related Project Record Drawing

information where applicable). The Contractor shall pay particular attention to substitutions, selection of product options, and information on concealed installations that would be difficult to identify or measure and record later. Upon completion of the mark ups, the Contractor shall submit record Specifications to the COTR. As with master relines, Contractor shall maintain record specifications for Resident Engineer review and inspection at anytime.

11. Record Product Data: The Contractor shall maintain one (1) copy of each Product Data submittal for Project Record Document purposes. The Data shall be marked to indicate the actual product installed where the installation varies substantially from that indicated in the Product Data submitted. Significant changes in the product delivered to the site and changes in manufacturer's instructions and recommendations for installation shall be included. Particular attention will be given to information on concealed products and installations that cannot be readily identified or recorded later. Note related Change Orders and mark up of Record Construction Documents, where applicable. Upon completion of mark up, submit a complete set of Record Product Data to the COTR.
12. Miscellaneous Records: The Contractor shall maintain one (1) copy of miscellaneous records for Project Record Document purposes. Refer to other Specifications for miscellaneous record-keeping requirements and submittals concerning various construction activities. Before substantial completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for use and reference. Categories of requirements resulting in miscellaneous records include, a minimum of the following:
    a. Certificates received instead of labels on bulk products.
    b. Testing and qualification of tradesmen. (“Contractor’s Qualifications”)
    c. Documented qualification of installation firms.
    d. Load and performance testing.
    e. Inspections and certifications.
    f. Final inspection and correction procedures.
    g. Project schedule
13. Record Construction Documents (Record As-Built)
    a. Upon project completion, the contractor shall submit the project master redlines to the Resident Engineer prior to development of Record construction documents. The Resident Engineer shall be given a minimum of a thirty (30) day review period to determine the adequacy of the master redlines. If the master redlines are found suitable by the Resident Engineer, the Resident Engineer will initial and date each sheet and turn redlines over to the contractor for as built development.
    b. The Contractor shall provide the Resident Engineer a complete set of "as-built" drawings and original master redlined marked "as-built" blue-line in the latest version of AutoCAD drawings unlocked on CD or DVD. The as-built drawing shall include security device number, security closet connection location, data gathering panel number, and input or output number as applicable. All corrective notations made by the Contractor shall be legible when submitted to the COTR. If, in the opinion of the COTR, any redlined notation is not legible, it shall be returned to the Contractor for re-submission at no extra cost to the Owner. The Contractor shall organize the Record Drawing sheets into manageable sets bound with durable paper cover sheets with suitable titles, dates, and other identifications printed on the cover. The submitted as built shall be in editable formats and the ownership of the drawings shall be fully relinquished to the owner.
    c. Where feasible, the individual or entity that obtained record data, whether the individual or entity is the installer, sub-contractor, or similar entity, is required to prepare the mark up on Record Drawings. Accurately record the information in a comprehensive drawing technique. Record the data when possible after it has been obtained. For concealed installations, record and check the mark up before concealment. At the time of substantial completion, submit the Record Construction Documents to the COTR. The Contractor shall organize into bound and labeled sets for the COTR's continued usage. Provide device, conduit, and

cable lengths on the conduit drawings. Exact in-field conduit placement/routings shall be shown. All conduits shall be illustrated in their entire length from termination in security closets; no arrowed conduit runs shall be shown. Pull box and junction box sizes are to be shown if larger than 100mm (4 inch).

O. FIPS 201 Compliance Certificates
   1. Provide Certificates for all software components and device types utilizing credential verification. Provide certificates for:
      a. Card Readers
      b. Facial Image Capturing Camera
      c. PIV Middelware
      d. Template Matcher
      e. Electromagnetically Opaque Sleeve
      f. Certificate Management
         1) CAK Authentication System
         2) PIV Authentication System
         3) Certificate Validator
         4) Cryptographic Module

P. Approvals will be based on complete submission of manuals together with shop drawings.

Q. Completed System Readiness Checklists provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 28 08 00 COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below (including amendments, addenda, revisions, supplement, and errata) form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American National Standards Institute (ANSI)/ Security Industry Association (SIA):
   AC-03 ..... Access Control: Access Control Guideline Dye Sublimation Printing Practices for PVC Access Control Cards

   TVAC-01..... CCTV to Access Control Standard - Message Set for System Integration

C. American National Standards Institute (ANSI)/ International Code Council (ICC):
   A117.1 ..... Standard on Accessible and Usable Buildings and Facilities

D. Department of Justice American Disability Act (ADA)
   28 CFR Part 36 ..... ADA Standards for Accessible Design 2010

E. Department of Veterans Affairs (VA):
   PACS-R:..... Physical Access Control System (PACS) Requirements

   VA Handbook 0730 ..... Security and Law Enforcement

F. Government Accountability Office (GAO):
   ..... GAO-03-8-02 Security Responsibilities for Federally Owned and Leased Facilities

G. National Electrical Contractors Association
   303-2005 ..... Installing Closed Circuit Television (CCTV) Systems

H. National Electrical Manufactures Association (NEMA):

250-08 ..... Enclosures for Electrical Equipment (1000 Volts Maximum)

I. National Fire Protection Association (NFPA):
70-11 ..... National Electrical Code

J. Underwriters Laboratories, Inc. (UL):
294-99 ..... The Standard of Safety for Access Control System Units
305-08 ..... Standard for Panic Hardware
639-97 ..... Standard for Intrusion-Detection Units
752-05 ..... Standard for Bullet-Resisting Equipment
827-08 ..... Central Station Alarm Services
1076-95 ..... Standards for Proprietary Burglar Alarm Units and Systems
1981-03 ..... Central Station Automation System
2058-05 ..... High Security Electronic Locks

K. Homeland Security Presidential Directive (HSPD):
HSPD-12 ..... Policy for a Common Identification Standard for Federal Employees and Contractors

L. Federal Communications Commission (FCC):
(47 CFR 15) Part 15 ..... Limitations on the Use of Wireless Equipment/Systems

M. Federal Information Processing Standards (FIPS):
FIPS-201-1 ..... Personal Identity Verification (PIV) of Federal Employees and Contractors

N. National Institute of Standards and Technology (NIST):
IR 6887 V2.1 ..... Government Smart Card Interoperability Specification (GSC-IS)
Special Pub 800-63 ..... Electronic Authentication Guideline
Special Pub 800-96 ..... PIV Card Reader Interoperability Guidelines
Special Pub 800-73-3 ..... Interfaces for Personal Identity Verification (4 Parts)
..... Pt. 1- End Point PIV Card Application Namespace, Data Model & Representation
..... Pt. 2- PIV Card Application Card Command Interface
..... Pt. 3- PIV Client Application Programming Interface
..... Pt. 4- The PIV Transitional Interfaces & Data Model Specification
Special Pub 800-76-1 ..... Biometric Data Specification for Personal Identity Verification
Special Pub 800-78-2 ..... Cryptographic Algorithms and Key Sizes for Personal Identity Verification
Special Pub 800-79-1 ..... Guidelines for the Accreditation of Personal Identity Verification Card Issuers
Special Pub 800-85B-1 ..... DRAFTPIV Data Model Test Guidelines
Special Pub 800-85A-2 ..... PIV Card Application and Middleware Interface Test Guidelines (SP 800-73-3 compliance)
Special Pub 800-96 ..... PIV Card Reader Interoperability Guidelines

Special Pub 800-37 ..... Guide for Applying the Risk Management Framework to Federal Information Systems

Special Pub 800-96 ..... PIV Card Reader Interoperability Guidelines

Special Pub 800-96 ..... PIV Card Reader Interoperability Guidelines

Special Pub 800-104A ..... Scheme for PIV Visual Card Topography

Special Pub 800-116 ..... Recommendation for the Use of PIV Credentials in Physical Access Control Systems (PACS)

O. Institute of Electrical and Electronics Engineers (IEEE):
C62.41 ..... IEEE Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits

P. International Organization for Standardization (ISO):
7810 ..... Identification cards – Physical characteristics

7811 ..... Physical Characteristics for Magnetic Stripe Cards

7816-1 ..... Identification cards - Integrated circuit(s) cards with contacts - Part 1: Physical characteristics

7816-2 ..... Identification cards - Integrated circuit cards - Part 2: Cards with contacts -Dimensions and location of the contacts

7816-3 ..... Identification cards - Integrated circuit cards - Part 3: Cards with contacts - Electrical interface and transmission protocols

7816-4 ..... Identification cards - Integrated circuit cards - Part 11: Personal verification through biometric methods

7816-10 ..... Identification cards - Integrated circuit cards - Part 4: Organization, security and commands for interchange

14443 ..... Identification cards - Contactless integrated circuit cards; Contactless Proximity Cards Operating at 13.56 MHz in up to 5 inches distance

15693 ..... Identification cards -- Contactless integrated circuit cards - Vicinity cards; Contactless Vicinity Cards Operating at 13.56 MHz in up to 50 inches distance

19794 ..... Information technology - Biometric data interchange formats

Q. Uniform Federal Accessibility Standards (UFAS) 1984

R. ADA Standards for Accessible Design 2010

S. Section 508 of the Rehabilitation Act of 1973

1.6 DEFINITIONS

A. ABA Track: Magnetic stripe that is encoded on track 2, at 75-bpi density in binary-coded decimal format; for example, 5-bit, 16-character set.

B. Access Control List: A list of (identifier, permissions) pairs associated with a resource or an asset. As an expression of security policy, a person may perform an operation on a resource or asset if and only if the person's identifier is present in the access control list (explicitly or implicitly), and the permissions in the (identifier, permissions) pair include the permission to perform the requested operation.

C. Access Control: A function or a system that restricts access to authorized persons only.

D. API Application Programming Interface

E. Assurance Level (or E-Authentication Assurance Level): A measure of trust or confidence in an authentication mechanism defined in OMB Memorandum M-04-04 and NIST Special Publication (SP) 800-63, in terms of four levels: M-04-04
   1. Level 1: LITTLE OR NO confidence
   2. Level 2: SOME confidence
   3. Level 3: HIGH confidence
   4. Level 4: VERY HIGH confidence

F. Authentication: A process that establishes the origin of information, or determines an entity's identity. In this publication, authentication often means the performance of a PIV authentication mechanism.

G. Authenticator: A memory, possession, or quality of a person that can serve as proof of identity, when presented to a verifier of the appropriate kind. For example, passwords, cryptographic keys, and fingerprints are authenticators.

H. Authorization: A process that associates permission to access a resource or asset with a person and the person's identifier(s).

I. BIO or BIO-A: A FIPS 201 authentication mechanism that is implemented by using a Fingerprint data object sent from the PIV Card to the PACS. Note that the short-hand "BIO (-A)" is used throughout the document to represent both BIO and BIO-A authentication mechanisms.

J. Biometric: An authenticator produced from measurable qualities of a living person.

K. CAC EP – CAC End Point with end point PIV applet

L. CAC NG – CAC Next Generation with transitional PIV applet

M. Card Authentication Key (CAK): A PIV authentication mechanism (or the PIV Card key of the same name) that is implemented by an asymmetric or symmetric key challenge/response protocol. The CAK is an optional mechanism defined in NIST SP 800-73. SP800-73 NIST strongly recommends that every PIV Card contain an asymmetric CAK and corresponding certificate, and that agencies use the asymmetric CAK protocol, rather than a symmetric CAK protocol, whenever the CAK authentication mechanism is used with PACS.

N. CCTV: Closed-circuit television.

O. Central Station: A PC with software designated as the main controlling PC of the PACS. Where this term is presented with initial capital letters, this definition applies.

P. Controller: An intelligent peripheral control unit that uses a computer for controlling its operation. Where this term is presented with an initial capital letter, this definition applies.

Q. CPU: Central processing unit.

R. Credential: Data assigned to an entity and used to identify that entity.

S. File Server: A PC in a network that stores the programs and data files shared by users.

T. FIPS Federal Information Processing Standards

U. FRAC – First Responder Authentication Credential

V. HSPD Homeland Security Presidential Directive

W. I/O: Input/Output.

X. Identifier: A credential card, keypad personal identification number or code, biometric characteristic, or other unique identification entered as data into the entry-control database for the purpose of identifying an individual. Where this term is presented with an initial capital letter, this definition applies.

Y. IEC International Electrotechnical Commission

Z. ISO International Organization for Standardization

AA. KB Kilobyte

BB. kbit/s Kilobits / second

CC. LAN: Local area network.

DD. LED: Light-emitting diode.

EE. Legacy CAC – Contact only Common Access Card with v1 and v2 applets

FF. Location: A Location on the network having a PC-to-Controller communications link, with additional Controllers at the Location connected to the PC-to-Controller link with RS-485 communications loop. Where this term is presented with an initial capital letter, this definition applies.

GG. NIST: National Institute of Standards and Technology

HH. PACS: Physical Access Control System

II. PC/SC: Personal Computer / Smart Card

JJ. PC: Personal computer. This acronym applies to the Central Station, workstations, and file servers.

KK. PCI Bus: Peripheral component interconnect; a peripheral bus providing a high-speed data path between the CPU and peripheral devices (such as monitor, disk drive, or network).

LL. PDF: (Portable Document Format.) The file format used by the Acrobat document exchange system software from Adobe.

MM. PIV: Personal Identification Verification

NN. PIV-I – PIV Interoperable credential

OO. PPS: Protocol and Parameters Selection

PP. RF: Radio frequency.

QQ. ROM: Read-only memory. ROM data are maintained through losses of power.

RR. RS-232: An TIA/EIA standard for asynchronous serial data communications between terminal devices. This standard defines a 25-pin connector and certain signal characteristics for interfacing computer equipment.

SS. RS-485: An TIA/EIA standard for multipoint communications.

TT. TCP/IP: Transport control protocol/Internet protocol incorporated into Microsoft Windows.

UU. TPDU: Transport Protocol Data Unit

VV. TWIC – Transportation Worker Identification Credential

WW. UPS: Uninterruptible power supply.

XX. Vcc: Voltage at the Common Collector

YY. WAN: Wide area network.

ZZ. WAV: The digital audio format used in Microsoft Windows.

AAA. Wiegand: Patented magnetic principle that uses specially treated wires embedded in the credential card.

BBB. Windows: Operating system by Microsoft Corporation.

CCC. Workstation: A PC with software that is configured for specific limited security system functions.

1.7 COORDINATION

A. Coordinate arrangement, mounting, and support of electronic safety and security equipment:
   1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
   2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
   3. To allow right of way for piping and conduit installed at required slope.
   4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electronic safety and security items that are behind finished surfaces or otherwise concealed.

1.8 MAINTENANCE & SERVICE

A. General Requirements
   1. The Contractor shall provide all services required and equipment necessary to maintain the entire integrated electronic security system in an operational state as specified for a period of one (1) year after formal written acceptance of the system. The Contractor shall provide all necessary material required for performing scheduled adjustments or other non-scheduled work. Impacts on facility operations shall be minimized when performing scheduled adjustments or other non-scheduled work. See also General Project Requirements.

B. Description of Work
   1. The adjustment and repair of the security system includes all software updates, panel firmware, and the following new items computers equipment, communications transmission equipment and data transmission media (DTM), local processors, security system sensors, physical access control equipment, facility interface, signal transmission equipment, and video equipment.

C. Personnel
   1. Service personnel shall be certified in the maintenance and repair of the selected type of equipment and qualified to accomplish all work promptly and satisfactorily. The Resident Engineer shall be advised in writing of the name of the designated service representative, and of any change in personnel. The Resident Engineer shall be provided copies of system manufacturer certification for the designated service representative.

D. Schedule of Work
   1. The work shall be performed during regular working ours, Monday through Friday, excluding federal holidays. These inspections shall include:
      a. The Contractor shall perform two (2) minor inspections at six (6) month intervals or more if required by the manufacturer, and two (2) major inspections offset equally between the minor inspections to effect quarterly inspection of alternating magnitude.
         1) Minor Inspections shall include visual checks and operational tests of all console equipment, peripheral equipment, local processors, sensors, electrical and mechanical controls, and adjustments on printers.
         2) Major Inspections shall include all work described for Minor Inspections and the following: clean all system equipment and local processors including interior and exterior surfaces; perform diagnostics on all equipment; operational tests of the CPU, switcher, peripheral equipment, recording devices, monitors, picture quality from each camera; check, walk test, and calibrate each sensor; run all system software diagnostics and correct all problems; and resolve any previous outstanding problems.

E. Emergency Service
   1. The owner shall initiate service calls whenever the system is not functioning properly. The Contractor shall provide the Owner with an emergency service center telephone number. The emergency service center shall be staffed 24 hours a day 365 days a year. The Owner shall have sole authority for determining catastrophic and non-catastrophic system failures within parameters stated in General Project Requirements.
      a. For catastrophic system failures, the Contractor shall provide same day four (4) hour service response with a defect correction time not to exceed eight (8) hours from notification. Catastrophic system failures are defined as any system failure that the Owner determines will place the facility(s) at increased risk.
      b. For non-catastrophic failures, the Contractor within eight (8) hours with a defect correction time not to exceed 24 hours from notification.

F. Operation
   1. Performance of scheduled adjustments and repair shall verify operation of the system as demonstrated by the applicable portions of the performance verification test.

G. Records & Logs
   1. The Contractor shall maintain records and logs of each task and organize cumulative records for each component and for the complete system chronologically. A continuous log shall be submitted for all devices. The log shall contain all initial settings, calibration, repair, and programming data. Complete logs shall be maintained and available for inspection on site, demonstrating planned and systematic adjustments and repairs have been accomplished for the system.

H. Work Request
   1. The Contractor shall separately record each service call request, as received. The record shall include the serial number identifying the component involved, its location, date and time the call was received, specific nature of trouble, names of service personnel assigned to the task, instructions describing the action taken, the amount and nature of the materials used, and the date and time of commencement and completion. The Contractor shall deliver a record of the work performed within five (5) working days after the work was completed.

I. System Modifications
   1. The Contractor shall make any recommendations for system modification in writing to the COTR. No system modifications, including operating parameters and control settings, shall be made without prior written approval from the COTR. Any modifications made to the system shall be incorporated into the operation and maintenance manuals and other documentation affected.

J. Software
   1. The Contractor shall provide all software updates when approved by the Owner from the manufacturer during the installation and 12-month warranty period and verify operation of the system. These updates shall be accomplished in a timely manner, fully coordinated with the system operators, and incorporated into the operations and maintenance manuals and software documentation. There shall be at least one (1) scheduled update near the end of the first year's warranty period, at which time the Contractor shall install and validate the latest released version of the Manufacturer's software. All software changes shall be recorded in a log maintained in the unit control room. An electronic copy of the software update shall be maintained within the log. At a minimum, the contractor shall provide a description of the modification, when the modification occurred, and name and contact information of the individual performing the modification. The log shall be maintained in a white 3 ring binder and the cover marked "SOFTWARE CHANGE LOG".

1.9 PERFORMANCE REQUIREMENTS

A. PACS shall provide support for multiple authentication modes and bidirectional communication with the reader. PACS shall provide implementation capability for enterprise security policy and incident response.

B. All processing of authentication information must occur on the “safe side” of a door

C. Physical Access Control System shall provide access to following Security Areas:
   1. Controlled
   2. Limited
   3. Exclusion

D. PACS shall provide:
   1. One authentication factor for access to Controlled security areas
   2. Two authentication factors for access to Limited security areas
   3. Three authentication factors for access to Exclusion security areas

E. PACS shall provide Credential Validation and Path Validation per NIST 800-116.

F. The PACS System shall have an Enterprise Path Validation Module (PVM) component that processes X.509 certification paths composed of X.509 v3 certificates and X.509 v2 CRLs. The PVM component MUST support the following features:
   1. Name chaining;
   2. Signature chaining;
   3. Certificate validity;
   4. Key usage, basic constraints, and certificate policies certificate extensions;
   5. Full CRLs; and
   6. CRLs segmented on names.

G. Distributed Processing: System shall be a fully distributed processing system so that information, including time, date, valid codes, access levels, and similar data, is downloaded to Controllers so that each Controller makes access-control decisions for that Location. Do not use intermediate Controllers for physical access control. If communications to Central Station are lost, all Controllers shall automatically buffer event transactions until communications are restored, at which time buffered events shall be uploaded to the Central Station.

H. Number of Locations: Support unlimited number of separate Locations using a single PC with combinations of direct-connect, dial-up, or TCP/IP LAN connections to each Location.
   1. Each Location shall have its own database and history in the Central Station. Locations may be combined to share a common database.

I. Capacity:
   1. 130 different card-reader formats.
   2. 999 comments.
   3. 16 graphic file types for importing maps.

J. Location Capacity:
   1. 128 reader-controlled doors.
   2. 50,000 total access credentials.
   3. 2048 supervised alarm inputs.
   4. 2048 programmable outputs.
   5. 32,000 custom action messages per Location to instruct operator on action required when alarm is received.

K. System Network Requirements:
   1. Interconnect system components and provide automatic communication of status changes, commands, field-initiated interrupts, and other communications required for proper system operation.
   2. Communication shall not require operator initiation or response, and shall return to normal after partial or total network interruption such as power loss or transient upset.

3. System shall automatically annunciate communication failures to the operator and identify the communication link that has experienced a partial or total failure.
4. Communications Controller may be used as an interface between the Central Station display systems and the field device network. Communications Controller shall provide functions required to attain the specified network communications performance.

L. Central Station shall provide operator interface, interaction, display, control, and dynamic and real-time monitoring. Central Station shall control system networks to interconnect all system components, including workstations and field-installed Controllers.

M. Field equipment shall include Controllers, sensors, and controls. Controllers shall serve as an interface between the Central Station and sensors and controls. Data exchange between the Central Station and the Controllers shall include down-line transmission of commands, software, and databases to Controllers. The up-line data exchange from the Controller to the Central Station shall include status data such as intrusion alarms, status reports, and entry-control records. Controllers are classified as alarm-annunciation or entry-control type.

N. System Response to Alarms: Field device network shall provide a system end-to-end response time of 1 second(s) or less for every device connected to the system. Alarms shall be annunciated at the Central Station within 1 second of the alarm occurring at a Controller or device controlled by a local Controller, and within 100 ms if the alarm occurs at the Central Station. Alarm and status changes shall be displayed within 100 ms after receipt of data by the Central Station. All graphics shall be displayed, including graphics-generated map displays, on the console monitor within 5 seconds of alarm receipt at the security console. This response time shall be maintained during system heavy load.

O. False Alarm Reduction: The design of Central Station and Controllers shall contain features to reduce false alarms. Equipment and software shall comply with SIA CP-01.

P. Error Detection: A cyclic code error detection method shall be used between Controllers and the Central Station, which shall detect single- and double-bit errors, burst errors of eight bits or less, and at least 99 percent of all other multibit and burst error conditions. Interactive or product error detection codes alone will not be acceptable. A message shall be in error if one bit is received incorrectly. System shall retransmit messages with detected errors. A two-digit decimal number shall be operator assignable to each communication link representing the number of retransmission attempts. When the number of consecutive retransmission attempts equals the assigned quantity, the Central Station shall print a communication failure alarm message. System shall monitor the frequency of data transmission failure for display and logging.

Q. Data Line Supervision: System shall initiate an alarm in response to opening, closing, shorting, or grounding of data transmission lines.

R. Door Hardware Interface: Coordinate with Division 08 Sections that specify door hardware required to be monitored or controlled by the PACS. The Controllers in this Section shall have electrical characteristics that match the signal and power requirements of door hardware. Integrate door hardware specified in Division 08 Sections to function with the controls and PC-based software and hardware in this Section.

S. References to industry and trade association standards and codes are minimum installation requirement standards.

T. Drawings and other specification sections shall govern in those instances where requirements are greater than those specified in the above standards.

1.10 EQUIPMENT AND MATERIALS

A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts shall be available.

B. When more than one unit of the same class of equipment is required, such units shall be the product of a single manufacturer.

C. Equipment Assemblies and Components:
   1. Components of an assembled unit need not be products of the same manufacturer.
   2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
   3. Components shall be compatible with each other and with the total assembly for the intended service.
   4. Constituent parts which are similar shall be the product of a single manufacturer.

D. Factory wiring shall be identified on the equipment being furnished and on all wiring diagrams.

E. When Factory Testing Is Specified:
   1. The Government shall have the option of witnessing factory tests. The contractor shall notify the VA through the Resident Engineer a minimum of 15 working days prior to the manufacturers making the factory tests.
   2. Four copies of certified test reports containing all test data shall be furnished to the Resident Engineer prior to final inspection and not more than 90 days after completion of the tests.
   3. When equipment fails to meet factory test and re-inspection is required, the contractor shall be liable for all additional expenses, including expenses of the Government.

1.11 WARRANTY OF CONSTRUCTION.

A. Warrant PACS work subject to the Article “Warranty of Construction” of FAR clause 52.246-21.

B. Demonstration and training shall be performed prior to system acceptance.

1.12 GENERAL REQUIREMENTS

A. For general requirements that are common to more than one section in Division 28 refer to Section 28 05 00, REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATIONS.

B. General requirements applicable to this section include:
   1. General Arrangement Of Contract Documents,
   2. Delivery, Handling and Storage,
   3. Project Conditions,
   4. Electrical Power,
   5. Lightning, Power Surge Suppression, and Grounding,
   6. Electronic Components,
   7. Substitute Materials and Equipment, and
   8. Like Items.

PART 2 - PRODUCTS

2.1 GENERAL

A. Basis of Design: Johnson Controls C-Cure 9000 – required to match and continue existing station systems -no substitutions.

B. All equipment and materials for the system will be compatible to ensure correct operation as outlined in FIPS 201, March 2006 and HSPD-12.

C. The security system characteristics listed in this section will serve as a guide in selection of equipment and materials for the PACS. If updated or more suitable versions are available then the Contracting Officer will approve the acceptance of prior to an installation.

D. PACS equipment shall meet or exceed all requirements listed below.

E. A PACS shall be comprised of, but not limited to, the following components:
1. Physical Access Control System
2. Application Software
3. System Database
4. Surge and Tamper Protection
5. Standard Workstation Hardware
6. Communications Workstation
7. Controllers (Data Gathering Panel)
8. Secondary Alarm Annunciator
9. Keypads
10. Card Readers
11. Credential Cards
12. Biometric Identity Verification Equipment
13. Enrolment Center (To be provided in accordance with the VA PIV enrollment and issuance system.)
14. System Sensors and Related Equipment
15. Push Button Switches
16. Interfaces
17. Door and Gate Hardware interface
18. RS-232 ASCII Interface
19. Floor Select Elevator Control
20. After-Hours HVAC Control
21. Real Time Guard Tour
22. Video and Camera Control
23. Cables
24. Transformers

2.2 SECURITY MANAGEMENT SYSTEM (SMS)

A. Shall allow the configuration of an enrollment and badging, alarm monitoring, administrative, asset management, digital video management, intrusion detection, visitor enrollment, remote access level management, and integrated client workstations or any combination of all or some.

B. Shall be expandable to support an unlimited number of individual module or integrated client workstations. All access control field hardware, including Data Gathering Panels(DGP), shall be connected to all physical access control system workstation on the network.

C. Shall have the ability to compose, file, maintain, update, and print reports for either individuals or the system as follows.
1. Individual reports that consist of an employee's name, office location, phone number or direct extension, and normal hours of operation. The report shall provide a detail listing of the employee's daily events in relation to accessing points within a facility.
2. System reports shall be able to produce information on a daily/weekly/monthly basis for all events, alarms, and any other activity associated with a system user.

D. All reports shall be in a date/time format and all information shall be clearly presented. Shall be designed to allow it to work with any industry standard network protocol and topology listed below:
1. Transmission Control Protocol (TCP)/IP
2. Novell Netware (IPX/SPX)
3. Banyan VINES
4. IBM LAN Server (NetBEUI)
5. Microsoft LAN Manager (NetBEUI)
6. Network File System (NFS) Networks
7. Remote Access Service (RAS) via ISDN, x.25, and standard phone lines.

E. Shall provide full interface and control of the PACS to include the following subsystems within the PACS:

1. Public Key Infrastructure
2. Card Management
3. Identity and Access Management
4. Personal Identity Verification

F. Shall have the following features or compatibilities:
1. The ability to be operated locally or remotely via a LAN, WAN, internet, or intranet.
2. Event and Alarm Monitoring
3. Database Partitioning
4. Ability to fully integrate with all other security subsystems
5. Enhanced Monitoring Station with Split Screen Views
6. Alternate and Extended Shunt by Door
7. Escort Management
8. Enhanced IT-based Password Protection
9. N-man Rule and Occupancy Restrictions
10. Open Journal Data Format for Enhanced Reporting
11. Automated Personnel Import
12. ODBC Support
13. Windows 2000 Professional, Windows Server 2003, Windows XP Professionals for Servers, Windows 7
14. Field-Level Audit Trail
15. Cardholder Access Events

2.3 APPLICATION SOFTWARE

A. System Software: Based on 32-bit, Microsoft Windows central-station and workstation operating system and application software. Software shall have the following features:
1. Multiuser multitasking to allow independent activities and monitoring to occur simultaneously at different workstations.
2. Graphical user interface to show pull-down menus and a menu tree format.
3. Capability for future additions within the indicated system size limits.
4. Open architecture that allows importing and exporting of data and interfacing with other systems that are compatible with operating system.
5. Password-protected operator and smart card login and access.

B. Peer Computer Control Software: Shall detect a failure of a central computer, and shall cause the other central computer to assume control of all system functions without interruption of operation. Drivers shall be provided in both central computers to support this mode of operation.

C. Application Software: Interface between the alarm annunciation and entry-control Controllers, to monitor sensors and DTS links, operate displays, report alarms, generate reports, and help train system operators. Software shall have the following functions:
1. Resides at the Central Station, workstations, and Controllers as required to perform specified functions.
2. Operate and manage peripheral devices.
3. Manage files for disk I/O, including creating, deleting, and copying files; and automatically maintain a directory of all files, including size and location of each sequential and random-ordered record.
4. Import custom icons into graphics views to represent alarms and I/O devices.
5. Globally link I/O so that any I/O can link to any other I/O within the same Location, without requiring interaction with the host PC. This operation shall be at the Controller.
6. Globally code I/O links so that any access-granted event can link to any I/O with the same Location without requiring interaction with the host PC. This operation shall be at the Controller.
7. Messages from PC to Controllers and Controllers to Controllers shall be on a polled network that utilizes check summing and acknowledgment of each message.

Communication shall be automatically verified, buffered, and retransmitted if message is not acknowledged.

8. Selectable poll frequency and message time-out settings shall handle bandwidth and latency issues for TCP/IP, RF, and other PC-to-Controller communications methods by changing the polling frequency and the amount of time the system waits for a response.
9. Automatic and encrypted backups for database and history backups shall be automatically stored at the central control PC and encrypted with a nine-character alphanumeric password, which must be used to restore or read data contained in backup.
10. Operator audit trail for recording and reporting all changes made to database and system software.

D. Workstation Software:
1. Password levels shall be individually customized at each workstation to allow or disallow operator access to program functions for each Location.
2. Workstation event filtering shall allow user to define events and alarms that will be displayed at each workstation. If an alarm is unacknowledged (not handled by another workstation) for a preset amount of time, the alarm will automatically appear on the filtered workstation.

E. Controller Software:
1. Controllers shall operate as an autonomous intelligent processing unit. Controllers shall make decisions about physical access control, alarm monitoring, linking functions, and door locking schedules for its operation, independent of other system components. Controllers shall be part of a fully distributed processing control network. The portion of the database associated with a Controller and consisting of parameters, constraints, and the latest value or status of points connected to that Controller, shall be maintained in the Controller.
2. Functions: The following functions shall be fully implemented and operational within each Controller:
   a. Monitoring inputs.
   b. Controlling outputs.
   c. Automatically reporting alarms to the Central Station.
   d. Reporting of sensor and output status to Central Station on request.
   e. Maintaining real time, automatically updated by the Central Station at least once a day.
   f. Communicating with the Central Station.
   g. Executing Controller resident programs.
   h. Diagnosing.
   i. Downloading and uploading data to and from the Central Station.
3. Controller Operations at a Location:
   a. Location: Up to 64 Controllers connected to RS-485 communications loop. Globally operating I/O linking and anti-passback functions between Controllers within the same Location without central-station or workstation intervention. Linking and anti-passback shall remain fully functional within the same Location even when the Central Station or workstations are off line.
   b. In the event of communications failure between the Central Station and a Location, there shall be no degradation in operations at the Controllers at that Location. The Controllers at each Location shall be connected to a memory buffer with a capacity to store up to 10,000 events; there shall be no loss of transactions in system history files until the buffer overflows.
   c. Buffered events shall be handled in a first-in-first-out mode of operation.
4. Individual Controller Operation:
   a. Controllers shall transmit alarms, status changes, and other data to the Central Station when communications circuits are operable. If communications are not available, Controllers shall function in a stand-alone mode and operational data, including the status and alarm data normally transmitted to the Central Station,

shall be stored for later transmission to the Central Station. Storage capacity for the latest 1024 events shall be provided at each Controller.

b. Card-reader ports of a Controller shall be custom configurable for at least 120 different card-reader or keypad formats. Multiple reader or keypad formats may be used simultaneously at different Controllers or within the same Controller.

c. Controllers shall provide a response to card-readers or keypad entries in less than 0.25 seconds, regardless of system size.

d. Controllers that are reset, or powered up from a nonpowered state, shall automatically request a parameter download and reboot to its proper working state. This shall happen without any operator intervention.

e. Initial Startup: When Controllers are brought on-line, database parameters shall be automatically downloaded to them. After initial download is completed, only database changes shall be downloaded to each Controller.

f. Failure Mode: On failure for any reason, Controllers shall perform an orderly shutdown and force Controller outputs to a predetermined failure mode state, consistent with the failure modes shown and the associated control device.

g. Startup After Power Failure: After power is restored, startup software shall initiate self-test diagnostic routines, after which Controllers shall resume normal operation.

h. Startup After Controller Failure: On failure, if the database and application software are no longer resident, Controllers shall not restart, but shall remain in the failure mode until repaired. If database and application programs are resident, Controllers shall immediately resume operation. If not, software shall be restored automatically from the Central Station.

5. Communications Monitoring:

a. System shall monitor and report status of RS-485 communications loop TCP/IP communication status of each Location.

b. Communication status window shall display which Controllers are currently communicating, a total count of missed polls since midnight, and which Controller last missed a poll.

c. Communication status window shall show the type of CPU, the type of I/O board, and the amount of RAM memory for each Controller.

6. Operating systems shall include a real-time clock function that maintains seconds, minutes, hours, day, date, and month. The real-time clock shall be automatically synchronized with the Central Station at least once a day to plus or minus 10 seconds. The time synchronization shall be automatic, without operator action and without requiring system shutdown.

F. PC-to-Controller Communications:

1. Central-station or workstation communications shall use the following:

a. Direct connection using serial ports of the PC.

b. TCP/IP LAN network interface cards.

c. Dial-up modems for connections to Locations.

2. Serial Port Configuration: Each serial port used for communications shall be individually configurable for "direct communications," "modem communications incoming and outgoing," or "modem communications incoming only"; or as an ASCII output port.

3. Multiport Communications Board: Use if more than two serial ports are needed.

a. Expandable and modular design. Use a 4-, 8-, or 16-serial port configuration that is expandable to 32 or 64 serial ports.

b. Connect the first board to an internal PCI bus adapter card.

4. Direct serial, TCP/IP, and dial-up communications shall be alike in the monitoring or control of system, except for the connection that must first be made to a dial-up Location.

5. TCP/IP network interface card shall have an option to set the poll frequency and message response time-out settings.

6. PC-to-Controller and Controller-to-Controller communications (direct, dial-up, or TCP/IP) shall use a polled-communication protocol that checks sum and acknowledges each

message. All communications shall be verified and buffered and retransmitted if not acknowledged.

G. Direct Serial or TCP/IP PC-to-Controller Communications:
1. Communication software on the PC shall supervise the PC-to-Controller communications link.
2. Loss of communications to any Controller shall result in an alarm at all PCs running the communications software.
3. When communications are restored, all buffered events shall automatically upload to the PC, and any database changes shall be automatically sent to the Controller.

H. Dial-up Modem PC-to-Controller Communications:
1. Communication software on the PC shall supervise the PC-to-Controller communications link during dial-up modem connect times.
2. Communication software shall be programmable to routinely poll each of the remote dial-up modem Locations, collecting event logs and verifying phone lines at time intervals that are operator selectable for each Location.
3. System shall be programmable for dialing and connecting to all dial-up modem Locations and for retrieving the accrued history transactions on an automatic basis as often as once every 10 minutes and up to once every 9999 minutes.
4. Failure to communicate to a dial-up Location three times in a row shall result in an alarm at the PC.
5. Time offset capabilities shall be present so that Locations in a different geographical time zone than the host PC will be set to, and maintained at, the proper local time. This feature shall allow for geographical time zones that are ahead of or behind the host PC.
6. The Controller connected to a dial-up modem shall automatically buffer all normal transactions until its buffer reaches 80 percent of capacity. When the transaction buffer reaches 80 percent, the Controller shall automatically initiate a call to the Central Station and upload all transactions.
7. Alarms shall be reported immediately.
8. Dial-up modems shall be provided by manufacturer of the system. Modems used at the Controller shall be powered by the Controller. Power to the modem shall include battery backup if the Controller is so equipped.

I. Controller-to-Controller Communications:
1. Controller-to-Controller Communications: RS-485, 4-wire, point-to-point, regenerative (repeater) communications network methodology.
2. RS-485 communications signal shall be regenerated at each Controller.

J. Database Downloads:
1. All data transmissions from PCs to a Location, and between Controllers at a Location, shall include a complete database checksum to check the integrity of the transmission. If the data checksum does not match, a full data download shall be automatically retransmitted.
2. If a Controller is reset for any reason, it shall automatically request and receive a database download from the PC. The download shall restore data stored at the Controller to their normal working state and shall take place with no operator intervention.
3. Software shall provide for setting downloads via dial-up connection to once per 24-hour period, with time selected by the operator.
4. Software shall provide for setting delays of database downloads for dial-up connections. Delays change the download from immediately to a delay ranging from 1 to 999 minutes.

K. Operator Interface:
1. Inputs in system shall have two icon representations, one for the normal state and one for the abnormal state.
2. When viewing and controlling inputs, displayed icons shall automatically change to the proper icon to display the current system state in real time. Icons shall also display the

input's state, whether armed or bypassed, and if the input is in the armed or bypassed state due to a time zone or a manual command.

3. Outputs in system shall have two icon representations, one for the secure (locked) state and one for the open (unlocked) state.
4. Icons displaying status of the I/O points shall be constantly updated to show their current real-time condition without prompting by the operator.
5. The operator shall be able to scroll the list of I/Os and press the appropriate toolbar button, or right click, to command the system to perform the desired function.
6. Graphic maps or drawings containing inputs, outputs, and override groups shall include the following:
   a. Database to import and store full-color maps or drawings and allow for input, output, and override group icons to be placed on maps.
   b. Maps to provide real-time display animation and allow for control of points assigned to them.
   c. System to allow inputs, outputs, and override groups to be placed on different maps.
   d. Software to allow changing the order or priority in which maps will be displayed.
7. Override Groups Containing I/Os:
   a. System shall incorporate override groups that provide the operator with the status and control over user-defined "sets" of I/Os with a single icon.
   b. Icon shall change automatically to show the live summary status of points in that group.
   c. Override group icon shall provide a method to manually control or set to time zone points in the group.
   d. Override group icon shall allow the expanding of the group to show icons representing the live status for each point in the group, individual control over each point, and the ability to compress the individual icons back into one summary icon.
8. Schedule Overrides of I/Os and Override Groups:
   a. To accommodate temporary schedule changes that do not fall within the holiday parameters, the operator shall have the ability to override schedules individually for each input, output, or override group.
   b. Each schedule shall be composed of a minimum of two dates with separate times for each date.
   c. The first time and date shall be assigned the override state that the point shall advance to, when the time and date become current.
   d. The second time and date shall be assigned the state that the point shall return to, when the time and date become current.
9. Copy command in database shall allow for like data to be copied and then edited for specific requirements, to reduce redundant data entry.

L. Operator Access Control:
1. Control operator access to system controls through three password-protected operator levels. System operators and managers with appropriate password clearances shall be able to change operator levels for operators.
2. Three successive attempts by an operator to execute functions beyond their defined level during a 24-hour period shall initiate a software tamper alarm.
3. A minimum of 32 passwords shall be available with the system software. System shall display the operator's name or initials in the console's first field. System shall print the operator's name or initials, action, date, and time on the system printer at login and logoff.
4. The password shall not be displayed or printed.
5. Each password shall be definable and assignable for the following:
   a. Commands usable.
   b. Access to system software.
   c. Access to application software.
   d. Individual zones that are to be accessed.

e. Access to database.

M. Operator Commands:
1. Command Input: Plain-language words and acronyms shall allow operators to use the system without extensive training or data-processing backgrounds. System prompts shall be a word, a phrase, or an acronym.
2. Command inputs shall be acknowledged and processing shall start in not less than 1 second(s).
3. Tasks that are executed by operator's commands shall include the following:
   a. Acknowledge Alarms: Used to acknowledge that the operator has observed the alarm message.
   b. Place Zone in Access: Used to remotely disable intrusion alarm circuits emanating from a specific zone. System shall be structured so that console operator cannot disable tamper circuits.
   c. Place Zone in Secure: Used to remotely activate intrusion alarm circuits emanating from a specific zone.
   d. System Test: Allows the operator to initiate a system-wide operational test.
   e. Zone Test: Allows the operator to initiate an operational test for a specific zone.
   f. Print reports.
   g. Change Operator: Used for changing operators.
   h. Security Lighting Controls: Allows the operator to remotely turn on/off security lights.
   i. Display Graphics: Used to display any graphic displays implemented in the system. Graphic displays shall be completed within 20 seconds from time of operator command.
   j. Run system tests.
   k. Generate and format reports.
   l. Request help with the system operation.
      1) Include in main menus.
      2) Provide unique, descriptive, context-sensitive help for selections and functions with the press of one function key.
      3) Provide navigation to specific topic from within the first help window.
      4) Help shall be accessible outside the applications program.
   m. Entry-Control Commands:
      1) Lock (secure) or unlock (open) each controlled entry and exit up to four times a day through time-zone programming.
      2) Arm or disarm each monitored input up to four times a day through time-zone programming.
      3) Enable or disable readers or keypads up to twice a day through time-zone programming.
      4) Enable or disable cards or codes up to four times per day per entry point through access-level programming.
4. Command Input Errors: Show operator input assistance when a command cannot be executed because of operator input errors. Assistance screen shall use plain-language words and phrases to explain why the command cannot be executed. Error responses that require an operator to look up a code in a manual or other document are not acceptable. Conditions causing operator assistance messages include the following:
   a. Command entered is incorrect or incomplete.
   b. Operator is restricted from using that command.
   c. Command addresses a point that is disabled or out of service.
   d. Command addresses a point that does not exist.
   e. Command is outside the system's capacity.

N. Alarms:
1. System Setup:
   a. Assign manual and automatic responses to incoming point status change or alarms.

b. Automatically respond to input with a link to other inputs, outputs, operator-response plans, unique sound with use of WAV files, and maps or images that graphically represent the point location.
c. 60-character message field for each alarm.
d. Operator-response-action messages shall allow message length of at least 65,000 characters, with database storage capacity of up to 32,000 messages. Setup shall assign messages to access point.
e. Secondary messages shall be assignable by the operator for printing to provide further information and shall be editable by the operator.
f. Allow 25 secondary messages with a field of 4 lines of 60 characters each.
g. Store the most recent 1000 alarms for recall by the operator using the report generator.

2. Software Tamper:
   a. Annunciate a tamper alarm when unauthorized changes to system database files are attempted. Three consecutive unsuccessful attempts to log onto system shall generate a software tamper alarm.
   b. Annunciate a software tamper alarm when an operator or other individual makes three consecutive unsuccessful attempts to invoke functions beyond their authorization level.
   c. Maintain a transcript file of the last 5000 commands entered at the each Central Station to serve as an audit trail. System shall not allow write access to system transcript files by any person, regardless of their authorization level.
   d. Allow only acknowledgment of software tamper alarms.
3. Read access to system transcript files shall be reserved for operators with the highest password authorization level available in system.
4. Animated Response Graphics: Highlight alarms with flashing icons on graphic maps; display and constantly update the current status of alarm inputs and outputs in real time through animated icons.
5. Multimedia Alarm Annunciation: WAV files to be associated with alarm events for audio annunciation or instructions.
6. Alarm Handling: Each input may be configured so that an alarm cannot be cleared unless it has returned to normal, with options of requiring the operator to enter a comment about disposition of alarm. Allow operator to silence alarm sound when alarm is acknowledged.
7. Alarm Automation Interface: High-level interface to Central Station alarm automation software systems. Allows input alarms to be passed to and handled by automation systems in same manner as burglar alarms, using an RS-232 ASCII interface.
8. CCTV Alarm Interface: Allow commands to be sent to CCTV systems during alarms (or input change of state) through serial ports.
9. Camera Control: Provides operator ability to select and control cameras from graphic maps.

O. Alarm Monitoring: Monitor sensors, Controllers, and DTS circuits and notify operators of an alarm condition. Display higher-priority alarms first and, within alarm priorities, display the oldest unacknowledged alarm first. Operator acknowledgment of one alarm shall not be considered acknowledgment of other alarms nor shall it inhibit reporting of subsequent alarms.
   1. Displayed alarm data shall include type of alarm, location of alarm, and secondary alarm messages.
   2. Printed alarm data shall include type of alarm, location of alarm, date and time (to nearest second) of occurrence, and operator responses.
   3. Maps shall automatically display the alarm condition for each input assigned to that map, if that option is selected for that input location.
   4. Alarms initiate a status of "pending" and require the following two handling steps by operators:

a. First Operator Step: "Acknowledged." This action shall silence sounds associated with the alarm. The alarm remains in the system "Acknowledged" but "Un-Resolved."
b. Second Operator Step: Operators enter the resolution or operator comment, giving the disposition of the alarm event. The alarm shall then clear.

5. Each workstation shall display the total pending alarms and total unresolved alarms.
6. Each alarm point shall be programmable to disallow the resolution of alarms until the alarm point has returned to its normal state.
7. Alarms shall transmit to Central Station in real time, except for allowing connection time for dial-up locations.
8. Alarms shall be displayed and managed from a minimum of four different windows.
   a. Input Status Window: Overlay status icon with a large red blinking icon. Selecting the icon will acknowledge the alarm.
   b. History Log Transaction Window: Display name, time, and date in red text. Selecting red text will acknowledge the alarm.
   c. Alarm Log Transaction Window: Display name, time, and date in red. Selecting red text will acknowledge the alarm.
   d. Graphic Map Display: Display a steady colored icon representing each alarm input location. Change icon to flashing red when the alarm occurs. Change icon from flashing red to steady red when the alarm is acknowledged.
9. Once an alarm is acknowledged, the operator shall be prompted to enter comments about the nature of the alarm and actions taken. Operator's comments may be manually entered or selected from a programmed predefined list, or a combination of both.
10. For locations where there are regular alarm occurrences, provide programmed comments. Selecting that comment shall clear the alarm.
11. The time and name of the operator who acknowledged and resolved the alarm shall be recorded in the database.
12. Identical alarms from same alarm point shall be acknowledged at same time the operator acknowledges the first alarm. Identical alarms shall be resolved when the first alarm is resolved.
13. Alarm functions shall have priority over downloading, retrieving, and updating database from workstations and Controllers.
14. When a reader-controlled output (relay) is opened, the corresponding alarm point shall be automatically bypassed.

P. Monitor Display: Display text and graphic maps that include zone status integrated into the display. Colors are used for the various components and current data. Colors shall be uniform throughout the system.
1. Color Code:
   a. FLASHING RED: Alerts operator that a zone has gone into an alarm or that primary power has failed.
   b. STEADY RED: Alerts operator that a zone is in alarm and alarm has been acknowledged.
   c. YELLOW: Advises operator that a zone is in access.
   d. GREEN: Indicates that a zone is secure and that power is on.
2. Graphics:
   a. Support 32,000 graphic display maps and allow import of maps from a minimum of 16 standard formats from another drawing or graphics program.
   b. Allow I/O to be placed on graphic maps by the drag-and-drop method.
   c. Operators shall be able to view the inputs, outputs, and the point's name by moving the mouse cursor over the point on graphic map.
   d. Inputs or outputs may be placed on multiple graphic maps. The operator shall be able to toggle to view graphic map associated with inputs or outputs.
   e. Each graphic map shall have a display-order sequence number associated with it to provide a predetermined order when toggled to different views.

f. Camera icons shall have the ability to be placed on graphic maps that, when selected by an operator, will open a video window, display the camera associated with that icon, and provide pan-tilt-zoom control.
g. Input, output, or camera placed on a map shall allow the ability to arm or bypass an input, open or secure an output, or control the pan-tilt-zoom function of the selected camera.

Q. System test software enables operators to initiate a test of the entire system or of a particular portion of the system.
1. Test Report: The results of each test shall be stored for future display or printout. The report shall document the operational status of system components.

R. Report Generator Software: Include commands to generate reports for displaying, printing, and storing on disk and tape. Reports shall be stored by type, date, and time. Report printing shall be the lowest priority activity. Report generation mode shall be operator selectable but set up initially as periodic, automatic, or on request. Include time and date printed and the name of operator generating the report. Report formats may be configured by operators.
1. Automatic Printing: Setup shall specify, modify, or inhibit the report to be generated; the time the initial report is to be generated; the time interval between reports; the end of period; and the default printer.
2. Printing on Requests: An operator may request a printout of any report.
3. Alarm Reports: Reporting shall be automatic as initially set up. Include alarms recorded by system over the selected time and information about the type of alarm (such as door alarm, intrusion alarm, tamper alarm, etc.), the type of sensor, the location, the time, and the action taken.
4. Access and Secure Reports: Document zones placed in access, the time placed in access, and the time placed in secure mode.
5. Custom Reports: Reports tailored to exact requirements of who, what, when, and where. As an option, custom report formats may be stored for future printing.
6. Automatic History Reports: Named, saved, and scheduled for automatic generation.
7. Cardholder Reports: Include data, or selected parts of the data, as well as the ability to be sorted by name, card number, imprinted number, or by any of the user-defined fields.
8. Cardholder by Reader Reports: Based on who has access to a specific reader or group of readers by selecting the readers from a list.
9. Cardholder by Access-Level Reports: Display everyone that has been assigned to the specified access level.
10. Who Is In (Muster) Report:
    a. Emergency Muster Report: One click operation on toolbar launches report.
    b. Cardholder Report. Contain a count of persons that are "In" at a selected Location and a count with detailed listing of name, date, and time of last use, sorted by the last reader used or by the group assignment.
11. Panel Labels Reports: Printout of control-panel field documentation including the actual location of equipment, programming parameters, and wiring identification. Maintain system installation data within system database so that they are available on-site at all times.
12. Activity and Alarm On-Line Printing: Activity printers for use at workstations; prints all events or alarms only.
13. History Reports: Custom reports that allows the operator to select any date, time, event type, device, output, input, operator, Location, name, or cardholder to be included or excluded from the report.
    a. Initially store history on the hard disk of the host PC.
    b. Permit viewing of the history on workstations or print history to any system printer.
    c. The report shall be definable by a range of dates and times with the ability to have a daily start and stop time over a given date range.
    d. Each report shall depict the date, time, event type, event description, device, or I/O name, cardholder group assignment, and cardholder name or code number.

e. Each line of a printed report shall be numbered to ensure that the integrity of the report has not been compromised.
f. Total number of lines of the report shall be given at the end of the report. If the report is run for a single event such as "Alarms," the total shall reflect how many alarms occurred during that period.

14. Reports shall have the following four options:
    a. View on screen.
    b. Print to system printer. Include automatic print spooling and "Print To" options if more than one printer is connected to system.
    c. "Save to File" with full path statement.
    d. System shall have the ability to produce a report indicating status of system inputs and outputs or of inputs and outputs that are abnormal, out of time zone, manually overridden, not reporting, or in alarm.
15. Custom Code List Subroutine: Allow the access codes of system to be sorted and printed according to the following criteria:
    a. Active, inactive, or future activate or deactivate.
    b. Code number, name, or imprinted card number.
    c. Group, Location, access levels.
    d. Start and stop code range.
    e. Codes that have not been used since a selectable number of days.
    f. In, out, or either status.
    g. Codes with trace designation.
16. The reports of system database shall allow options so that every data field may be printed.
17. The reports of system database shall be constructed so that the actual position of the printed data shall closely match the position of the data on the data-entry windows.

S. Anti-Passback:
1. System shall have global and local anti-passback features, selectable by Location. System shall support hard and soft anti-passback.
2. Hard Anti-Passback: Once a credential holder is granted access through a reader with one type of designation (IN or OUT), the credential holder may not pass through that type of reader designation until the credential holder passes though a reader of opposite designation.
3. Soft Anti-Passback: Should a violation of the proper IN or OUT sequence occur, access shall be granted, but a unique alarm shall be transmitted to the control station, reporting the credential holder and the door involved in the violation. A separate report may be run on this event.
4. Timed Anti-Passback: A Controller capability that prevents an access code from being used twice at the same device (door) within a user-defined amount of time.
5. Provide four separate zones per Location that can operate without requiring interaction with the host PC (done at Controller). Each reader shall be assignable to one or all four anti-passback zones. In addition, each anti-passback reader can be further designated as "Hard," "Soft," or "Timed" in each of the four anti-passback zones. The four anti-passback zones shall operate independently.
6. The anti-passback schemes shall be definable for each individual door.
7. The Master Access Level shall override anti-passback.
8. System shall have the ability to forgive (or reset) an individual credential holder or the entire credential holder population anti-passback status to a neutral status.

T. Visitor Assignment:
1. Provide for and allow an operator to be restricted to only working with visitors. The visitor badging subsystem shall assign credentials and enroll visitors. Allow only access levels that have been designated as approved for visitors.
2. Provide an automated log of visitor name, time and doors accessed, and whom visitor contacted.
3. Allow a visitor designation to be assigned to a credential holder.

4. PACS shall be able to restrict the access levels that may be assigned to credentials that are issued to visitors.
5. Allow operator to recall visitors' credential holder file, once a visitor is enrolled in the system.
6. The operator may designate any reader as one that deactivates the credential after use at that reader. The history log shall show the return of the credential.
7. System shall have the ability to use the visitor designation in searches and reports. Reports shall be able to print all or any visitor activity.

U. Time and Attendance:
1. Time and attendance reporting shall be provided to match IN and OUT reads and display cumulative time in for each day and cumulative time in for length of the report.
2. Shall be provided to match IN and OUT reads and display cumulative time in for each day and cumulative time in for length of the report.
3. System software setup shall allow designation of selected access-control readers as time and attendance hardware to gather the clock-in and clock-out times of the users at these readers.
   a. Reports shall show in and out times for each day, total in time for each day, and a total in time for period specified by the user.
   b. Allow the operator to view and print the reports, or save the report to a file.
   c. Alphabetically sort reports on the person's last name, by Location or location group. Include all credential holders or optionally select individual credential holders for the report.

V. Training Software: Enables operators to practice system operation including alarm acknowledgment, alarm assessment, response force deployment, and response force communications. System shall continue normal operation during training exercises and shall terminate exercises when an alarm signal is received at the console.

W. Entry-Control Enrollment Software: Database management functions that allow operators to add, delete, and modify access data as needed.
1. The enrollment station shall not have alarm response or acknowledgment functions.
2. Provide multiple, password-protected access levels. Database management and modification functions shall require a higher operator access level than personnel enrollment functions.
3. The program shall provide means to disable the enrollment station when it is unattended to prevent unauthorized use.
4. The program shall provide a method to enter personnel identifying information into the entry-control database files through enrollment stations. In the case of personnel identity verification subsystems, this shall include biometric data. Allow entry of personnel identifying information into the system database using menu selections and data fields. The data field names shall be customized during setup to suit user and site needs. Personnel identity verification subsystems selected for use with the system shall fully support the enrollment function and shall be compatible with the entry-control database files.
5. Cardholder Data: Provide 99 user-defined fields. System shall have the ability to run searches and reports using any combination of these fields. Each user-defined field shall be configurable, using any combination of the following features:
   a. MASK: Determines a specific format that data must comply with.
   b. REQUIRED: Operator is required to enter data into field before saving.
   c. UNIQUE: Data entered must be unique.
   d. DEACTIVATE DATE: Data entered will be evaluated as an additional deactivate date for all cards assigned to this cardholder.
   e. NAME ID: Data entered will be considered a unique ID for the cardholder.
6. Personnel Search Engine: A report generator with capabilities such as search by last name, first name, group, or any predetermined user-defined data field; by codes not used in definable number of days; by skills; or by seven other methods.

7. Multiple Deactivate Dates for Cards: User-defined fields to be configured as additional stop dates to deactivate any cards assigned to the cardholder.
8. Batch card printing.
9. Default card data can be programmed to speed data entry for sites where most card data are similar.
10. Enhanced ACSII File Import Utility: Allows the importing of cardholder data and images.
11. Card Expire Function: Allows readers to be configured to deactivate cards when a card is used at selected devices.

X. System Redundancy & High Availability: The system shall provide multiple levels of communications redundancy and failover for all PACS hosted controllers, digital video recorders, and client workstations. The PACS shall be capable of automatically re-routing communications to alternate computers across the system without operator intervention.
1. PACS system configuration with a single application/ database server shall provide at a minimum the following redundancy and failover capability:
   a. The PACS shall provide communications redundancy and failover for network-attached devices. Each network attached device shall have one or more alternative communication sever(s) that can provide hosting in case of primary communications server failure.
   b. In case of primary communications server failure, the system shall automatically re-route network-attached devices to their designated backup communications servers to allow continuous system operations without loss of alarm and event transaction processing during failover.
   c. Network-attached devices which transition to backup communications servers, shall be able to be redirected back to their default primary servers, once the primary communications servers have been restored.
2. PACS system configuration with multiple regional application/ database servers shall provide at a minimum the following redundancy and failover capability:
   a. The PACS shall support the same level of communications redundancy and failover for network-attached devices per regional application/database server, allowable to span across regional application/database servers in the event of a regional application/database server failure.
   b. In case of a regional application/database server failure, client workstations shall be able to failover to their designated backup regional application/database server to allow continuous system operations.
   c. In case of a regional application/database server failure, upon server restoration, the ISMS shall automatically update and synchronize the regional application/database server.
   d. Client workstations which transition to a backup regional application/database server, shall be able to be redirected back to their default regional application/database server, once the regional application/database server functions have been restored.

2.4 SURGE AND TAMPER PROTECTION

A. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor-entry connection to components.
1. Minimum Protection for Power Connections 120 V and More: Auxiliary panel suppressors complying with requirements in Division 26 Section "Transient-Voltage Suppression for Low-Voltage Electrical Power Circuits."
2. Minimum Protection for Communication, Signal, Control, and Low-Voltage Power Connections: Comply with requirements in Division 26 Section "Transient-Voltage Suppression for Low-Voltage Electrical Power Circuits" as recommended by manufacturer for type of line being protected.

B. Tamper Protection: Tamper switches on enclosures, control units, pull boxes, junction boxes, cabinets, and other system components shall initiate a tamper-alarm signal when unit is opened

or partially disassembled. Control-station control-unit alarm display shall identify tamper alarms and indicate locations.

2.5 PACS SERVER HARDWARE

A. SMS Server Computer: Standard unmodified PC of modular design. The CPU word size shall be 64 bytes or larger; the CPU operating speed shall be at least 3.4 GHz.
   1. Processor family: Intel® Xeon® E5640 (4 core, 2.66 GHz, 12MB L3, 80W).
   2. Number of processors: 2
   3. Memory: 12 GB RAM , expandable to a minimum of 192 GB without additional chassis or power supplies. Memory protection Mirrored Memory, Online Spare, Advanced ECC, Memory Lock Step Mode.
   4. Input/Output: 2 expansions slots, Network Controller (2) 1GbE NC382i Multifunction 4 Ports.
   5. Power Supply: Dual - minimum capacity of 460W hot plug.
   6. Real-Time Clock:
      a. Accuracy: Plus or minus 1 minute per month.
      b. Time Keeping Format: 24-hour time format including seconds, minutes, hours, date, day, and month; resettable by software.
      c. Clock shall function for 1 year without power.
      d. Provide automatic time correction once every 24 hours by synchronizing clock with the Time Service Department of the U.S. Naval Observatory.
   7. Serial Ports: Provide two RS-232-F serial ports for general use, with additional ports as required. Data transmission rates shall be selectable under program control.
   8. Parallel Port: An enhanced parallel port.
   9. The server shall have a 1 GB NIC or greater network card, rated at 100/1000 MB/sec.
   10. The server shall have dual 100 GB hard disk drives at 7200 RPM.
   11. The server shall have a CD / DVD combo drive.
   12. The server operating system shall be either:
      a. Windows 2003 Server, 32 bit native mode, with Service Pack 2 or later with default services enabled.
      b. Windows XP Professional Service Pack 2 or later and default services enabled.
      c. Windows 2008.
   13. The Web Server shall be IIS 7.0 or better.
   14. The Database shall be SQL Server 2005 (Express, Standard, Data Center, or Enterprise).
   15. Sound Card: For playback and recording of digital WAV sound files that are associated with audible warning and alarm functions.
   16. Color Monitor: 17” or larger SVGA (1024 x 768) monitor with true color support.. The server shall have a dedicated 256 MB SVGA accelerated video card with at least 64 MB onboard RAM.
   17. Keyboard: With a minimum of 64 characters, standard ASCII character set based on ANSI X3.154.
   18. Mouse: Standard, compatible with the installed software.
   19. Special function keyboard attachments or special function keys to facilitate data input of the following operator tasks:
      a. Help.
      b. Alarm Acknowledge.
      c. Place Zone in Access.
      d. Place Zone in Secure.
      e. System Test.
      f. Print Reports.
      g. Change Operator.

   20. CD-ROM Drive:
      a. Nominal storage capacity of 650 MB.
      b. Data Transfer Rate: 1.2 Mbps.

c. Average Access Time: 150 ms.
d. Cache Memory: 256 KB.
e. Data Throughput: 1MB/second, minimum.

21. Dot Matrix Alarm Printer:
    a. Connected to the Central Station.
    b. Minimum of 96 characters, standard ASCII character set based on ANSI X3.154, and with graphics capability and programmable control of top-of-form.
    c. Prints in both red and black without ribbon change.
    d. Adjustable sprockets for paper width up to 11 inches.
    e. 80 columns per line, minimum speed of 200 characters per second.
    f. Character Spacing: Selectable at 10, 12, or 17 characters per inch.
    g. Paper: Sprocket-fed fan fold paper.
22. Report Printer:
    a. Connected to the Central Station and designated workstations.
    b. Laser printer with minimum resolution of 1200 dpi.
    c. RAM: 2 MB, minimum.
    d. Printing Speed: Minimum 12 pages per minute.
    e. Paper Handling: Automatic sheet feeder with 250-sheet paper cassette and with automatic feed.
    f. Interface: Bidirectional parallel and universal serial bus.

B. Redundant Central Computer: One identical redundant central computer, connected in a hot standby, peer configuration. This computer shall automatically maintain its own copies of system software, application software, and data files. System transactions and other activities that alter system data files shall be updated to system files of redundant computer in near real-time. If central computer fails, redundant computer shall assume control immediately and automatically.

C. PACS controllers clustering shall support the following features:
1. Assignment of Master and alternate master controllers for cluster communication to the SMS server
2. Primary and backup communication paths to the SMS server
3. Encrypted communications
4. Up to 16 controllers per cluster
5. Logical event linking between controllers in a cluster independent of SMS server communication
6. Asynchronous communication via TCP/IP (Polled devices shall not be acceptable)

D. UPS: Self-contained; complying with requirements in Division 26 Section "Static Uninterruptible Power Supply."
1. Size: Provide a minimum of 15 hours of operation of the central-station equipment, including 2 hours of alarm printer operation.
2. Batteries: Sealed, valve regulated, recombinant, lead calcium.
3. Accessories:
    a. Transient voltage suppression.
    b. Input-harmonics reduction.
    c. Rectifier/charger.
    d. Battery disconnect device.
    e. Static bypass transfer switch.
    f. Internal maintenance bypass/isolation switch.
    g. External maintenance bypass/isolation switch.
    h. Output isolation transformer.
    i. Remote UPS monitoring.
    j. Battery monitoring.
    k. Remote battery monitoring.

2.6 STANDARD WORKSTATION HARDWARE

A. Workstation shall consist of a standard unmodified PC, with accessories and peripherals that configure the workstation for a specific duty.

B. Workstation Computer: Standard unmodified PC of modular design. The CPU word size shall be 32 bytes or larger; the CPU operating speed shall be at least 66 MHz.
   1. Memory: 256 MB of usable installed memory, expandable to a minimum of 1024 MB without additional chassis or power supplies.
   2. Power Supply: Minimum capacity of 250W.
   3. Real-Time Clock:
      a. Accuracy: Plus or minus 1 minute per month.
      b. Time Keeping Format: 24-hour time format including seconds, minutes, hours, date, day, and month; resettable by software.
      c. Provide automatic time correction once every 24 hours by synchronizing clock with the Central Station.
   4. Serial Ports: Provide two RS-232-F serial ports for general use, with additional ports as required. Data transmission rates shall be selectable under program control.
   5. Parallel Port: An enhanced parallel port.
   6. LAN Adapter Card: 10/100 Mbps PCI bus, internal network interface card.
   7. Sound Card: For playback and recording of digital WAV sound files that are associated with audible warning and alarm functions.
   8. Color Monitor: Not less than 17 inches (430 mm), with a minimum resolution of 1280 by 1024 pixels, noninterlaced, and a maximum dot pitch of 0.28 mm. The video card shall support at least 256 colors at a resolution of 1280 by 1024 at a minimum refresh rate of 70 Hz.
   9. Keyboard: With a minimum of 64 characters, standard ASCII character set based on ANSI X3.154.
   10. Mouse: Standard, compatible with the installed software.
   11. Disk storage shall include the following, each with appropriate controller:
      a. Minimum 10 GB hard disk, maximum average access time of 10 ms.
      b. Floppy Disk Drive: High density, 3-1/2-inch (90-mm) size.
   12. CD-ROM Drive:
      a. Nominal storage capacity of 650MB.
      b. Data Transfer Rate: 1.2 Mbps.
      c. Average Access Time: 150 ms.
      d. Cache Memory: 256 KB.
      e. Data Throughput: 1 MB/second, minimum.
   13. Printer:
      a. Connected to the Central Station and designated workstations.
      b. Laser printer with minimum resolution of 600 dpi.
      c. RAM: 2 MB, minimum.
      d. Printing Speed: Minimum 12 pages per minute.
      e. Paper Handling: Automatic sheet feeder with 250-sheet paper cassette and with automatic feed.
   14. Interface: Bidirectional parallel, and universal serial bus.
   15. LAN Adapter Card: 10/100 Mbps internal network interface card.

C. Redundant Workstation: One identical redundant workstation, connected in a hot standby, peer configuration. This workstation shall automatically maintain its own copies of system software, application software, and data files. System transactions and other activities that alter system data files shall be updated to system files of redundant workstation in near real time. If its associated workstation fails, redundant workstation shall assume control immediately and automatically.

D. UPS: Self-contained, complying with requirements in Division 26 Section "Static Uninterruptible Power Supply."

1. Size: Provide a minimum of 6 hours of operation of the central-station equipment, including 2 hours of alarm printer operation.
2. Batteries: Sealed, valve regulated, recombinant, lead calcium.
3. Accessories:
   a. Transient voltage suppression.
   b. Input-harmonics reduction.
   c. Rectifier/charger.
   d. Battery disconnect device.
   e. Static bypass transfer switch.
   f. Internal maintenance bypass/isolation switch.
   g. External maintenance bypass/isolation switch.
   h. Output isolation transformer.
   i. Remote UPS monitoring.
   j. Battery monitoring.
   k. Remote battery monitoring.

2.7 COMMUNICATIONS WORKSTATION

A. Standard workstation, modified as follows:
   1. Additional RS-232-F serial ports. The CPU word size shall be 32 bytes or larger; the CPU operating speed shall be at least 66 MHz. Multiplexed serial ports shall be expandable with 8 character transmit and receive buffers for each port. Total buffer size shall be a minimum of 1 MB.
   2. Redundant workstation is not required.
   3. Printer is required.

2.8 CONTROLLERS

A. Controllers: Intelligent peripheral control unit, complying with UL 294, that stores time, date, valid codes, access levels, and similar data downloaded from the Central Station or workstation for controlling its operation.

B. Subject to compliance with requirements in this Article, manufacturers may use multipurpose Controllers.

C. Battery Backup: Sealed, lead acid; sized to provide run time during a power outage of 90 minutes, complying with UL 924.

D. Alarm Annunciation Controller:
   1. The Controller shall automatically restore communication within 10 seconds after an interruption with the field device network with dc line supervision on each of its alarm inputs.
      a. Inputs: Monitor dry contacts for changes of state that reflect alarm conditions. Provides at least eight alarm inputs, which are suitable for wiring as normally open or normally closed contacts for alarm conditions.
      b. Alarm-Line Supervision:
         1) Supervise the alarm lines by monitoring each circuit for changes or disturbances in the signal, and for conditions as described in UL 1076 for line security equipment using dc change measurements. System shall initiate an alarm in response to an abnormal current, which is a dc change of 5 percent or more for longer than 500 ms.
         2) Transmit alarm-line-supervision alarm to the Central Station during the next interrogation cycle after the abnormal current condition.
      c. Outputs: Managed by Central Station software.
   2. Auxiliary Equipment Power: A GFI service outlet inside the Controller enclosure.

E. Entry-Control Controller:

1. Function: Provide local entry-control functions including one- and two-way communications with access-control devices such as card readers, keypads, biometric personal identity verification devices, door strikes, magnetic latches, gate and door operators, and exit push-buttons.
    a. Operate as a stand-alone portal Controller using the downloaded database during periods of communication loss between the Controller and the field-device network.
    b. Accept information generated by the entry-control devices; automatically process this information to determine valid identification of the individual present at the portal:
        1) On authentication of the credentials or information presented, check privileges of the identified individual, allowing only those actions granted as privileges.
        2) Privileges shall include, but not be limited to, time of day control, day of week control, group control, and visitor escort control.
    c. Maintain a date-, time-, and Location-stamped record of each transaction. A transaction is defined as any successful or unsuccessful attempt to gain access through a controlled portal by the presentation of credentials or other identifying information.
2. Inputs:
    a. Data from entry-control devices; use this input to change modes between access and secure.
    b. Database downloads and updates from the Central Station that include enrollment and privilege information.
3. Outputs:
    a. Indicate success or failure of attempts to use entry-control devices and make comparisons of presented information with stored identification information.
    b. Grant or deny entry by sending control signals to portal-control devices and mask intrusion alarm annunciation from sensors stimulated by authorized entries.
    c. Maintain a date-, time-, and Location-stamped record of each transaction and transmit transaction records to the Central Station.
    d. Door Prop Alarm: If a portal is held open for longer than 20 seconds, alarm sounds.
4. With power supplies sufficient to power at voltage and frequency required for field devices and portal-control devices.
5. Data Line Problems: For periods of loss of communications with Central Station, or when data transmission is degraded and generating continuous checksum errors, the Controller shall continue to control entry by accepting identifying information, making authentication decisions, checking privileges, and controlling portal-control devices.
    a. Store up to 1000 transactions during periods of communication loss between the Controller and access-control devices for subsequent upload to the Central Station on restoration of communication.
6. Controller Power: NFPA 70, Class II power supply transformer, with 12- or 24-V ac secondary, backup battery and charger.
    a. Backup Battery: Premium, valve-regulated, recombinant-sealed, lead-calcium battery; spill proof; with a full 1-year warranty and a pro rata 19-year warranty. With single-stage, constant-voltage-current, limited battery charger, comply with battery manufacturer's written instructions for battery terminal voltage and charging current recommendations for maximum battery life.
    b. Backup Battery: Valve-regulated, recombinant-sealed, lead-acid battery; spill proof. With single-stage, constant-voltage-current, limited battery charger, comply with battery manufacturer's written instructions for battery terminal voltage and charging current recommendations for maximum battery life.
    c. Backup Power Supply Capacity: 90 minutes of battery supply. Submit battery and charger calculations.

d. Power Monitoring: Provide manual dynamic battery load test, initiated and monitored at the control center; with automatic disconnection of the Controller when battery voltage drops below Controller limits. Report by using local Controller-mounted LEDs and by communicating status to Central Station. Indicate normal power on and battery charger on trickle charge. Indicate and report the following:
   1) Trouble Alarm: Normal power off load assumed by battery.
   2) Trouble Alarm: Low battery.
   3) Alarm: Power off.

2.9 PIV MIDDLEWARE

A. PIV Middleware shall have ability to :
   1. Verify cardholder identity and validates FIPS 201-compliant PIV-II, next-generation (NG) CAC, TWIC, or FRAC credentials in real-time
   2. Perform three-factor authentication of cardholder using PIN, biometrics, and certificate (or serial numbers) detecting forged or cloned cards
   3. Enroll FASC-N, photo, and pertinent cardholder information into PACS software
   4. Automatically suspend a cardholder's badge if his or her PIV, TWIC, or CAC card certificate serial number is on the Certificate Revocation List (CRL)
   5. Upload a cardholder transaction audit trail to central database or exports it to a .csv file for centralized transaction management
   6. Be compatible with biometric mobile terminal for off-site verification and enrollment
   7. Re-validate imported cardholder certificates on a periodic basis via the Internet
   8. Revalidate imported cardholder certificates at regular intervals, ensuring that the credentials used in PACS system are backed by a valid set of digital certificates. Digital certificates are verified against local OCSP repeater/validation authority using the issuer's validation authority, or Microsoft Crypto Application Programming Interface (API) on Windows XP SP3 or Vista.
   9. Certificate Manager shall fully support SCVP and OCSP for fast, online validation.
   10. Provide verification of TWIC credentials against a live TSA hot list.
   11. Support uploading local transactions to a central database for consolidated activity reporting. This application shall support a variety of ODBC- or ADO-compliant databases, including Oracle, SQL Server 2005, Informix, DB2, and Firebird.
   12. Provide user with ability to produce canned transaction log queries as well as creating queries directly from the SQL database.

B. PIV Middleware PC requirements:
   1. PIV Middleware software shall operate on Intel-based PC with minimum 1.8 GHz CPU, 1 GB RAM, 40 GB hard disk, and Microsoft Windows XP SP2 with Microsoft .NET Framework 2.0

C. PIV Middleware shall be FIPS 201 approved product.

2.10 CARD READERS

A. Existing campus: Provide card reader to match existing system, combination of magnetic strip and proximity reader similar to HID RMPK40, model # 925PTNNEK00135.

B. Power: Card reader shall be powered from its associated Controller, including its standby power source.

C. Response Time: Card reader shall respond to passage requests by generating a signal that is sent to the Controller. Response time shall be 800ms or less, from the time the card reader finishes reading the credential card until a response signal is generated.

D. Enclosure: Suitable for surface, semiflush, or pedestal mounting. Mounting types shall additionally be suitable for installation in the following locations:
   1. Indoors, controlled environment.
   2. Indoors, uncontrolled environment.

3. Outdoors, with built-in heaters or other cold-weather equipment to extend the operating temperature range as needed for operation at the site.

E. Display: LED or other type of visual indicator display shall provide visual and audible status indications and user prompts. Indicate power on/off, whether user passage requests have been accepted or rejected, and whether the door is locked or unlocked.

F. Shall be utilized for controlling the locking hardware on a door and allows for reporting back to the main control panel with the time/date the door was accessed, the name of the person accessing the point of entry, and its location.

G. Will be fully programmable and addressable, locally and remotely, and hardwired to the system.

H. Shall be individually home run to the main panel.

I. Shall be installed in a manner that they comply with:
   1. The Uniform Federal Accessibility Standards (UFAS)
   2. The Americans with Disabilities Act (ADA)
   3. The ADA Standards for Accessible Design

J. Shall support a variety of card readers that must encompass a wide functional range. The PACS may combine any of the card readers described below for installations requiring multiple types of card reader capability (i.e., card only, card and/or PIN, card and/or biometrics, card and/or pin and/or biometrics, supervised inputs, etc.). These card readers shall be available in the approved technology to meet FIPS 201, and is ISO 14443 A or B, ISO/IEC 7816 compliant. The reader output can be Wiegand, RS-22, 485 or TCP/IP.

K. Shall be housed in an aluminum bezel with a wide lead-in for easy card entry.

L. Shall contain read head electronics, and a sender to encode digital door control signals.

M. LED's shall be utilized to indicate card reader status and access status.

N. Shall be able to support a user defined downloadable off-line mode of operation (e.g. locked, unlocked), which will go in effect during loss of communication with the main control panel.

O. Shall provide audible feedback to indicate access granted/denied decisions. Upon a card swipe, two audible tones or beeps shall indicate access granted and three tones or beeps shall indicate access denied. All keypad buttons shall provide tactile audible feedback.

P. Shall have a minimum of two programmable inputs and two programmable outputs.

Q. All card readers that utilize keypad controls along with a reader and shall meet the following specifications:
   1. Entry control keypads shall use a unique combination of alphanumeric and other symbols as an identifier. Keypads shall contain an integral alphanumeric/special symbols keyboard with symbols arranged in ascending ASCII code ordinal sequence. Communications protocol shall be compatible with the local processor.

R. Shall include a Light Emitting Diode (LED) or other type of visual indicator display and provide visual or visual and audible status indications and user prompts. The display shall indicate power on/off, and whether user passage requests have been accepted or rejected. The design of the keypad display or keypad enclosure shall limit the maximum horizontal and vertical viewing angles of the keypad. The maximum horizontal viewing angle shall be plus and minus five (5) degrees or less off a vertical plane perpendicular to the plane of the face of the keypad display. The maximum vertical viewing angle shall be plus and minus 15 degrees or less off a horizontal plane perpendicular to the plane of the face of the keypad display.
   1. Shall respond to passage requests by generating a signal to the local processor. The response time shall be 800 milliseconds or less from the time the last alphanumeric symbol is entered until a response signal is generated.
   2. Shall be powered from the source as designed and shall not dissipate more than 150 Watts.
   3. Shall be suitable for surface, semi-flush, pedestal, or weatherproof mounting as required.

4. Shall provide a means for users to indicate a duress situation by entering a special code.

S. PIV Contact Card Reader
1. Application Protocol Data Unit (APDU) Support: At a minimum, the contact interface shall support all card commands for contact based access specified in Section 7, End-point PIV Card Application Card Command Interface of SP 800-73-1, Interfaces for Personal Identity Verification.
2. Buffer Size: The reader must contain a buffer large enough to receive the maximum size frame permitted by International Organization for Standardization International Electrotechnical Commission (ISO/IEC) 7816-3:1997, Section 9.4.
3. Programming Voltage: PIV Readers shall not generate a Programming Voltage.
4. Support for Operating Class: PIV Readers shall support cards with Class A Vccs as defined in ISO/IEC 7816-3:1997 and ISO/IEC 7816-3:1997/Amd 1:2002.
5. Retrieval Time: Retrieval time[1] for 12.5 kilobytes (KB) of data through the contact interface of the reader shall not exceed 2.0 seconds.
6. Transmission Protocol: The PIV Reader shall support both the character-based T=0 protocol and block-based T=1 protocol as defined in ISO/IEC 7816-3:1997.
7. Support for PPS Procedure: The reader shall support Protocol and Parameters Selection (PPS) procedure by having the ability to read character TA1 of the Answer to Reset (ATR) sent by the card as defined in ISO/IEC 7816-3:1997.

T. Contactless Smart Cards and Readers
1. Smart card readers shall read credential cards whose characteristics of size and technology meet those defined by ISO/IEC 7816, 14443, 15693.
2. The readers shall have "flash" download capability to accommodate card format changes.
3. The card reader shall have the capability of reading the card data and transmitting the data to the main monitoring panel.
4. The card reader shall be contactless and meet or exceed the following technical characteristics:
   a. Data Output Formats: FIPS 201 low outputs the FASC-N in an assortment of Wiegand bit formats from 40 – 200 bits. FIPS 201 medium outputs a combination FASC-N and HMAC in an assortment of Wiegand bit formats from 32 – 232 bits. All Wiegand formats or the upgradeability from Low to Medium Levels can be field configured with the use of a command card.
   b. FIPS 201 readers shall be able to read, but not be limited to, DESfire and iCLASS cards.
   c. Reader range shall comply with ISO standards 7816, 14443, and 15693, and also take into consideration conditions, are at a minimum 1” to 2” (2.5 – 5 cm).
   d. APDU Support: At a minimum, the contactless interface shall support all card commands for contactless based access specified in Section 7, End-point PIV Card Application Card Command Interface of SP 800-73-1, Interfaces for Personal Identity Verification.
   e. Buffer Size: The reader shall contain a buffer large enough to receive the maximum size frame permitted by ISO/IEC 7816-3, Section 9.4.
   f. ISO 14443 Support: The PIV Reader shall support parts (1 through 4) of ISO/IEC 14443 as amended in the References of this publication.
   g. Type A and B Communication Signal Interfaces: The contactless interface of the reader shall support both the Type A and Type B communication signal interfaces as defined in ISO/IEC 14443-2:2001.
   h. Type A and B Initialization and Anti-Collision The contactless interface of the reader shall support both Type A and Type B initialization and anti-collision methods as defined in ISO/IEC 14443-3:2001.

i. Type A and B Transmission Protocols: The contactless interface of the reader shall support both Type A and Type B transmission protocols as defined in ISO/IEC 14443-4:2001.
j. Retrieval Time: Retrieval time for 4 KB of data through the contactless interface of the reader shall not exceed 2.0 seconds.
k. Transmission Speeds: The contactless interface of the reader shall support bit rates of fc/128 (~106 kbits/s), fc/64(~212 kbits/s), and configurable to allow activation/deactivation.
l. Readibility Range: The reader shall not be able to read PIV card more than 10cm(4inch) from the reader

2.11 BIOMETRIC IDENTITY VERIFICATION EQUIPMENT

2.12 KEYPADS

A. Designed for use with unique combinations of alphanumeric and other symbols as an Identifier. Keys of keypads shall contain an integral alphanumeric/special symbol keyboard with symbols arranged in ascending ASCII-code ordinal sequence. Communications protocol shall be compatible with Controller.
1. Keypad display or enclosure shall limit viewing angles of the keypad as follows:
a. Maximum Horizontal Viewing Angle: 5 degrees or less off in either direction of a vertical plane perpendicular to the plane of the face of the keypad display.
b. Maximum Vertical Viewing Angle: 15 degrees or less off in either direction of a horizontal plane perpendicular to the plane of the face of the keypad display.
2. Duress Codes: Provide duress situation indication by entering a special code.

2.13 CREDENTIAL CARDS

A. Personal Identity Verification (PIV) credential cards shall comply to Federal Information Processing Standards Publication (FIPS) 201.

B. Visual Card Topography shall be compliant with NIST 800-104.

C. PIV logical credentials shall contain multiple data elements for the purpose of verifying the cardholder's identity at graduated assurance levels. These mandatory data elements shall collectively comprise the data model for PIV logical credentials, and include the following:
1. CHUID
2. PIN
3. PIV authentication data (one asymmetric key pair and corresponding certificate)

D. The credential card (PIV) shall be an ISO 14443 type smart card with contactless interface that operates at 13.56 MHZ.

E. The credential card (PIV) shall be an ISO 7816 type smart card.

2.14 SYSTEM SENSORS AND RELATED EQUIPMENT

A. The PACS (Physical Access Control System) and related Equipment provided by the Contractor shall meet or exceed the following performer specifications:

B. Request to Exit Detectors:
1. Passive Infrared Request to Exit Motion Detector (REX PIR) (1) The Contractor shall provide a surface mounted motion detector to signal the physical access control system request to exit input. The motion detector shall be a passive infrared sensor designed for wall or ceiling mounting 2134 to 4572 mm (7 to 15 ft) height. The detector shall provide two (2) form “C” (SPDT) relays rated one (1) Amp. @ 30 VDC for DC resistive loads. The detectors relays shall be user adjustable with a latch time from 1-60 seconds. The detector shall also include a selectable relay reset mode to follow the timer or absence of motion. The detection pattern shall be adjustable plus or minus fourteen (± 14) degrees. The detector shall operate on 12 VDC with approximately 26 mA continuous current draw. The detector shall have an externally visible activation LED. The motion detector

shall measure approximately 38 mm H x 158 mm W x 38 mm D (1.5 x 6.25 x 1.5 in). The detector shall be immune to radio frequency interference. The detector shall not activate or set-up on critical frequencies in the range 26 to 950 Megahertz using a 50 watt transmitter located 30.5 cm (1 ft) from the unit or attached wiring. The detector shall be available on gray or black enclosures. The color of the housing shall be coordinated with the surrounding surface.

C. Guard tour stations:
   1. The guard tour station shall be single gang brushed steel plate flush mounted in a single gang box. The switch shall be a normally open momentary keyed switch.

D. Delayed Egress (DE)
   1. General:
      a. The delay egress locking hardware shall provide a method to secure emergency exits and provide an approved delayed emergency exit method. The package shall be Underwriters Laboratories listed as a delay egress-locking device. The delay egress device shall be available to support configurations with both rated and non-rated fire doors. The delay egress device shall comply with Life Safety Codes (NFPA-101, BOCA) as it applies to special locking arrangements for delay egress locks. Unless specifically identified as a non-fire rated opening, all doors shall be equipped with fire rated door hardware. The Contractor shall be responsible for providing all equipment and installation to provide a fully functioning system. Need to amend to use crashbars type mechanical release switches.
   2. The delay-locking device shall include all of the following features:
      a. Delay Egress Mode
         1) The delayed egress device shall be a SDC 101V Series Exit Check with wall mounted control module. Upon activation of an approved panic bar the delay locking device shall begin a delay sequence of 30 seconds; a flush mounted wall LED panel adjacent to the door will indicate initiation of the countdown time. During the 30 second delay period, a local sounding device shall annunciate a tone activation of the delay cycle and verbal exit instructions. At the end of the delay cycle the locking device shall unlock and allow free egress. The reset of the local sounding device shall be user definable and include options to select either local sound until silenced by reset or local sounder silenced upon opening of the door. Unless otherwise indicated the local delay sounder shall be silenced upon opening of the door. The SDC's device trigger output shall be connected to the SMS DGP alarm panel for pre-activation warning. The contractor shall specify the bond sensor option when ordering the delayed egress hardware; this output shall be wired to the SMS DGP to activate an alarm if the door does not lock. Use of reset panel not top mounted device.
         2) Delayed egress doors will have bond sensors.
         3) Delayed egress activation shall also trigger CCTV call –up.
      b. Fire Alarm Mode
         1) Upon activation of the facility's fire evacuation and water flow alarm signal the delay locking devices shall immediately unlock and provide free egress. The Contractor shall provide any required fire alarm relays or interface devices.
      c. Reset Mode
         1) The delay egress device shall be manually reset by the Delayed Egress controller located at the door via key switch.
         2) The delay egress device shall automatically reset upon fire alarm system reset.
         3) The delayed egress shall be resettable through the SMS.
      d. The Contractor shall provide a Master Open Switch for all the facility's delayed egress hardware, with protective cover and permanent labeling in the Unit Control

Room. The switch shall be wired into the fire alarm system to activate the evacuation alarms. When the switch is pressed all delayed egress or evacuation doors shall unlock and generate an alarm at the security console monitor showing and recording time and date of when the switch was pressed. The contractor is responsible for coordinating the wiring and connection with the fire alarm contactor. The Master Open Switch shall be linked to the fire alarm panel for the release of doors locks.

e. Each individual delayed egress door shall have the ability to unlock through a manual action on the SMS.

f. Unless otherwise indicated the Contractor shall provide all of the above reset methods for each door. All signs will meet the latest ADA requirements.

g. Signs

1) The delay egress package shall be provided with a warning sign complying with local code requirements. The warning sign shall be attached to the interior side of the controlled door. The sign shall be located on the interior side of the door above and within 304 mm (12 in) of the panic bar. The sign shall read:

a) EMERGENCY EXIT.
b) PUSH UNTIL
c) ALARM SOUNDS
d) DOOR CAN BE OPENED,
e) IN 30 SECONDS.

2) Signs shall be coordinated and comply with the building's existing sign specifications. Signs shall include grade 2 Braille.

3) Signs shall meet the current ADA requirements.

4) In instances of code and specification conflicts, the life safety code requirement shall prevail.

5) The Division 10 Contractor shall provide samples for approval with their submittal package.

3. Physical Access Control Interface

a. The delay egress device shall be capable of interface with card access control systems.

b. The system shall include a bypass feature that is activated via a dry contact relay output from the physical access control system. This bypass shall allow authorized personnel to pass through the controlled portal without creating an alarm condition or activating the delay egress cycle. The bypass shall include internal electronic shunts or door switches to prevent activation (re-arming) until the door returns to the closed position. An unused access event shall not cause a false alarm and shall automatically rearm the delay egress lock upon expiration of the programmed shunt time. The delay egress physical access control interface shall support extended periods of automated and/or manual lock and unlock cycles.

E. Crash Bar:

1. Emergency Exit with Alarm (Panic):

a. Entry control portals shall include panic bar emergency exit hardware as designed.

b. Panic bar emergency exit hardware shall provide an alarm shunt signal to the PACS and SMS.

c. The panic bar shall include a conspicuous warning sign with one (1) inch (2.5 cm) high, red lettering notifying personnel that an alarm will be annunciated if the panic bar is operated.

d. Operation of the panic bar hardware shall generate an intrusion alarm that reports to both the SMS and Intrusion Detection System. The use of a micro switch installed within the panic bar shall be utilized for this.

e. The panic bar shall utilize a fully mechanical connection only and shall not depend upon electric power for operation.

f. The panic bar shall be compatible with mortise or rim mount door hardware and shall operate by retracting the bolt manually by either pressing the panic bar or with a key by-pass. Refer to Section 2.2.I.9 for key-bypass specifications.

g. Normal Exit:

1) Entry control portals shall include panic bar non-emergency exit hardware as designed.

2) Panic bar non-emergency exit hardware shall be monitored by and report to the SMS.

3) Operation of the panic bar hardware shall not generate a locally audible or an intrusion alarm within the IDS.

4) When exiting, the panic bar shall depend upon a mechanical connection only. The exterior, non-secure side of the door shall be provided with an electrified thumb latch or lever to provide access after the credential I.D. authentication by the SMS.

5) The panic bar shall be compatible with mortise or rim mount door hardware and shall operate by retracting the bolt manually by either pressing the panic bar or with a key by-pass. Refer to Section 2.2.I.9 for key-bypass specifications. The strikes/bolts shall include a micro switch to indicate to the system when the bolt is not engaged or the strike mechanism is unlocked. The signal switches shall report a forced entry to the system in the event the door is left open or accessed without the identification credentials.

F. Key Bypass:

1. Shall be utilized for all doors that have a mortise or rim mounted door hardware.
2. Each door shall be individually keyed with one master key per secured area.
3. Cylinders shall be six (6)-pin and made of brass or equivalent. Keys for the cylinders shall be constructed of solid material and produced and cut by the same distributor. Keys shall not be purchased, cut, and supplied by multiple dealers.
4. All keys shall have a serial number cut into the key. No two serial numbers shall be the same.
5. All keys and cylinders shall be stored in a secure area that is monitored by the Intrusion Detection System.

G. Automatic Door Opener and Closer:

1. Shall be low energy operators.
2. Door closing force shall be adjustable to ensure adequate closing control.
3. Shall have an adjustable back-check feature to cushion the door opening speed if opened violently.
4. Motor assist shall be adjustable from 0 to 30 seconds in five (5) second increments. Motor assist shall restart the time cycle with each new activation of the initiating device.
5. Unit shall have a three-position selector mode switch that shall permit unit to be switched “ON” to monitor for function activation, switched to “H/O” for indefinite hold open function or switched to “OFF,” which shall deactivate all control functions but will allow standard door operation by means of the internal mechanical closer.
6. Door control shall be adjustable to provide compliance with the requirements of the Americans with Disabilities Act (ADA) and ANSI standards A117.1.
7. All automatic door openers and closers shall:

a. Meet UL standards.

b. Be fire rated.

c. Have push and go function to activate power operator or power assist function.

d. Have push button controls for setting door close and door open positions.

e. Have open obstruction detection and close obstruction detection built into the unit.

f. Have door closer assembly with adjustable spring size, back-check valve, sweep valve, latch valve, speed control valve and pressure adjustment valve to control door closing.

g. Have motor start-up delay, vestibule interface delay; electric lock delay and door hold open delay up to 30 seconds. All operators shall close door under full spring power when power is removed.
h. Are to be hard wired with power input of 120 VAC, 60Hz and connected to a dedicated circuit breaker located on a power panel reserved for security equipment.

H. Door Status Indicators:
1. Shall monitor and report door status to the SMS.
2. Door Position Sensor:
a. Shall provide an open or closed indication for all doors operated on the PACS and report directly to the SMS.
b. Shall also provide alarm input to the Intrusion Detection System for all doors operated by the PACS and all other doors that require monitoring by the intrusion detection system.
c. Switches for doors operated by the PACS shall be double pole double throw (DPDT). One side of the switch shall monitor door position and the other side if the switch shall report to the intrusion detection system. For doors with electromagnetic locks a magnetic bonding sensor (MBS) can be used in place of one side of a DPDT switch, in turn allowing for the use of a single pole double throw (SPDT) switch in it place of a DPDT switch.
d. Switches for doors not operated by the PACS shall be SPDT and report directly to the IDS.
e. Shall be surface or flush mounted and wide gap with the ability to operate at a maximum distance of up to 2” (5 cm).

2.15 PUSH BUTTON SWITCHES

A. Push-Button Switches: Momentary-contact back-lighted push buttons, with stainless-steel switch enclosures.
1. Electrical Ratings:
a. Minimum continuous current rating of 10A at 120 V ac or 5A at 240-V ac.
b. Contacts that will make 720 VA at 60A and that will break at 720 VA at 10A.
2. Enclosures: Flush or surface mounting. Push buttons shall be suitable for flush mounting in the switch enclosures.
3. Enclosures shall additionally be suitable for installation in the following locations:
a. Indoors, controlled environment.
b. Indoors, uncontrolled environment.
c. Outdoors.
4. Power: Push-button switches shall be powered from their associated Controller, using dc control.

2.16 PORTAL CONTROL DEVICES

A. Shall be used to assist the PACS.

B. Such devices shall:
1. Provide a means of monitoring the doors status.
2. Allow for exiting a space via either a push button, request to exit, or panic/crash bar.
3. Provide a means of override to the PACS via a keypad or key bypass.
4. Assist door operations utilizing automatic openers and closures.
5. Provide a secondary means of access to a space via a keypad.

C. Shall be connected to and monitored by the main PACS panel.

D. Shall be installed in a manner that they comply with:
1. The Uniform Federal Accessibility Standards (UFAS)
2. The Americans with Disabilities Act (ADA)
3. The ADA Standards for Accessible Design

E. Shall provide a secondary means of physical access control within a secure area.

F. Push-Button Switches:
1. Shall be momentary contact, back lighted push buttons, and stainless steel switch enclosures for each push button as shown. Buttons are to be utilized for secondary means of releasing a locking mechanism.
   a. In an area where a push button is being utilized for remote access of the locking device then no more than two (2) buttons shall operate one door from within one secure space. Buttons will not be wired in series with one other.
   b. In an area where locally stationed guards control entry to multiple secure points via remote switches. An interface board shall be designed and constructed for only the amount of buttons it shall house. These buttons shall be flush mounted and clearly labeled for ease of use. All buttons shall be connected to the PACS and SMS system for monitoring purposes.
   c. Shall have double-break silver contacts that will make 720 VA at 60 amperes and break 720 VA at 10 amperes.

G. Entry Control Devices:
1. Shall be hardwired to the PACS main control panel and operated by either a card reader or a biometric device via a relay on the main control panel.
2. Shall be fail-safe in the event of power failure to the PACS system.
3. Shall operate at 24 VCD, with the exception of turnstiles and be powered by a separate power supply dedicated to the door control system. Each power supply shall be rated to operate a minimum of two doors simultaneously without error to the system or overload the power supply unit.
4. Shall have a diode or metal-oxide veristor (MOV) to protect the controller and power supply from reverse current surges or back-check.
5. Electric Strikes/Bolts: Shall be:
   a. Made of heavy-duty construction and tamper resistant design.
   b. Tested to over one million cycles.
   c. Rated for a minimum of 1000 lbs. holding strength.
   d. Utilize an actuating solenoid for the strike/bolt. The solenoid shall move from fully open to fully closed position and back in not more than 500 milliseconds and be rated for continuous duty.
   e. Utilize a signal switch that will indicate to the system if the strike/bolt is not engaged or is unlocked when it should be secured.
   f. Flush mounted within the door frame.
6. Electric Mortise Locks: Shall be installed within the door and an electric transfer hinge shall be utilized to allow the wires to be transferred from the door frame to the lock. If utilized with a double door then the lock shall be installed inside the active leaf. Electric Mortise Locks shall:
   a. These locks shall be provided and installed by the Division 8 “DOOR HARDWARE” Contractor.
   b. Provide integration of the Electric Mortise Locks with the PACS for:
      1) Lock Power
7. Electromagnetic Locks:
   a. These locks shall be without mechanical linkage utilizing no moving parts, and securing the door to its frame solely on electromagnetic force.
   b. Shall be comprised of two pieces, the mag-lock and the door plate. The electromagnetic locks shall be surface mounted to the door frame and the door plate shall be surface mounted to the door.
   c. Ensure a diode is installed in line with the DC voltage supplying power to the unit in order to prevent back-check on the system when the electromagnetic lock is powered.
   d. Electromagnetic locks shall meet the following minimum technical characteristics:

Operating Voltage	24 VDC
Current Draw	.5A

Holding Force	Swing Doors	675 kg (1500 lbs)
	Sliding Doors	225 kg (500 lbs)

8. Turnstiles:
   a. Shall operate at 110 VAC, 60 Hz or 220 VAC, 50 Hz supplied from a dedicated circuit breaker on a security power panel. This device does not require a back-up power source.
   b. Shall be utilized as a means of monitoring and controlling access in a lobby.
   c. Shall meet the following minimum requirements:
      1) Be UFAS compliant.
      2) Provide either an audible or visual confirmation that access has been granted to a cleared individual.
      3) Provide an audible alarm in the event a non-cleared individual is attempting to gain access.
      4) Interface with the SMS and utilize a card reader for accessing and exiting a facility, and provide a recorded event of personnel accessing these points.
      5) Have a built-in step-down transformer to provide power to a card reader unit.
      6) Have built-in signal wiring chassis to allow for plug and play capabilities with the PACS.
      7) Have the ability to detect tailgating within one quarter on an inch to prevent unauthorized access to a facility.
9. Vehicle Gate Operator: Interface electrical operation of gate with controls of this Section. Vehicle gate operators shall be connected, monitored, and controlled, by the security access Controllers. Vehicle gate and accessories are specified in Division 32 Section "Chain Link Fences and Gates."

2.17 SECONDARY ALARM ANNUNCIATOR

A. Secondary Alarm Annunciation Site: A workstation with limited I/O capacity, consisting of a secondary alarm annunciation workstation to allow the operator to duplicate functions of the main operator interface, and to show system status changes.

2.18 INTERFACES

A. CCTV System Interface
   1. An RS232 Ethernet interface associated driver, and controller shall be provided for connection of the SMS Central Computer to the CCTV Alarm interface and switcher. The interface shall provide alarm data to the CCTV Alarm interface for automatic camera call-up. If required the Security Contractor shall be responsible for programming the command strings into the SMS Server.

B. Intercom System Interface
   1. The CCTV call-up from intercom stations shall be through the intercom unit via RS232 Ethernet communications interface to the SMS system, then through the matrix switcher.
      a. Application Software
         1) Provides the interface between the Alarm Annunciation System and Operator; all sensors, local processors and data links, drive displays, report alarms, and report generation.
         2) Software is categorized as System Software and Application Software. System Software must consist of software to support set-up, operation, hard drive back-ups and maintenance processor. Application Software must consist of software to provide the completion of Physical Access Control System.

C. Power Supplies:
   1. Shall be UL rated and able to adequately power (enter number) entry control devices on a continuous base without failure.
   2. Shall meet the following minimum technical characteristics:

INPUT POWER	110 VAC 60 HZ (enter amperage)A
OUTPUT VOLTAGE	12 VDC Nominal (13.8 VDC) 24 VDC Nominal (27.6 VDC) Filtered and Regulated
BATTERY	Dependant on Output Voltage shall provide up to 1500mAh
OUTPUT CURRENT	10 amp max. @ 13.8 VDC 5 amp max. @ 27.6 VDC
PRIMARY FUSE SIZE	6.3 amp (non-removable)
BATTERY FUSE SIZE	12 amp, 3AG
CHARGING CIRCUIT	Built-in standard

2.19 FLOOR SELECT ELEVATOR CONTROL

A. Elevator access control shall be integral to security access.
   1. System shall be capable of providing full elevator security and control through dedicated Controllers without relying on the control-station host PC for elevator control decisions.
   2. Access-control system shall enable and disable car calls on each floor and floor select buttons in each elevator car, restricting passengers' access to the floors where they have been given access.
   3. System setup shall, through programming, automatically secure and unsecure each floor select button of a car individually by time and day. Each floor select button within a car shall be separately controlled so that some floors may be secure while others remain unsecure.
   4. When a floor select button is secure, it shall require the passenger to use his/her access code and have access to that floor before the floor select button will operate. The passenger's credential shall determine which car call and floor select buttons are to be enabled, restricting access to floors unless authorized by system's access code database. Floor select button shall be enabled only in the car where the credential holder is the passenger.

B. PACS shall record which call button is pressed, along with credential and time information.
   1. System Controller shall record elevator access data.
   2. The Controller shall reset all additional call buttons that may have been enabled by the user's credential.
   3. The floor select elevator control shall allow for manual override either individually by floor or by cab as a group from a workstation PC.

2.20 AFTER-HOURS HVAC CONTROL

A. After-Hours HVAC Control: Provide for any credential read to activate or control individual HVAC zones based on access level. This control module shall control and record the after-hours use of the heating and cooling system in zones or tenant space.
   1. This control shall give the administrator the ability to determine how much extra energy consumption each tenant is responsible for. This information can be used in billing tenants for the extra after-hour usage.
   2. At the specified time every day, the HVAC shall automatically go into its after-hours mode. It shall then revert into its normal business hours mode by a tenant using an access code or card at a designated keypad or reader.
   3. Once enabled, the tenant's HVAC zone shall be under thermostat control for a preset amount of time. When the preset amount of time elapses, the HVAC for that zone shall revert back to after-hours mode unless a tenant uses his/her code or card again. This shall continue until the unit automatically returns to its normal business hours operation.

B. Control module activates the HVAC system after a valid access by any of three methods; however, the HVAC control shall always allow for manual override from the PC.

1. By time expiration after access of an adjustable period from 1 second to 546 minutes (9.1 hours).
2. By use of the card or code again at the same or different reader or keypad.
3. By system returning to its normal business hours operation.

C. After-hours HVAC control shall operate with all other features running simultaneously and use the central-station PC that controls access for the building but shall not rely on the host PC for any HVAC control decisions.

2.21 REAL TIME GUARD TOUR

A. Guard tour module shall provide the ability to plan, track, and route tours. Module shall input an alarm during tour if guard fails to make a station. Tours can be programmed for sequential or random tour-station order.
   1. Guard tour setup shall define specific routes or tours for the guard to take, with time restrictions in which to reach every predefined tour station.
   2. Guard tour activity shall be automatically logged to the central-station PC's hard drive.
   3. If the guard is early or late to a tour station, a unique alarm per station shall appear at the Central Station to indicate the time and station.
   4. Guard tour setup shall allow the tours to be executed sequentially or in a random order with an overall time limit set for the entire tour instead of individual times for each tour station.
   5. Setup shall allow recording of predefined responses that will display for the operator at the control station should a "Failed to Check-in" alarm occur.

B. A tour station is a physical location a guard shall reach and perform an action indicating that the guard has arrived. This action, performed at the tour station, shall be 1 of 13 different events with any combination of station types within the same tour. A tour station shall be one of the following event types:
   1. Access Granted.
   2. Access Denied Code.
   3. Access Denied Card plus PIN.
   4. Access Denied Time Zone.
   5. Access Denied Level.
   6. Access Denied Facility.
   7. Access Denied Code Timer.
   8. Access Denied Anti-Passback.
   9. Access Granted Passback Violation.
   10. Alarm.
   11. Restored.
   12. Input Normal.
   13. Input Abnormal.

C. Guard tour and other system features shall operate simultaneously with no interference.

D. Guard Tour Module Capacity: 999 possible guard tour definitions with each tour having up to 99 tour stations. System shall allow all 999 tours to be running at same time.

2.22 VIDEO AND CAMERA CONTROL

A. Control station or designated workstation displays live video from a CCTV source.
   1. Control Buttons: On the display window, with separate control buttons to represent Left, Right, Up, Down, Zoom In, Zoom Out, Scan, and a minimum of two custom command auxiliary controls.
   2. Provide at least seven icons to represent different types of cameras, with ability to import custom icons. Provide option for display of icons on graphic maps to represent their physical location.
   3. Provide the alarm-handling window with a command button that will display the camera associated with the alarm point.

B. Display mouse-selectable icons representing each camera source, to select source to be displayed. For CCTV sources that are connected to a video switcher, control station shall automatically send control commands through a COM port to display the requested camera when the camera icon is selected.

C. Allow cameras with preset positioning to be defined by displaying a different icon for each of the presets. Provide control with Next and Previous buttons to allow operator to cycle quickly through the preset positions.

2.23 WIRES AND CABLES

A. Comply with Division 28 Section "CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY."

B. PVC-Jacketed, RS-232 Cable: Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors, polypropylene insulation, and individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage; PVC jacket. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
1. NFPA 70, Type CM.
2. Flame Resistance: UL 1581 Vertical Tray.

C. Plenum-Type, RS-232 Cable: Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors, plastic insulation, and individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage; plastic jacket. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
1. NFPA 70, Type CMP.
2. Flame Resistance: NFPA 262 Flame Test.

D. RS-485 communications require 2 twisted pairs, with a distance limitation of 4000 feet (1220 m).

E. PVC-Jacketed, RS-485 Cable: Paired, 2 pairs, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors, PVC insulation, unshielded, PVC jacket, and NFPA 70, Type CMG.

F. Plenum-Type, RS-485 Cable: Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors, fluorinated-ethylene-propylene insulation, unshielded, and fluorinated-ethylene-propylene jacket.
1. NFPA 70, Type CMP.
2. Flame Resistance: NFPA 262 Flame Test.

G. Multiconductor, Readers and Wiegand Keypads Cables: No. 22 AWG, paired and twisted multiple conductors, stranded (7x30) tinned copper conductors, semirigid PVC insulation, overall aluminum foil-polyester tape shield with 100 percent shield coverage, plus tinned copper braid shield with 65 percent shield coverage, and PVC jacket.
1. NFPA 70, Type CMG.
2. Flame Resistance: UL 1581 Vertical Tray.
3. For TIA/EIA-RS-232 applications.

H. Paired Readers and Wiegand Keypads Cables: Paired, 3 pairs, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors, polypropylene insulation, individual aluminum foil-polyester tape shielded pairs each with No. 22 AWG, stranded tinned copper drain wire, 100 percent shield coverage, and PVC jacket.
1. NFPA 70, Type CM.
2. Flame Resistance: UL 1581 Vertical Tray.

I. Paired Readers and Wiegand Keypads Cable: Paired, 3 pairs, twisted, No. 20 AWG, stranded (7x28) tinned copper conductors, polyethylene (polyolefin) insulation, individual aluminum foil-polyester tape shielded pairs each with No. 22 AWG, stranded (19x34) tinned copper drain wire, 100 percent shield coverage, and PVC jacket.
1. NFPA 70, Type CM.
2. Flame Resistance: UL 1581 Vertical Tray.

J. Plenum-Type, Paired, Readers and Wiegand Keypads Cable: Paired, 3 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors, plastic insulation, individual aluminum foil-polypropylene tape shielded pairs each with No. 22 AWG, stranded tinned copper drain wire, 100 percent shield coverage, and fluorinated-ethylene-propylene jacket.
   1. NFPA 70, Type CMP.
   2. Flame Resistance: NFPA 262 Flame Test.

K. Plenum-Type, Multiconductor, Readers and Keypads Cable: 6 conductors, No. 20 AWG, stranded (7x28) tinned copper conductors, fluorinated-ethylene-propylene insulation, overall aluminum foil-polyester tape shield with 100 percent shield coverage plus tinned copper braid shield with 85 percent shield coverage, and fluorinated-ethylene-propylene jacket.
   1. NFPA 70, Type CMP.
   2. Flame Resistance: NFPA 262 Flame Test.

L. Paired Lock Cable: 1 pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors, PVC insulation, unshielded, and PVC jacket.
   1. NFPA 70, Type CMG.
   2. Flame Resistance: UL 1581 Vertical Tray.

M. Plenum-Type, Paired Lock Cable: 1 pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors, PVC insulation, unshielded, and PVC jacket.
   1. NFPA 70, Type CMP.
   2. Flame Resistance: NFPA 262 Flame Test.

N. Paired Lock Cable: 1 pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors, PVC insulation, unshielded, and PVC jacket.
   1. NFPA 70, Type CMG.
   2. Flame Resistance: UL 1581 Vertical Tray.

O. Plenum-Type, Paired Lock Cable: 1 pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors, fluorinated-ethylene-propylene insulation, unshielded, and plastic jacket.
   1. NFPA 70, Type CMP.
   2. Flame Resistance: NFPA 262 Flame Test.

P. Paired Input Cable: 1 pair, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors, polypropylene insulation, overall aluminum foil-polyester tape shield with No. 22 AWG, stranded (7x30) tinned copper drain wire, 100 percent shield coverage, and PVC jacket.
   1. NFPA 70, Type CMR.
   2. Flame Resistance: UL 1666 Riser Flame Test.

Q. Plenum-Type, Paired Input Cable: 1 pair, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors, fluorinated-ethylene-propylene insulation, aluminum foil-polyester tape shield (foil side out), with No. 22 AWG drain wire, 100 percent shield coverage, and plastic jacket.
   1. NFPA 70, Type CMP.
   2. Flame Resistance: NFPA 262 Flame Test.

R. Paired AC Transformer Cable: 1 pair, twisted, No. 18 AWG, stranded (7x26) tinned copper conductors, PVC insulation, unshielded, and PVC jacket.
   1. NFPA 70, Type CMG.

S. Plenum-Type, Paired AC Transformer Cable: 1 pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors, fluorinated-ethylene-propylene insulation, unshielded, and plastic jacket.
   1. NFPA 70, Type CMP.
   2. Flame Resistance: NFPA 262 Flame Test.

T. Elevator Travel Cable: Steel center core, with shielded, twisted pairs, No. 20 AWG conductor size.
   1. Steel Center Core Support: Preformed, flexible, low-torsion, zinc-coated, steel wire rope; insulated with 60 deg C flame-resistant PVC and covered with a nylon or cotton braid.

2. Shielded Pairs: Insulated copper conductors; color-coded, insulated with 60 deg C flame-resistant PVC; each pair shielded with bare copper braid for 85 percent coverage.
3. Jute Filler: Electrical grade, dry.
4. Binder: Helically wound synthetic fiber.
5. Braid: Rayon or cotton braid applied with 95 percent coverage.
6. Jacket: 60 deg C PVC specifically compounded for flexibility and abrasion resistance. UL VW-1 and CSA FT1 flame rated.

U. LAN (Ethernet) Cabling: Comply with Division 28 Section "Conductors and Cables for Electronic Safety and Security."

PART 3 - PART 3 - EXECUTION

3.1 3.1 GENERAL

A. The Contractor shall install all system components and appurtenances in accordance with the manufacturers' instructions, ANSI C2, and shall furnish all necessary interconnections, services, and adjustments required for a complete and operable system as specified. Control signals, communications, and data transmission lines grounding shall be installed as necessary to preclude ground loops, noise, and surges from affecting system operation. Equipment, materials, installation, workmanship, inspection, and testing shall be in accordance with manufacturers' recommendations and as modified herein.

B. Consult the manufacturers' installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation. Refer to the Riser/Connection diagram for all schematic system installation/termination/wiring data.

C. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., sensors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

3.2 CURRENT SITE CONDITIONS

A. The Contractor shall visit the site and verify that site conditions are in agreement with the design package. The Contractor shall report all changes to the site or conditions which will affect performance of the system to the Owner in a report as defined in paragraph Group II Technical Data Package. The Contractor shall not take any corrective action without written permission from the Owner.

3.3 EXAMINATION

A. Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.

B. Examine roughing-in for LAN and control cable conduit systems to PCs, Controllers, card readers, and other cable-connected devices to verify actual locations of conduit and back boxes before device installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.4 PREPARATION

A. Comply with recommendations in SIA CP-01.

B. Comply with EIA/TIA-606, "Administration Standard for the Telecommunications Infrastructure of Commercial Buildings."

C. Obtain detailed Project planning forms from manufacturer of access-control system; develop custom forms to suit Project. Fill in all data available from Project plans and specifications and publish as Project planning documents for review and approval.

1. Record setup data for control station and workstations.
2. For each Location, record setup of Controller features and access requirements.
3. Propose start and stop times for time zones and holidays, and match up access levels for doors.
4. Set up groups, linking, and list inputs and outputs for each Controller.
5. Assign action message names and compose messages.
6. Set up alarms. Establish interlocks between alarms, intruder detection, and video surveillance features.
7. Prepare and install alarm graphic maps.
8. Develop user-defined fields.
9. Develop screen layout formats.
10. Propose setups for guard tours and key control.
11. Discuss badge layout options; design badges.
12. Complete system diagnostics and operation verification.
13. Prepare a specific plan for system testing, startup, and demonstration.
14. Develop acceptance test concept and, on approval, develop specifics of the test.
15. Develop cable and asset management system details; input data from construction documents. Include system schematics and Technical Drawings.

D. In meetings with Architect and Owner, present Project planning documents and review, adjust, and prepare final setup documents. Use final documents to set up system software.

3.5 CABLING

A. Comply with NECA 1, "Good Workmanship in Electrical Contracting."

B. Install cables and wiring according to requirements in Division 28 Section "Conductors and Cables for Electronic Safety and Security."

C. Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters. Conceal raceway and wiring except in unfinished spaces.

D. Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Use NRTL-listed plenum cable in environmental air spaces, including plenum ceilings. Conceal raceway and cables except in unfinished spaces.

E. Install LAN cables using techniques, practices, and methods that are consistent with Category 6a rating of components and that ensure Category 6a performance of completed and linked signal paths, end to end.

F. Install cables without damaging conductors, shield, or jacket.

G. Boxes and enclosures containing security system components or cabling, and which are easily accessible to employees or to the public, shall be provided with a lock. Boxes above ceiling level in occupied areas of the building shall not be considered to be accessible. Junction boxes and small device enclosures below ceiling level and easily accessible to employees or the public shall be covered with a suitable cover plate and secured with tamperproof screws.

H. Install end-of-line resistors at the field device location and not at the Controller or panel location.

3.6 CABLE APPLICATION

A. Comply with EIA/TIA-569, "Commercial Building Standard for Telecommunications Pathways and Spaces."

B. Cable application requirements are minimum requirements and shall be exceeded if recommended or required by manufacturer of system hardware.

C. RS-232 Cabling: Install at a maximum distance of 50 feet (15 m).

D. RS-485 Cabling: Install at a maximum distance of 4000 feet (1220 m).

E. Card Readers and Keypads:
   1. Install number of conductor pairs recommended by manufacturer for the functions specified.
   2. Unless manufacturer recommends larger conductors, install No. 22 AWG wire if maximum distance from Controller to the reader is 250 feet (75 m), and install No. 20 AWG wire if maximum distance is 500 feet (150 m).
   3. For greater distances, install "extender" or "repeater" modules recommended by manufacturer of the Controller.
   4. Install minimum No. 18 AWG shielded cable to readers and keypads that draw 50 mA or more.

F. Install minimum No. 16 AWG cable from Controller to electrically powered locks. Do not exceed 250 feet (75 m).

G. Install minimum No. 18 AWG ac power wire from transformer to Controller, with a maximum distance of 25 feet (8 m).

3.7 GROUNDING

A. Comply with Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Comply with IEEE 1100, "Power and Grounding Sensitive Electronic Equipment."

C. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

D. Signal Ground:
   1. Terminal: Locate in each equipment room and wiring closet; isolate from power system and equipment grounding.
   2. Bus: Mount on wall of main equipment room with standoff insulators.
   3. Backbone Cable: Extend from signal ground bus to signal ground terminal in each equipment room and wiring closet.

3.8 INSTALLATION

A. System installation shall be in accordance with UL 294, manufacturer and related documents and references, for each type of security subsystem designed, engineered and installed.

B. Components shall be configured with appropriate “service points” to pinpoint system trouble in less than 30 minutes.

C. The Contractor shall install all system components including Government furnished equipment, and appurtenances in accordance with the manufacturer's instructions, documentation listed in Sections 1.4 and 1.5 of this document, and shall furnish all necessary connectors, terminators, interconnections, services, and adjustments required for a operable system.

D. The PACS will be designed, engineered, installed, and tested to ensure all components are fully compatible as a system and can be integrated with all associated security subsystems, whether the system is a stand alone or a network.

E. For integration purposes, the PACS shall be integrated where appropriate with the following associated security subsystems:
   1. CCTV:
      a. Provide 24 hour coverage of all entry points to the perimeter and agency buildings. As well as all emergency exits utilizing a fixed color camera.
      b. Be able to monitor, control and record cameras on a 24 hours basis.
      c. Be programmed automatically call up a camera when an access point is but into an alarm state.
      d. For additional PACS system requirements as they relate to the CCTV, refer to Section 28 23 00, VIDEO SURVEILLANCE.
   2. IDS:
      a. Be able monitor door control sensors.

b. Be able to monitor and control the IDS on a 24 hours basis.
c. Be programmed to go into an alarm state when an IDS device is put into an alarm state, and notify the operator via an audible alarm.

3. Security Access Detection:
   a. Be able to monitor all objects that have been screened with an x-ray machine and be able to monitor all data acquired by the bomb detection unit.
4. EPPS:
   a. Be programmed to go into an alarm state when an emergency call box or duress alarm/panic device is activated, and notify the Physical Access Control System and Database Management of an alarm event.

F. Integration with these security subsystems shall be achieved by computer programming or the direct hardwiring of the systems.

G. For programming purposes refer to the manufacturers requirements for correct system operations. Ensure computers being utilized for system integration meet or exceed the minimum system requirements outlined on the systems software packages.

H. The Contractor shall visit the site and verify that site conditions are in agreement with the design package. The Contractor shall report all changes to the site or conditions that will affect performance of the system. The Contractor shall not take any corrective action without written permission from the Government.

I. The Contractor shall visit the site and verify that site conditions are in agreement/compliance with the design package. The Contractor shall report all changes to the site or conditions that will affect performance of the system to the Contracting Officer in the form of a report. The Contractor shall not take any corrective action without written permission received from the Contracting Officer.

J. Existing Equipment:
   1. The Contractor shall connect to and utilize existing door equipment, control signal transmission lines, and devices as outlined in the design package. Door equipment and signal lines that are usable in their original configuration without modification may be reused with Contracting Officer approval.
   2. The Contractor shall perform a field survey, including testing and inspection of all existing door equipment and signal lines intended to be incorporated into the PACS, and furnish a report to the Contracting Officer as part of the site survey report. For those items considered nonfunctioning, provide (with the report) specification sheets, or written functional requirements to support the findings and the estimated cost to correct the deficiency. As part of the report, the Contractor shall include a schedule for connection to all existing equipment.
   3. The Contractor shall make written requests and obtain approval prior to disconnecting any signal lines and equipment, and creating equipment downtime. Such work shall proceed only after receiving Contracting Officer approval of these requests. If any device fails after the Contractor has commenced work on that device, signal or control line, the Contractor shall diagnose the failure and perform any necessary corrections to the equipment.
   4. The Contractor shall be held responsible for repair costs due to Contractor negligence, abuse, or improper installation of equipment.
   5. The Contracting Officer shall be provided a full list of all equipment that is to be removed or replaced by the Contractor, to include description and serial/manufacturer numbers where possible. The Contractor shall dispose of all equipment that has been removed or replaced based upon approval of the Contracting Officer after reviewing the equipment removal list. In all areas where equipment is removed or replaced the Contractor shall repair those areas to match the current existing conditions.

K. Enclosure Penetrations: All enclosure penetrations shall be from the bottom of the enclosure unless the system design requires penetrations from other directions. Penetrations of interior enclosures involving transitions of conduit from interior to exterior, and all penetrations on

exterior enclosures shall be sealed with rubber silicone sealant to preclude the entry of water and will comply with VA Master Specification 07 84 00, Firestopping. The conduit riser shall terminate in a hot-dipped galvanized metal cable terminator. The terminator shall be filled with an approved sealant as recommended by the cable manufacturer and in such a manner that the cable is not damaged.

L. Cold Galvanizing: All field welds and brazing on factory galvanized boxes, enclosures, and conduits shall be coated with a cold galvanized paint containing at least 95 percent zinc by weight.

M. Control Panels:
1. Connect power and signal lines to the controller.
2. Program the panel as outlined by the design and per the manufacturer's programming guidelines.

N. SMS:
1. Coordinate with the VA agency's IT personnel to place the computer on the local LAN or Intranet and provide the security system protection levels required to insure only authorized VA personnel have access to the system.
2. Program and set-up the SMS to ensure it is in fully operation.

O. Card Readers:
1. Connect all signal inputs and outputs as shown and specified.
2. Terminate input signals as required.
3. Program and address the reader as per the design package.
4. Readers shall be surface or flushed mounted and all appropriate hardware shall be provided to ensure the unit is installed in an enclosed conduit system.

P. Biometrics:
1. Connect all signal input and output cables along with all power cables.
2. Program and ensure the device is in operating order.

Q. Portal Control Devices:
1. Install all signal input and output cables as well as all power cables.
2. Devices shall be surface or flush mounted as per the design package.
3. Program all devices and ensure they are working.

R. Door Status Indicators:
1. Install all signal input and output cables as well as all power cables.
2. RTE's shall be surface mounted and angled in a manner that they cannot be compromised from the non-secure side of a windowed door, or allow for easy release of the locking device from a distance no greater than 6 feet from the base of the door.
3. Door position sensors shall be surface or flush mounted and wide gap with the ability to operate at a maximum distance of up to 2" (5 cm).

S. Entry Control Devices:
1. Install all signal input and power cables.
2. Strikes and bolts shall be mounted within the door frame.
3. Mortise locks shall be mounted within the door and an electric transfer hinge shall be utilized to transfer the wire from within the door frame to the mortise lock inside the door.
4. Electromagnetic locks shall be installed with the mag-lock mounted to the door frame and the metal plate mounted to the door.

T. System Start-Up:
1. The Contractor shall not apply power to the PACS until the following items have been completed:
   a. PACS equipment items and have been set up in accordance with manufacturer's instructions.
   b. A visual inspection of the PACS has been conducted to ensure that defective equipment items have not been installed and that there are no loose connections.

c. System wiring has been tested and verified as correctly connected as indicated.
d. All system grounding and transient protection systems have been verified as installed and connected as indicated.
e. Power supplies to be connected to the PACS have been verified as the correct voltage, phasing, and frequency as indicated.

2. Satisfaction of the above requirements shall not relieve the Contractor of responsibility for incorrect installation, defective equipment items, or collateral damage as a result of Contractor work efforts.
3. The Commissioning Agent will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the Resident Engineer and Commissioning Agent. Provide a minimum of 7 days prior notice.

U. Supplemental Contractor Quality Control:
1. The Contractor shall provide the services of technical representatives who are familiar with all components and installation procedures of the installed PACS; and are approved by the Contracting Officer.
2. The Contractor will be present on the job site during the preparatory and initial phases of quality control to provide technical assistance.
3. The Contractor shall also be available on an as needed basis to provide assistance with follow-up phases of quality control.
4. The Contractor shall participate in the testing and validation of the system and shall provide certification that the system installed is fully operational as all construction document requirements have been fulfilled.

3.9 SYSTEM SOFTWARE

A. Install, configure, and test software and databases for the complete and proper operation of systems involved. Assign software license to Owner.

3.10 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Testing Agency: Engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports:

C. Perform the following field tests and inspections and prepare test reports:
1. LAN Cable Procedures: Inspect for physical damage and test each conductor signal path for continuity and shorts. Use Class 2, bidirectional, Category 5 tester. Test for faulty connectors, splices, and terminations. Test according to TIA/EIA-568-1, "Commercial Building Telecommunications Cabling Standards - Part 1 General Requirements." Link performance for UTP cables must comply with minimum criteria in TIA/EIA-568-B.
2. Test each circuit and component of each system. Tests shall include, but are not limited to, measurements of power supply output under maximum load, signal loop resistance, and leakage to ground where applicable. System components with battery backup shall be operated on battery power for a period of not less than 10 percent of the calculated battery operating time. Provide special equipment and software if testing requires special or dedicated equipment.
3. Operational Test: After installation of cables and connectors, demonstrate product capability and compliance with requirements. Test each signal path for end-to-end performance from each end of all pairs installed. Remove temporary connections when tests have been satisfactorily completed.

3.11 PROTECTION

A. Maintain strict security during the installation of equipment and software. Rooms housing the control station, and workstations that have been powered up shall be locked and secured, with

an activated burglar alarm and access-control system reporting to a Central Station complying with UL 1610, "Central-Station Burglar-Alarm Units," during periods when a qualified operator in the employ of Contractor is not present.

3.12 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 28 08 00 – COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS for all inspection, start up, and contractor testing required above and required by the System Readiness Checklist provided by the Commissioning Agent.

B. Components provided under this section of the specification will be tested as part of a larger system. Refer to Section 28 08 00 – COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS and related sections for contractor responsibilities for system commissioning.

3.13 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer's technical representative for four hours to instruct VA personnel in operation and maintenance of units.

B. Submit training plans and instructor qualifications in accordance with the requirements of Section 28 08 00 – COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS.

C. Develop separate training modules for the following:
   1. Computer system administration personnel to manage and repair the LAN and databases and to update and maintain software.
   2. Operators who prepare and input credentials to man the control station and workstations and to enroll personnel.
   3. Security personnel.
   4. Hardware maintenance personnel.
   5. Corporate management.

D. All testing and training shall be compliant with the VA General Requirements, Section 01 00 00, GENERAL REQUIREMENTS.

-----END----

SECTION 28 23 00

VIDEO SURVEILLANCE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide and install a complete Video Assessment and Surveillance System hereinafter referred to as the VASS System as specified in this section. This facility uses C-CURE 9000 by Software House as the access control and event management platform, which integrates with Illustra Pro series cameras and American Dynamics Video Management System Software. The system is serviced by Johnson Controls Security Solutions LLC. Point of contact is Mike Scott (Michael.4.scott@JCI.com) 781-206-9079. Substitutes shall NOT be permitted by the facility.

B. This Section includes video surveillance system consisting of cameras, data transmission wiring, and a control station with its associated equipment.

1.2 RELATED WORK

A. Section 01 00 00 - GENERAL REQUIREMENTS. For General Requirements.

B. Section 07 84 00 - FIRESTOPPING. Requirements for firestopping application and use.

C. Section 10 14 00 - SIGNAGE. Requirements for labeling and signs.

D. Section 26 05 11 - REQUIREMENTS FOR ELECTRICAL INSTALLATIONS. Requirements for connection of high voltage.

E. Section 26 05 19 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW). Requirements for power cables.

F. Section 28 05 00 – COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY. Requirements for general requirements that are common to more than one section in Division 28.

G. Section 28 05 13 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for conductors and cables.

H. Section 28 05 26 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY. Requirements for grounding of equipment.

I. Section 28 05 28.33 - CONDUITS AND BACKBOXES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for infrastructure.

J. Section 28 08 00 - COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY. Requirements for commissioning, systems readiness checklists, and training.

K. Section 28 13 00 - PHYSICAL ACCESS CONTROL SYSTEM. Requirements for physical access control system integration.

1.3 DEFINITIONS

A. AGC: Automatic gain control.

B. B/W: Black and white.

C. CCD: Charge-coupled device.

D. CIF: Common Intermediate Format CIF images are 352 pixels wide and 88/240 (PAL/NTSC) pixels tall (352 x 288/240).

E. 4CIF: resolution is 704 pixels wide and 576/480 (PAL/NTSC) pixels tall (704 x 576/480).

F. H.264 (also known as MPEG4 Part 10): a encoding format that compresses video much more effectively than older (MPEG4) standards.

G. ips: Images per second.

H. MPEG: Moving picture experts group.

I. MPEG4: a video encoding and compression standard that uses inter-frame encoding to significantly reduce the size of the video stream being transmitted.

J. NTSC: National Television System Committee.

K. UPS: Uninterruptible power supply.

L. PTZ: refers to a movable camera that has the ability to pan left and right, tilt up and down, and zoom or magnify a scene.

1.4 QUALITY ASSURANCE

A. The Contractor shall be responsible for providing, installing, and the operation of the VASS System as shown. The Contractor shall also provide certification as required.

B. The security system shall be installed and tested to ensure all components are fully compatible as a system and can be integrated with all associated security subsystems, whether the security system is stand-alone or a part of a complete Information Technology (IT) computer network.

C. The Contractor or security sub-contractor shall be a licensed security Contractor as required within the state or jurisdiction of where the installation work is being conducted.

D. Manufacturers Qualifications: The manufacturer shall regularly and presently produce, as one of the manufacturer's principal products, the equipment and material specified for this project, and shall have manufactured the item for at least three years.

E. Product Qualification:
   1. Manufacturer's product shall have been in satisfactory operation, on three installations of similar size and type as this project, for approximately three years.
   2. The Government reserves the right to require the Contractor to submit a list of installations where the products have been in operation before approval.

F. Contractor Qualification:
   1. The Contractor or security sub-contractor shall be a licensed security Contractor with a minimum of five (5) years experience installing and servicing systems of similar scope and complexity. The Contractor shall be an authorized regional representative of the Video Assessment and Surveillance System's (VASS) manufacturer. The Contractor shall provide four (4) current references from clients with systems of similar scope and complexity which became operational in the past three (3) years. At least three (3) of the references shall be utilizing the same system components, in a similar configuration as the proposed system. The references must include a current point of contact, company or agency name, address, telephone number, complete system description, date of completion, and approximate cost of the project. The owner reserves the option to visit the reference sites, with the site owner's permission and representative, to verify the quality of installation and the references' level of satisfaction with the system. The Contractor shall provide copies of system manufacturer certification for all technicians. The Contractor shall only utilize factory-trained technicians to install, program, and service the VASS. The Contractor shall only utilize factory-trained technicians to install, terminate and service cameras, control, and recording equipment. The technicians shall have a minimum of five (5) continuous years of technical experience in electronic security systems. The Contractor shall have a local service facility. The facility shall be located within 60 miles of the project site. The local facility shall include sufficient spare parts inventory to support the service requirements associated with this contract. The facility shall also include appropriate diagnostic equipment to perform diagnostic procedures. The COR reserves the option of surveying the company's facility to verify the service inventory and presence of a local service organization.
   2. The Contractor shall provide proof project superintendent with BICSI Certified Commercial Installer Level 1, Level 2, or Technician to provide oversight of the project.

3. Cable installer must have on staff a Registered Communication Distribution Designer (RCDD) certified by Building Industry Consulting Service International. The staff member shall provide consistent oversight of the project cabling throughout design, layout, installation, termination and testing.

G. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within four hours of receipt of notification that service is needed. Submit name and address of service organizations.

1.5 SUBMITTALS

A. Submit below items in conjunction with Master Specification Sections 01 33 23, Shop Drawings, Product Data, and Samples, and Section 02 41 00, Demolition Drawings.

B. Provide certificates of compliance with Section 1.4, Quality Assurance.

C. Provide a pre-installation and as-built design package in both electronic format and on paper, minimum size 1220 x 1220 millimeters (48 x 48 inches); drawing submittals shall be per the established project schedule.

D. Pre-installation design and as-built packages shall include, but not be limited to:
1. Index Sheet that shall:
   a. Define each page of the design package to include facility name, building name, floor, and sheet number.
   b. Provide a list of all security abbreviations and symbols.
   c. Reference all general notes that are utilized within the design package.
   d. Specification and scope of work pages for all security systems that are applicable to the design package that will:
      1) Outline all general and job specific work required within the design package.
      2) Provide a device identification table outlining device Identification (ID) and use for all security systems equipment utilized in the design package.
2. Floor plans, site plans, and enlarged plans shall:
   a. Include a title block as defined above.
   b. Define the drawings scale in both standard and metric measurements.
   c. Provide device identification and location.
   d. Address all signal and power conduit runs and sizes that are associated with the design of the electronic security system and other security elements (e.g., barriers, etc.).
   e. Identify all pull box and conduit locations, sizes, and fill capacities.
   f. Address all general and drawing specific notes for a particular drawing sheet.
3. 3. A riser drawing for each applicable security subsystem shall:
   a. Indicate the sequence of operation.
   b. Relationship of integrated components on one diagram.
   c. Include the number, size, identification, and maximum lengths of interconnecting wires.
   d. Wire/cable types shall be defined by a wire and cable schedule. The schedule shall utilize a lettering system that will correspond to the wire/cable it represents (example: A = 18 AWG/1 Pair Twisted, Unshielded). This schedule shall also provide the manufacturer's name and part number for the wire/cable being installed.
4. A system drawing for each applicable security system shall:
   a. Identify how all equipment within the system, from main panel to device, shall be laid out and connected.
   b. Provide full detail of all system components wiring from point-to-point.
   c. Identify wire types utilized for connection, interconnection with associate security subsystems.
   d. Show device locations that correspond to the floor plans.
   e. All general and drawing specific notes shall be included with the system drawings.

5. A schedule for all of the applicable security subsystems shall be included. All schedules shall provide the following information:
   a. Device ID.
   b. Device Location (e.g. site, building, floor, room number, location, and description).
   c. Mounting type (e.g. flush, wall, surface, etc.).
   d. Power supply or circuit breaker and power panel number.
   e. In addition, for the VASS Systems, provide the camera ID, camera type (e.g. fixed or pan/tilt/zoom (P/T/Z), lens type (e.g. for fixed cameras only) and housing model number.
6. Detail and elevation drawings for all devices that define how they were installed and mounted.

E. Pre-installation design packages shall be reviewed by the Contractor along with a VA representative to ensure all work has been clearly defined and completed. All reviews shall be conducted in accordance with the project schedule. There shall be four (4) stages to the review process:
   1. 35 percent
   2. 65 percent
   3. 90 percent
   4. 100 percent

F. Provide manufacturer security system product cut-sheets. Submit for approval at least 30 days prior to commencement of formal testing, a Security System Operational Test Plan. Include procedures for operational testing of each component and security subsystem, to include performance of an integrated system test.

G. Submit manufacture's certification of Underwriters Laboratories, Inc. (UL) listing as specified. Provide all maintenance and operating manuals per the VA General Requirements, Section 01 00 00, GENERAL REQUIREMENTS.

H. Submit completed System Readiness Checklists provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 28 08 00 COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS.

1.6 APPLICABLE PUBLICATIONS

A. The publications listed below (including amendments, addenda, revisions, supplement, and errata) form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American National Standards Institute (ANSI)/Electronic Industries Alliance (EIA):
   330-09 ..... Electrical Performance Standards for CCTV Cameras

   375A-76 ..... Electrical Performance Standards for CCTV Monitors

C. Institute of Electrical and Electronics Engineers (IEEE):
   C62.41-02 ..... IEEE Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits

   802.3af-08 ..... Power over Ethernet Standard

D. Federal Communications Commision (FCC):

E. (47 CFR 15) Part 15 Limitations on the Use of Wireless Equipment/Systems

F. National Electrical Contractors Association (NECA):
   303-2005 ..... Installing Closed Circuit Television (CCTV) Systems

G. National Fire Protection Association (NFPA):
   70-08 ..... Article 780-National Electrical Code

H. Federal Information Processing Standard (FIPS):

140-2-02 ..... Security Requirements for Cryptographic Modules

I. Underwriters Laboratories, Inc. (UL):
983-06 ..... Standard for Surveillance Camera Units

3044-01 ..... Standard for Surveillance Closed Circuit Television Equipment

1.7 COORDINATION

A. Coordinate arrangement, mounting, and support of video surveillance equipment:
1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for video surveillance items that are behind finished surfaces or otherwise concealed.

1.8 WARRANTY OF CONSTRUCTION

A. Warrant VASS System work subject to the Article “Warranty of Construction” of FAR clause 52.246-21.

B. Demonstration and training shall be performed prior to system acceptance.

PART 2 - PRODUCTS

2.1 GENERAL

A. Basis of Design: Avigilon Network Video Recorder– required to match and continue existing station systems -no substitutions.

B. Basis of Design: Avigilon Cameras – required to match and continue existing station systems - no substitutions.
1. H5A fisheye camera
2. F5A-FE-DO surface mount camera
3. F5A-FE-DO with H5|A-FE-MT-MPTA1 Pendant adapter
4. H6A and H6X Dome Cameras
5. All Cameras will be EIA 330 and UL 1.

C. Video signal format shall comply with the NTSC standard composite video, interlaced. Composite video signal termination shall be 75 ohms.

D. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor entry connection to components.

E. Power Connections: Comply with requirements in Section 28 05 00 COMMON WORK REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY, Part 2, as recommended by manufacturer for type of line being protected.

F. Tamper Protection: Tamper switches on enclosures, control units, pull boxes, junction boxes, cabinets, and other system components shall initiate a tamper-alarm signal when unit is opened or partially disassembled. Control-station, control-unit alarm display shall identify tamper alarms and indicate locations.

2.2 CAMERAS

A. Basis of Design: Avigilon H5A, no substitutions.

B. All Cameras will be EIA 330 and UL 1.Minimum Protection for Power Connections 120 V and more. Auxiliary panel suppressors shall comply with requirements in Section 28 05 00 COMMON WORK REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY, Part 2.

C. Minimum Protection for Communication, Signal, Control, and Low-Voltage 983 compliant as well as:
   1. Will be charge coupled device (CCD cameras and shall conform to National Television System Committee (NTSC) formatting.
   2. Fixed cameras shall be color and the primary choice for monitoring following the activities described below. Pan/Tilt/Zoom (P/T/Z) cameras shall be color and are to be utilized to complement the fixed cameras.
   3. Shall be powered by either 12 volts direct current (VDC) or 24 volts alternate current (VAC). Power supplies shall be Class 2 and UL compliant and have a back-up power source to ensure cameras are still operational in the event of loss of primary power to the VASS System.
   4. Shall be powered over Ethernet. Network switches supporting PoE cameras shall have a back-up power source to ensure cameras are still operational in the event of loss of primary power to the VASS System.
   5. Shall be rated for continuous operation under the environmental conditions listed in Part 1, Project Conditions.
   6. Will be home run to a monitoring and recording device via a controlling device such as a matrix switcher or network server and monitored on a 24 hour basis at a designated Security Management System location.
   7. Each function and activity shall be addressed within the system by a unique user defined name, with minimum of twenty (20) characters. The use of codes or mnemonics identifying the VASS action shall not be accepted.
   8. Shall come with built-in video motion detection that shall automatically monitor and process information from each camera. The camera motion detection shall detect motion within the camera's field of view and provide automatic visual, remote alarms as a result of detected motion.
   9. Shall be programmed to digitally flip from color to black and white at dusk and vice versa at low light conditions.
   10. 10. Will be fitted with AI/DC lenses to ensure the image quality under different light conditions.
   11. P/T/Z cameras shall be utilized in a manner that they complement fixed cameras and shall not be used as a primary means of monitoring activity.
   12. Dummy or fake cameras will not be utilized at any time.
   13. Appropriate signage shall be designed, provided, and posted that notifies people that an area is under camera surveillance.

2.3 VIDEO MANAGEMENT SYSTEM (ANALOG)

A. The Video Management System (VMS)shall provide features and functions as specified below:
   1. Supports minimum of 20 client connections.
   2. The Video Management System shall be capable of recording more than 32 days on 1.6 TB of internal hard drive storage using the following parameters:
      a. Resolution – 4CIF
      b. Video Mode – NTSC
      c. Quality – Normal
      d. Sensitivity – Normal
      e. Number of Cameras – 16
      f. Record Audio – On
      g. Motion 50%

3. The Digital Video Management System shall, at a minimum, combine multiplexing, alarm detection, video motion detection, video, audio, and text recording.

B. System Chassis
1. The Video Management System must utilize a chassis no larger than three rack units in height, and be suitable for either desktop or rack mount installations. The unit must fit within a standard video rack as well as a server rack.
2. The Video Management System's chassis shall include three indicator lights easily viewed from the front panel. These indicator lights must be colored red, yellow, and green to signify system status.
3. The Video Management System's chassis shall incorporate a minimum of four front accessible, swappable drive bays. The bays must be behind a locking front cover that restricts access not only to the drives, but also to the power switch and reset switch.

C. Operating System
1. The Video Management System's operating system and application must be installed on a separate solid-state system drive (flash memory card), with no moving parts to wear out or fail, to reduce the risk of system failure. Units with the operating system and/or application installed on a hard drive are not acceptable.

D. Recording
1. The Digital Video Management System shall use record mode settings as continuous or event activated.
2. The Digital Video Management System shall provide for simultaneous recording, playback, transmitting, database searching and archiving.
3. The unit must simultaneously record, play back and archive video, text and audio while using sophisticated search functions to define and find only those important events that meet certain criteria. The system must also have the ability to host multiple remote users, archive data, and search for data, all while recording multiple video and text streams.
4. The Video Management System shall offer recording rates of up to 480 ips at 1CIF, 480 ips at 2CIF, and 480 ips at 4CIF. The unit shall be able to mix record speeds and quality settings on a "per camera" basis.
5. The Video Management System shall have the ability to capture critical information with higher frame rates for certain cameras, and assign the remainder of the available images per second (ips) to non-critical cameras.
6. The Video Management System shall be available with up to 4 TB of internal hard drive storage.
7. The Video Management System's recording format must give each image a unique identification "stamp" to ensure even though the file structure is PC compatible, the original video images cannot be altered or modified, enabling a solid chain of evidence.
8. The Video Management System shall be able to store recorded video on the RAID Storage System (RSS) via an iSCSI interface.
9. The Video Management System shall be able to manage storage of video, audio and text by exporting to Network Attached Storage (NAS), Storage Area Network (SAN) and Direct Attached Storage (DAS) devices using optional software.

E. Network Access
1. The Video Management System shall provide network access through two internal network connections that support 1/10 GB network operation.

F. User Interface
1. The Video Management System's user interface must be easy to use, allowing the user to access all operations using one-click buttons, pull-down menus, adjustable sliders, and tabbed screens.
2. The Video Management System shall include the ability to accept text through a network connection, as well as through a serial input with an RS-232 connection. The unit shall be able to mix serial inputs and TCP/IP inputs in any combination up to 16 channels of text.

3. The system shall provide ability for user to specify text criteria, such as a specific ASCII text stream, to schedule recording and search for video, allowing for recording only the video associated with the specified text.

G. Live Video Display
1. The Digital Video Management System's live video display must provide real-time motion in any screen format (full, 2x2, 3x3, and 4x4). The operator shall have the ability to expand any view to full screen with a single click of the mouse.

H. H. Self-Monitoring Analysis
1. The Digital Video Management System must incorporate Self-Monitoring Analysis and Reporting Technology (S.M.A.R.T.), incorporating a suite of advanced diagnostics that monitor the internal operation of a drive and provide early warning for many types of potential problems. This shall allow for the drive to be repaired or replaced before any data is lost or damaged.

I. External Storage
1. Using the integrated CD/DVD writer (CD-RW or DVD-RW), the Digital Video Management System shall allow users to save video, audio, and text to a standard recordable CD or DVD. The option to include the player software on the CD or DVD shall be available so that no additional software needs to be purchased. The unit must include the ability to export the latest video, audio, and text to a CD or DVD until the CD or DVD is full.

J. Alarm Recording Settings:
1. The Digital Video Management System shall allow for the following Alarm Recording settings:
   a. Image Rate
   b. Quality
   c. Sensitivity

K. Adjustable Alarm Duration
1. The Digital Video Management System shall incorporate an adjustable alarm duration with the pre-alarm and minimum alarm duration programmable from five seconds to five minutes. The units must also allow programmable recording times (alarm schedules) for each day of the week, in thirty minute increments.

L. Supported Dome Camera handlers
1. The Digital Video Management System shall work with the following dome camera handlers: AD168, MP48, AD1024 matrix, VM96RTT, RS422 Dome Control, VM16/ADTT16, VM16E/ADTT16E, Pelco Matrix Switch (models 6700, 6800, 8500, 9500, 9750 or 9760 Pelco P, Pelco D, Bosh, Autodome, BBV Starcard and USB-CCTV.

M. Alarm-Triggered Dome Events
1. The Digital Video Management System must include alarm-triggered dome events, allowing the operator to configure domes to respond to alarm conditions via Network Client™ or Intellex GUI (using supported dome control handlers). The event can be a motion filter (motion detection, perimeter protection, light change and motion exception), a wired alarm, video loss, or a manually generated alarm. The unit must have the ability to move a single dome, or multiple domes, to preset positions or patterns. This feature must be supported by the dome.

N. Email Support
1. The Digital Video Management System must include the ability to send an email via an email server to anyone, or any group, based upon an event. The events must include, but not necessarily limited to, the following:
   a. System Event
   b. Video Loss
   c. Generated Alarm
   d. Any Filter Alarm

e. Any Input Alarm
f. Individual Camera Alarm

O. API Support
1. The Digital Video Management System shall easily integrate with third party software application using an Application Programmers Interface (API). The manufacturer of the unit shall offer a Software Developers Kit (SDK) to select third party manufactures, in addition to sample modular programs with their source codes in both Visual Basic and Visual C++, allowing programmers to develop their own software to control the unit's functions.
2. The Digital Video Management System's API must be backwards compatible with previous versions of the software equal to or greater than v3.2

P. Recorded Event Search
1. In order to instantly retrieve recorded video of any event, the Digital Video Management System shall use a patented search feature to filter through hours of video to find only the essential events. The operator must have the ability to isolate video containing motion, and find video where perimeters were crossed, lights were turned on or off, alarms were triggered, and numerous additional scenarios.
2. In addition to the standard motion based mode, using advanced video analysis tools, the Digital Video Management System shall enable the user to schedule recording and search for video if the movement of an object meets specified size, speed, direction and Motion Exception criteria.

Q. Covert Camera Operation:
1. The Digital Video Management System shall include the ability to configure up to 15 cameras for "covert" operation, restricting their use to only those who are authorized.

R. Activity Log:
1. To provide for more effective security management, the Digital Video Management System must also allow for audits of the activity log to monitor changes to the settings and configurations. The activity log shall include, but not necessarily be limited to, the following information:
   a. User Name – Login name of the user
   b. Date/Time – Date and Time the action was performed
   c. Access Loc – Whether the action was local to the unit or done through remote software
   d. Category – The actions category
   e. Activity – The action performed within the category
   f. Data – Description of the action
2. The operator shall have the ability to export the entire log file, export the displayed log file, print the log file, or print the displayed log file locally and remotely through Network Client v4.3 software.

S. Antivirus Protection
1. The Digital Video Management System shall be compatible with the leading brands of anti-virus software in order to detect and deactivate malicious software that may attempt to attack the system.

T. Remote Configuration and Management software:
1. The Digital Video Management System must include support for Remote Configuration and Management software to allow a user to remotely configure the unit, view live video, or select video segments by time, date, alarm, or search results. The operator must have the ability to save, annotate, and organize copied video into "incident folders" to aid with investigations.
2. The remote management software must allow for up to 64 live video sessions, allowing the operator to view up to sixty four different cameras, from up to 64 different remote sites, simultaneously.

3. The remote management software shall also allow the exporting of video clips to an .avi file to play on any Microsoft Windows based PC. The software shall have the ability to enhance, print, or convert the individual images to standard formats.
4. The remote management software shall allow an operator to select units, cameras, and timeframes for automatic retrieval of video clips to an operators PC. This allows for downloads to be scheduled during times that network traffic restrictions are not an issue.

U. Playback and Multi-screen Playback
1. The Digital Video Management System shall incorporate playback and multi-screen playback functionality to allow the user to locate and select a single stored image to be enhanced using tools. The tools shall include, but not necessarily be limited to, the following:
   a. Brightness
   b. Contrast
   c. Hue
   d. Saturation
   e. Lightness
   f. Balance Light
   g. Edge Detect
   h. Enhance Light
   i. Noise Reduction
   j. Sharpen
   k. Sharpen More
   l. Smooth
   m. Smooth More
   n. Brightness Chart

V. Browser Client
1. A browser-based viewer (Browser Client) must also be available free of charge, enabling users to host and customize their own website to provide live viewing of the Digital Video Management System through a standard browser interface. Multiple viewers shall have the ability to access video and control domes remotely.

W. Minimum Performance Specifications

Power Supply	100-240 VAC, 50/60 Hz, 3.0/1.5A
Physical Characteristics:	Rack Mount Chassis Version Unit Dimensions (HxWxD) 130 mm (5.125”) High , 429 mm (16.895”) Wide, 546 mm (21.5”) Deep Rack Height Three (3) units Desktop Chassis Version(HxWxD) 130 mm (5.125”) High429 mm (16.895”) Wide546 mm (21.5”) Deep
Environmental Requirements	Operating Temperature 5° to 35° C (41° to 95° F) Humidity 5%-95% RH non-condensing
Regulatory	Immunity EN50130-4 (1996) (An Uninterruptable Power Supply must be used to fully comply with EN50130-4)

X. MATRIX SWITCHER
1. 1. The matrix switcher shall meet the following minimum requirements:
   a. Take multiple camera inputs and route them to multiple monitoring stations.

b. Allow for centralized user management controlling configurations.
c. Provide live viewing of all cameras.
d. Provide P/T/Z, focus, and iris control of all unitized cameras.
e. Be expandable to allow for the addition of multiple cameras and monitoring stations over the life of the system visual identification system by utilizing input and output video and controller cards.
f. Input cards shall allow for the addition of a minimum of four (4) camera inputs per card.
g. Output cards shall allow for the addition of a minimum of eight (8) outputs per card.
h. Have the ability to be programmed either locally or remotely.
i. Remotely operate multiple cameras from multiple stations.
j. Be able to fully interface with a digital video recorder (DVR) for recording of all events.
k. Utilize RS-232 or fiber optic connections for integration with the SMS computer station via a remote port on a network hub.
l. Shall have an alarm interface that is compatible with all associated security subsystems. Alarm inputs shall be via either a relay or an EIA ANSI/EIA/TIA-232-F interface. The interface shall allow for a minimum of 24 alarm inputs and 12 alarm outputs.
m. The switcher response time to an alarm input shall not be less than 200 milliseconds from the time an alarm is sensed until a picture is displayed on a monitor.
n. The switcher shall have a built in buffer to allow for back-log of alarms. These alarms shall be viewable by an operator.
o. Be addressable in the event multiple matrix switchers are connected to the SMS.
p. Be configured, i.e. camera names, monitor names, sequences, alarms and alarm actions, etc. utilizing the configuration program and tools provided by the matrix manufacturer.

2. The matrix switcher shall meet the following minimum input/output requirements:

Camera inputs	16
Video outputs	4
Keyboard/Controller Outputs	4
Alarm inputs	323

3. The matrix switcher will have the following components and technical characteristics:
a. Main Unit:

Functions	Monitor control Camera selection, tour sequence, group sequence, group preset, OSD display, Camera/Receiver control via coaxial or RS-485 cable communication, Recorder control
Alarm control	Alarm event, Alarm Acknowledge, Alarm reset, Alarm suspension, Alarm History Display, Timer event, and Camera event
RS-485 (Camera)Port	6-conductor modular jack x 12 (2- wire or 4-wire communication, With termination switches (MODE 1 to 4))
Extension Port	6-conductor modular jack x 2(With a (EXTENSION 1 IN, OUT) termination switch (TERM: ON, OFF))
Extension Port	37-pin D-sub connector x 2(EXTENSION IN 2 or 3)
Extension Port	37-pin D-sub connector x 2(EXTENSION OUT 2 or 3)

b. Input Board:

Camera Input	1 V P-P/75 Ohm (BNC), composite video signal 0.5 V P- P/75 Ohm data signal and 2.5 V P-P/75 Ohm (25 pin D sub connector x 4)
Alarm Input	N.O. (Normally Open contact) or N.C. (Normally Close contact) selectable x 32 (37 pin D sub connector)

c. Output Board:

Monitor Output	1 V P-P/75 Ohm (BNC)
Alarm Output	Open collector output x 32, Max. 24 VDC, 100 mA
Extension Port	6-conductor modular jack x 2
Serial Port	9-pin D-sub connector x 2

Y. IP Network Encoder
1. The units shall be used for video monitoring and surveillance over IP networks. IP Network Encoder shall encode analog video to MPEG-4 digital video.
2. The encoder shall use MPEG-4 compression for distribution of images over a network.
3. The encoder shall be rack mounted unit.
   The encoder shall include, but not be limited to the following:
   a. The encoder shall use “hybrid” technology in providing both analog and network connections with the purpose of allowing users to integrate existing equipment and digital IP products.
      1) The encoder shall provide one composite video input(s).
      2) The encoder shall provide one Ethernet connection.
   b. The encoder shall have the following digital resolution:
      1) D1: 720x576 (NTSC); 720x480 (PAL)
      2) CIF: 352 x 288 (NTSC); 352 x 240 (PAL)
      3) QCIF: 160 x 144 (NTSC); 160 x 112 (PAL)
   c. The encoder shall have a digital frame rate of up to 30 frames per second (NTSC) at 720x480 resolution or 25 fps (PAL) at 720x586 resolution.
   d. The encoder/decoder shall use the following protocols:
      1) TCP/IP
      2) UDP/IP
      3) DHCP
      4) Multicast
      5) Data Throttle
      6) Heart beat
   e. The encoder shall have the following connectors:
      1) Power connector: 3-pin male – for connecting the external power supply
      2) I/O connector: 16-pin male – for connecting alarm, audio, RS-232, RS-485 input and output
      3) Video I/O connector: SVHS style – for input and output connection of two composite monitors
      4) Ethernet port: RJ-45 – for connecting to a network
   f. The encoder/decoder shall have the following indicators:
      1) Power LED
      2) Link – indicates activity on the Ethernet port
      3) Tx activity
      4) Rx activity
   g. The encoder shall have the following additional specifications:
      1) Video
         a) Video signal input: 1 V p-p ±10% 75 ohms, autosensing
         b) Input termination: 75 ohm

c) Video compression standard: MPEG-4
d) Audio compression standard: MPEG-1 Layer 2

2) Audio
a) Audio input: 315 mV, 40 kOhms, unbalanced
b) Audio output: 315 mV, 600 ohms, unbalanced

3) Electrical
a) External power supply: 100 to 240 VAC
b) Output voltage: 13.5 V, 1.33 A
c) Power consumption: 0.5 W maximum

2.4 DIGITAL BASED VIDEO MANAGEMENT SYSTEM

A. Key Features
1. Open Platform: Open API/SDK, supports seamless integration with third party applications.
2. Multi-server and multi-site video surveillance solution: Unlimited recording of video from IP cameras, IP video encoders and selected DVRs with analog cameras.
3. Optimized Recording Storage Management: Unique data storage and archiving solution that combines superior performance and scalability and cost efficient long-term video storage
4. Wide IP camera and device support: Supports connection of more than 839 IP cameras, IP video encoders and selected DVR models from over 79 different vendors through dedicated device integration
5. ONVIF™ and PSIA compliant: Supports ONVIF™ and PSIA compliant cameras and devices
6. Wide compression technology support: Supports the news compression methods; MPEG4 ASP, MxPEG and H.264, besides MJEPG and MPEG4
7. System configuration wizards: Guides the user through the process of adding cameras, configuring video and recording, adjustment of motion detection and user configuration
8. Sequence Explorer: Displaying sequences and time intervals in thumbnail pre-views, the Sequence Explorer gives unparalleled visual overview of recorded video combined with smooth navigation
9. Overlay buttons: Intuitive control of cameras, camera-integrated devices and other integrated systems- directly from the camera view
10. Independent Playback: Instant and independent playback function allows you to independently playback recorded video for one or more cameras, while in live viewing or playback mode
11. Built-in Video Motion Detection: Independent of camera model and supporting up to 64 cameras simultaneously per server
12. Multiple language support: Let operators use the system in their native language with support for 20 different languages
13. Multi-channel, two-way audio: Communicate with people at gates/entrances or broadcast messages to many people at once with multichannel, two-way audio
14. Fast evidence export: Quickly deliver authentic evidence to public authorities by exporting video to various formats, including video from multiple cameras with viewer, logs, and user notes included

B. Administration Features
1. Single Management Application: A new Management Application provides a consolidated single point management access to Recording Servers.
2. System configuration wizards: Guides the user through the process of adding cameras, configuring video and recording, adjustment of motion detection and user configuration.
3. Automated device discovery: Enables fast discovery of camera devices using methods such as Universal Plug And Play, Broadcast and IP Range scanning.
4. Smart bulk configuration option: Change settings across multiple devices simultaneously and in a very few clicks.

5. Adaptable application behavior: Guides novice users, while expert users can optimize the application for efficient use.
6. Export/import of system and user configuration data: System backup for reliable system operation and fast system recovery. System cloning for efficient rollout of multiple systems with the same, or similar, configuration.
7. Import of off-line configuration data: Enabling off-line editing of configuration data, including camera and device definitions.
8. Automatic system restore points: A 'Restore Point' is created each time a configuration change is confirmed.
9. Enables easy rollback to previously defined system configuration points and enables cancelation of undesired configuration changes and restoration of earlier valid configurations.

C. Integration Options
1. Open Software Development Kit (SDK) makes it possible to video enable your business processes, through seamless integration of third party applications, such as video analytics, access systems, etc.
2. Compatible with Central for alarm overviews and operational status in larger video surveillance installations.
3. Integrate with physical access control systems, alarms, gates, building management systems, etc. using hardware I/O, internal events and TCP/IP events
4. Create, import and use HTML pages for navigation between views or to trigger a Smart Wall preset
5. Develop third party plug-ins for the Smart Client to expand with new functionality

D. Server Modules
1. Recording Server
   a. Simultaneous digital multi-channel video and audio recording and live viewing (relaying).
   b. Two-way audio enables integrated control of microphones and speakers connected to IP devices.
   c. Bandwidth optimized multi-streaming by splitting a single camera video stream to differentiated streams for live view and recording, where each can be optimized independently with respect to frame rate and resolution.
   d. Connectivity to cameras, video encoders and selected DVRs supports MJPEG, MPEG4, MPEG4 ASP*, H.264* and MxPEG.
   e. Auto-detect camera models during setup.
2. Flexible multi-site, multi-server license structure charged per camera.
3. Unlimited number of installed cameras; simultaneous recording and live view of up to 64 cameras per server.
4. Recording technology: secure high speed database holding JPEG images or MPEG4 and MxPEG streams including audio.
5. Recording speed: 30+ frames per second per camera, limited only by hardware.
6. Recording quality depends entirely on camera and video encoder capabilities: no software limitation.
7. Start cameras on live view requests from clients.
8. Unlimited recording capacity with multiple archives possible per day.
9. Hourly to daily database archiving with optional automatic move to network drive saves storage capacity on the local server – with images still available transparently for playback
10. Built-in, real-time, camera independent motion detection (VMD); fully adjustable sensitivity, zone exclusions, recording activation with frame rate speed up, and alert activation through email or SMS.
11. Start recording on event.
12. Client initiated start of recording based on pre-defined recording time and access privileges.
13. Pan Tilt Zoom (PTZ) preset positions, up to 50 per camera.

14. Absolute* and relative PTZ positioning.
15. PTZ go-to preset position on events.
16. Combine PTZ patrolling and go-to positions on events.
17. Set multiple patrolling schedules per camera per day: i.e. different for day/night/weekend.
18. PTZ scanning on supported devices: viewing or recording while moving slowly between PTZ positions.
19. VMD-sensitive PTZ patrolling among selected presets allows sending of Wipe and Wash commands to supported PTZ models.
20. On pre-defined events Matrix remote commands are automatically sent to display live video remotely on computers running the Matrix Monitor or the Smart
21. Client with Matrix Plug-in.
    a. Flexible notification (sound, e-mail and SMS) and camera patrolling scheduling, triggered by time or event.

E. Recording Server Manager
1. Local console management of the Recording Server accessible from the notification area.
2. Start and stop Recording Server service.
3. Access to Recording Server configuration settings.
4. Access to Recording Server help system.
5. View system status and log information.

F. Image Server
1. Remote access for Smart and Remote Clients.
2. Built-in web server for download and launch of clients and plug-ins.
3. Set up one Master and multiple Slave Servers.
4. Authenticate access based on Microsoft Active Directory user account, or user name and password.
5. Authorize access privileges per Microsoft Active Directory user account/group, user profile or grant full access.
6. User profiles control access to: Live view, PTZ, PTZ presets, Output control, Events, Listen to microphone, Talk to speaker, Manual recording; Playback, AVI export, JPG export, DB export, Sequences, Smart Search and audio. As well as Set up views, Edit private views and Edit shared public views.
7. Audit logs of exported evidence by user and file.
8. Audit logs of client user activity by time, locations and cameras.

G. Recording Viewer
1. Playback recorded video and audio locally on the

H. Recording Server.
1. View up to 16 cameras time-synched during playback.
2. Scrollable activity timeline with magnifying feature.
3. Instant search on recordings based on date/time and activity/alarm (Video Motion Detection).
4. ‘Smart Search’ for highlighted image zones and objects.
5. Evidence can be generated as a printed report, a JPEG image, an AVI film or in the native database format.
6. Export audio recordings in WAV or AVI format.
7. Export video digitally zoomed to view area of interest only and to minimize export footprint size.
8. Export ‘Evidence CD’ containing native database and Recording Viewer for instant, easy viewing by authorities.
9. Encryption & password protection option for exported recordings and files.
10. Ability to add comments to exported evidence, also encrypted.
11. Option to send email.
12. De-interlacing of video from analog cameras.
13. IPIX technology for PTZ in 360° recorded images.

I. PDA Server
   1. Remote access for PDA Client.
   2. Handle login and session requests between PDA clients and Image Server.
   3. Resize video surveillance images to fit the screen layout of PDA Client.

J. Smart Client Module
   1. Smart Client includes all the features of Remote Client plus more:
   2. Installed per default on Recording Server for local viewing and playback of video and audio.
   3. Start recording on cameras for a pre-defined time (default 5 minutes). Subject to privileges set by administrator.
   4. • Independent Playback capability allows for instant playback of recorded video for one or more cameras, while in live and playback mode
   5. Live view digital zoom allows zoomed-out recordings while the operator digitally can zoom in to see details.
   6. 'Update On Motion Only' optimizes CPU usage by letting motion detection control whether the image should be decoded and displayed or not. The visual effect is a still image in the view until motion is detected.
   7. Shared and private camera views offer 1x1 up to 10x10 layouts in addition to asymmetric views.
   8. Views optimized for both 4:3 and 16:9 screen ratios.
   9. Multiple computer monitor support with a main window and any number of either windowed or full screen views.
   10. Hotspot function for working in details with a camera selected from a view containing multiple cameras.
   11. Carousel function allows a specified view to rotate between pre-defined cameras with individual timing and order with multiple appearances. Carousel function can be controlled allowing the operator to pause carousel function and to switch to previous or next camera.
   12. Overlay buttons provides intuitive control of cameras, camera-integrated devices and other integrated systems- directly from the camera view
   13. Matrix function to view live video from multiple cameras through the Image Server in any view layout with customizable rotation path, remotely controlled by Smart
   14. Clients or Recording Servers sending Matrix remote commands
   15. Send Matrix remote commands to display live video remotely on computers running the Matrix Monitor or the Smart Client with Matrix Plug-in.
   16. Cameras' built-in audio sources available in live and in playback.
   17. Separate pop-up window displaying sequences and time intervals in thumbnail pre-views, the Sequence Explorer gives unparalleled visual overview of recorded video combined with smooth navigation
   18. Presents recorded sequences for individual cameras, or all cameras in a view
   19. Seamlessly available in both Live and Playback modes
   20. Smooth navigation with sliding preview and "drag-andthrow" function for video thumbnails
   21. Instant playback of video sequences
   22. Application Options allows users to adapt the layout and personalize the application to their particular preferences

K. Remote Client
   1. View live video or playback recordings for 1-16 cameras simultaneously; from the same or different servers.
   2. Advanced video navigation including fast/slow playback, jump to date/time, single step and video motion search.
   3. Individual views can be user-defined in various layouts: view or playback camera images from multiple servers simultaneously in the same view.
   4. Shared views can be managed centrally via the server with admin/user rights and user groups.

5. Import static or active HTML maps for fast navigation to cameras and good premise overviews.
6. Control output port relay operation, for example control of gates.
7. Quick overview of sequences with detected motion and preview window.
8. Quick overview of events/alerts.
9. Control PTZ cameras remotely, also using preset positions.
10. Remote PTZ Point-and-Click control
11. Remote PTZ zoom to a marked rectangle.
12. Take manual control over a PTZ camera that runs a patrolling scheme; after a timeout with no activity the camera reverts to its scheduled patrolling.
13. IPIX 1x2 or 2x2 'Quad View' for viewing all 360° at once.
14. Optional video compression in streaming from server to client gives better use of bandwidth.
15. Create AVI files or save JPEG images.
16. Print incident reports with free-text user comments.
17. System logon using user name and password.
18. System logon using Microsoft Active Directory user accounts.

L. PDA Client
1. View live or playback video from a single server or from multiple servers in half-screen or full-screen formats.
2. In live view you can control Pan/Tilt/Zoom cameras manually or use preset positions, and control the cameras' output relays to trigger external actions like opening doors or gates, turning on lights, etc.
3. To find recordings, you can jump to specific time/date or to next detected motion, or use motion detection sequence overviews.
4. When viewing recordings, you can playback at variable speed or single step image by image.
5. The PDA client shall connect to the VMS server using any IP connection; typically wireless LAN, GPRS, etc.
6. Video compression from the server to PDA optimizes bandwidth usage.
7. System logon using user name and password.

M. Matrix Monitor
1. Virtual Matrix showing live video directly from up to 4 cameras at a time triggered remotely by Matrix remote commands.
2. Camera view shifts by FIFO (first-in-first-out)
3. Multiple events can control a single Matrix monitor and single events can control multiple monitors.

N. Minimum System Requirements VMS Server
1. HW Platform:
   a. Minimum 2.4 GHz CPU and 1 GB RAM (2.4 GHz dual core processor and 2 GB RAM or more recommended).
   b. Minimum 1 GB disk space available, excluding space needed for recordings.
2. OS:
   a. Microsoft® Windows® XP Professional (32 bit or 64 bit*), Windows Server 2003 (32 bit or 64 bit*), Windows Server 2008 R1/R2 (32 bit or 64 bit*), Windows Vista™ Business (32 bit or 64 bit*), Windows Vista Enterprise (32 bit or 64 bit*), Windows Vista Ultimate (32 bit or 64 bit*), Windows 7 Professional (32 bit or 64 bit*), Windows 7 Enterprise (32 bit or 64 bit*) and Windows 7 Ultimate (32 bit or 64 bit*).
3. Software:
   a. Microsoft .NET 3.5 Framework SP1, or newer.
   b. DirectX 9.0 or newer required to run Playback Viewer application.

O. Minimum System Requirements PDA Server
1. HW Platform:

a. Minimum 2.4 GHz CPU and 1 GB RAM (2.4 GHz dual core processor and 2 GB RAM or more recommended).
b. Minimum 1 GB disk space available.

2. OS:
   a. Microsoft Windows XP Professional (32 bit or 64 bit*), Windows Server 2003 (32 bit or 64 bit*).
3. Software:
   a. Microsoft .NET 2.0 (not compatible with newer versions). Internet Information Server (IIS) 5.1.

P. Minimum System Requirements VMS Client
1. HW Platform:
   a. Minimum 2.4 GHz CPU, 1 GB RAM (more powerful CPU and higher RAM recommended for Smart Clients running high number of cameras and multiple views and displays).
2. Graphics Card:
   a. AGP or PCI-Express, minimum 1024 x 768 (1280 x 1024 recommended), 16 bit colors.
3. OS:
   a. Microsoft Windows XP Professional (32 bit or 64 bit*), Windows Server 2003 (32 bit or 64 bit*), Windows Server 2008 R1/R2 (32 bit or 64 bit*), Windows Vista Business (32 bit or 64 bit*), Windows Vista Enterprise (32 bit or 64 bit*), Windows Vista Ultimate (32 bit or 64 bit*), Windows 7 Professional (32 bit or 64 bit*), Windows 7 Enterprise (32 bit or 64 bit*) and Windows 7 Ultimate (32 bit or 64 bit*).
4. Software:
   a. DirectX 9.0 or newer required to run Playback Viewer application.
   b. Microsoft .NET 3.5 Framework SP1, or newer.

Q. Minimum System Requirements VMS Remote Client
1. HW Platform:
   a. Minimum 2.4 GHz CPU, RAM 1 GB (2 GB or higher recommended on Microsoft Windows Vista).
2. OS:
   a. Microsoft Windows XP Professional (32 bit or 64 bit*), Windows Server 2003 (32 bit or 64 bit*), Windows Server 2008 R1/R2 (32 bit or 64 bit*), Windows Vista Business (32 bit or 64 bit*), Windows Vista Enterprise (32 bit or 64 bit*) and Windows Vista Ultimate (32 bit or 64 bit*), Windows 7 Professional (32 bit or 64 bit*), Windows 7 Enterprise (32 bit or 64 bit*) and Windows 7 Ultimate (32 bit or 64 bit*).
3. Software:
   a. DirectX 9.0 or newer required to run Playback Viewer Application Microsoft Internet Explorer 6.0, or newer, 32 bit version required

R. Licensing Structure
1. Base Server License
   a. An VMS Base Server license is mandatory for installing the product.
2. The Base Server license contains:
   a. Unlimited numbers of Recording Server licenses
   b. Unlimited numbers of Smart Clients, Remote Clients, PDA Clients and Matrix Monitor licenses
3. Camera License
   a. To connect to a camera, a Device License per camera channel is required
   b. In total, for all copies of the product installed under a given Base Server license, the product may only be used with as many cameras as you have purchased camera licenses for • Video encoders and DVRs with multiple analog cameras require a license per channel to operate

c. Camera Licenses can be purchased in any numbers. To extend the installation with additional Camera Licenses, the Base Server License number (SLC) is required when ordering.

4. Client License:
   a. All client modules are not licensed and can be installed and used on any number of computers.

S. IP NETWORK DECODER
1. The unit shall be used for video monitoring and surveillance over IP networks. Network decoder shall decode MPEG-4 digital video to analog video.
2. The decoder shall use MPEG-4 compression for efficient distribution of images over a network.
3. The decoder shall be available as a standalone unit that can be horizontally or vertically mounted.
4. The decoder shall include, but not be limited to the following:
   a. The decoder shall use “hybrid” technology in providing both analog and network connections with the purpose of allowing users to integrate existing equipment and digital IP products.
      1) The decoder shall provide one composite video input and output connection.
      2) The decoder shall provide one Ethernet connection.
   b. The decoder shall have the following digital resolution:
      1) D1: 720x576 (NTSC); 720x480 (PAL)
      2) CIF: 352 x 288 (NTSC); 352 x 240 (PAL)
      3) QCIF: 160 x 144 (NTSC); 160 x 112 (PAL)
   c. The decoder shall have a digital frame rate of up to 30 frames per second (NTSC) at 720x480 resolution or 25 fps (PAL) at 720x586 resolution.
   d. The decoder shall use the following protocols:
      1) TCP/IP
      2) UDP/IP
      3) DHCP
      4) Multicast
      5) Data Throttle
      6) Heart beat
   e. The decoder shall have the following connectors:
      1) Power connector: 3-pin male – for connecting the external power supply
      2) I/O connector: 16-pin male – for connecting alarm, audio, RS-232, RS-485 input and output
      3) Video I/O connector: SVHS style – for input and output connection of two composite monitors
      4) Ethernet port: RJ-45 – for connecting to a network
   f. The decoder shall have the following indicators:
      1) Power LED
      2) Link – indicates activity on the Ethernet port
      3) Tx activity
      4) Rx activity
5. The decoder shall have the following additional specifications:
   a. Video
      1) Video signal output: 1 V p-p into 75 ohms
      2) Input termination: 75 ohm
      3) Video compression standard: MPEG-4
      4) Audio compression standard: MPEG-1 Layer 2
   b. b. Audio
      1) Audio input: 315 mV, 40 kOhms, unbalanced
      2) Audio output: 315 mV, 600 ohms, unbalanced
   c. Electrical
      1) External power supply: 100 to 240 VAC

2) Output voltage: 13.5 V, 1.33 A
3) Power consumption: 0.5 W maximum

2.5 VIDEO DISPLAY EQUIPMENT

A. Video Display Equipment
1. Will consist of color monitors and shall be EIA 375A compliant.
2. Shall be able to display analog, digital, and other images in either NTSC or MPEG format associated with the operation of the Security Management System (SMS).
3. Shall:
   a. Have front panel controls that provide for power on/off, horizontal and vertical hold, brightness, and contrast.
   b. Accept multiple inputs, either directly or indirectly.
   c. Have the capabilities to observe and program the VASS System.
   d. Be installed in a manner that they cannot be witnessed by the general public.

B. Color Video Monitors Technical Characteristics:

Sync Format	PAL/NTSC
Display Tube	90° deflection angle
Horizontal Resolution	250 TVL minimum, 300 TVL typical
Video Input	1.0 Vp-p, 75 Ohm
Front Panel Controls	Volume, Contrast, Brightness, Color
Connectors	BNC

C. Liquid Crystal Display (LCD) Flat Panel Display Monitor

D. The 17-inch color LCD monitor shall have a flat screen and 17-inch diagonal viewing area and consists of an LCD panel, bezel, and stand.

E. The monitor shall meet or exceed the following specifications:
1. The monitor shall incorporate a 17.1-inch active matrix TFT LCD panel.
   a. The pixel pitch of the monitor's LCD panel shall be 0.264 mm horizontal and 0.264 mm vertical.
   b. The monitor shall have a maximum resolution of 500 television lines.
   c. The contrast ratio shall be 500:1.
   d. The typical brightness shall be 250 cd/m²
   e. The monitor shall display at least 16.7 million colors.
   f. The light source for the LCD panel shall have a lifetime of 50,000 hours.
   g. The scan frequency horizontal shall be 30 K to 80 KHz and the scan frequency vertical shall be 56 to 75 Hz.
   h. The viewing angle for the monitor shall be 170 degrees horizontal and 170 degrees vertical.
2. The monitor shall have automatic NTSC or PAL recognition.
3. The monitor shall have a picture-in-picture function.
4. The monitor shall use the following signal connectors:
   a. Video 1.0 V peak-to-peak at 75 ohms
   b. BNC in/out
   c. Y/C (S-video) in/out
   d. Audio in/out
   e. VGA 15-pin D-Sub
5. The monitor shall have one/two audio speaker(s).
   a. The speaker shall be 0.5 W minimum.
6. The monitor shall have the following front control panel buttons:
   a. Power on/off

b. LED indicator
c. Mode
d. Increase (volume)
e. Decrease (volume)
f. Up (contrast adjustment)
g. Down (brightness adjustment)
h. Menu
i. Auto

7. The monitor shall have the following options for adjustment in an onscreen display menu:
   a. Color
   b. Tint
      1) NTSC mode only
         a) Brightness
         b) Contrast
         c) Sharpness
         d) Volume
         e) Language
         f) Scan
         g) Color Temp
         h) H-Position
         i) Recall

F. The electrical specifications for the monitor shall be as follows:
   1. Input voltage shall be 12 VDC/3 A.
   2. Power consumption shall be 50 W maximum.

G. The environmental specifications for the monitor shall be as follows:
   1. Operating temperature shall be 32 to 104 degrees Fahrenheit or 0 to 40 degrees Celsius.
   2. Operating humidity shall be 10 to 85 percent.

H. The physical specifications for the monitor shall be as follows:

I. The monitor shall conform to these compliance standards:
   1. FCC
   2. CE (EMC/LVD)
   3. UL

2.6 CONTROLLING EQUIPMENT

A. Shall be utilized to call up, operate, and program all cameras associated VASS System components.

B. Will have the ability to operate the cameras locally and remotely. A matrix switcher or a network server shall be utilized as the VASS System controller.

C. The controller shall be able to fit into a standard 47.5 cm (19 inch) equipment rack.

D. Control and programming keyboards shall be provided with its own type of switcher. All keyboards shall:
   1. Be located at each monitoring station.
   2. Be addressable for programming purposes.
   3. Provide interface between the operator and the VASS System.
   4. Provide full control and programming of the switcher.
   5. Have the minimum following controls:
      a. programming
      b. switching
      c. lens function
      d. P/T/Z
      e. environmental housing

f. annotation

2.7 VIDEO CAMERAS

A. The cameras shall be high-resolution color video cameras with wide dynamic range capturing capability.

B. The camera shall meet or exceed the following specifications:
1. The image capturing device shall be a 1/3-inch image sensor designed for capturing wide dynamic images.
   a. The image capturing device shall have a separate analog-to-digital converter for every pixel.
   b. The image capturing device shall sample each pixel multiple times per second.
   c. The dynamic range shall be 95 dB typical and 120 dB maximum.
2. The camera shall optimize each pixel independently.
3. The camera shall have onscreen display menus for programming of the camera's settings.
4. The signal system shall be NTSC.

C. The camera shall have composite video output.

D. The camera shall come with a manual varifocal lens.

E. The video output shall be composite: 1.0 volts peak-to-peak at 75-ohm load.

F. Fixed Color Camera
1. The camera shall be a high-resolution color video camera with wide dynamic range capturing capability.
2. Comply with UL 639.
3. Pickup Device: 1/3 CCD interline transfer.
4. Signal-to-Noise Ratio: Not less than 50 dB, with the camera AGC off.
5. With AGC, manually selectable on or off.
6. Manually selectable modes for backlight compensation or normal lighting.
7. Scanning Synchronization: Determined by external synch over the coaxial cable. Camera shall revert to internally generated synchronization on loss of external synch signal.
8. White Balance: Auto-tracing white balance, with manually selectable fixed balance option.
9. Fixed Color Cameras Technical Characteristics:

Pickup device	1/3" interline transfer CCD
Total pixels	NTSC: 811(H) x 508(V)
Effective pixels	NTSC: 768(H) x 494(V)
Resolution	500 TV lines
Sync. System	Internal Sync
Scanning system	NTSC: 525 Lines/60 Fields
S/N ratio	More than 48 dB
Electronic shutter	Auto 1/60 (1/50) ~1/100,000 sec.
Min. illumination	0.2 lux F2.0
Video output	Composite 1.0 Vp-p/75 ohm
White balance	Auto
Automatic gain control	ON
Frequency horizontal	NTSC: 15.734 KHz

Frequency vertical	NTSC: 59.94Hz
Lens type	Board lens/DC/AI varifocal lens
Focal length	3-12mm
Power source	DC12V/500mA or AC24/500mA
Power consumption	3W (Max)

10. Fixed color camera shall be enclosed in dome and have board mounted varifocal lens.
11. Camera accessories shall include:
    a. Surface mount adapter
    b. Wall mount adapter
    c. Flush mount adapter

2.8 AUTOMATIC COLOR DOME CAMERA - ANALOG

A. The camera shall be a high-resolution color video camera with wide dynamic range capturing capability.

B. Comply with UL 639.

C. Pickup Device: 1/3 CCD interline transfer.

D. Horizontal Resolution: 480 lines.

E. Signal-to-Noise Ratio: Not less than 50 dB, with the camera AGC off.

F. With AGC, manually selectable on or off.

G. Sensitivity: Camera shall deliver 1-V peak-to-peak video signal at the minimum specified light level. The illumination for the test shall be with lamps rated at approximately 2200-K color temperature, and with the camera AGC off.

H. Manually selectable modes for backlight compensation or normal lighting.

I. Pan and Tilt: Direct-drive motor, 360-degree rotation angle, and 180-degree tilt angle. Pan-and-tilt speed shall be variable controlled by operator. Movement from preset positions shall be not less than 300 degrees per second.

J. Preset positioning: 64 user-definable scenes. Controls shall include the following:
    1. In "sequence mode," camera shall continuously sequence through preset positions, with dwell time and sequencing under operator control.
    2. Motion detection shall be available at each camera position.

K. Scanning Synchronization: Determined by external synch over the coaxial cable. Camera shall revert to internally generated synchronization on loss of external synch signal.

L. White Balance: Auto-tracing white balance, with manually settable fixed balance option.

M. Motion Detector: Built-in digital.

N. Dome shall support multiplexed control communications using coaxial cable recommended by manufacturer.

O. Automatic Color Dome Camera Technical Characteristics:

Effective Pixels	768 (H) x 494 (V)
Scanning Area	1/4-type CCD
Synchronization	Internal/Line-lock/Multiplexed Vertical Drive (VD2)
Video Output	1.0 vp-p NTSC composite/75 ohm
H. Resolution	570-line at B/W, or 480-line at color imaging

Signal-to-noise Ratio	50dB (AGC off, weight on)
Super Dynamic II	64 times (36dB) (selectable on/off)
Minimum Illumination	0.06 lx (0.006 fc) at B/W, 1 lx(0.1 fc)
Zoom Speed	Approx. 2.1s (TELE/WIDE) in sequence mode
Focus Speed	Approx. 2s (FAR/NEAR) in sequence mode
Iris	Automatic (Open/Close is possible)/manual
Maximum Aperture Ratio	1:1.6 (Wide) ~ 3.0 (Tele)
Focal Length	3.79 ~ 83.4 mm
Angular Field of View	H 2.6° ~ 51.7° V 2.0° ~ 39.9°
Electronic Shutter	1/60 (off), 1/100, 1/250, 1/500, 1/1,000, 1/2,000, 1/4,000, 1/10,000 s
Zoom Ratio	Optical 22x w/10x electronic zoom
Iris Range	F1.6 ~ 64, Close
Panning Range	360° endless
Panning Speed	Manual: Approx. 0.1°/s ~ 120°/s 16 steps
Tilting Range	0 ~ 90° (Digital Flip off), 0 ~180° (Digital Flip on)
Tilting Speed	Manual: Approx. 0.1°/s ~ 120°/s. 16 steps
Pan/Tilt	Manual/Sequential position/Auto Pan
Controls	Pan/Tilt, Lens, 64 Preset Positions, Home Position
Video Connector	BNC
Controller I/F	Multiplex-coaxial

P. Camera accessories shall include:
   1. Surface mount adapter
   2. Wall mount adapter
   3. Flush mount adapter

Q. Indoor/Outdoor Fixed Mini Dome System (IP)
   1. The indoor/outdoor fixed mini dome system shall include a built-in 100Base-TX network interface for live streaming to a standard Web browser.
   2. The network mini dome shall be integrated into the back box design to accept multiple camera options without modification. The network mini dome shall operate in open architecture connectivity for third-party software recording solutions.
   3. The indoor/outdoor fixed mini dome system shall meet or exceed the following design and performance specifications.

Imaging Device	1/3-inch imager
Picture Elements	NTSC/PAL 720 (H) x 540 (V) 720 (H) x 540 (V)
Dynamic Range	102 dB typical/120 dB maximum (DW/CW models only)
Scanning System	2:1 interlace (progressive option on CW/DW models only

Synchronization	Internal
Electronic Shutter Range	Auto (1/15–1/22,000)
Lens Type	Varifocal with auto iris
Format Size	1/3-inch
Focal Length	3.0 mm–9.5 mm 9.0 mm–22.0 mm
Operation	Iris Auto (DC-drive) Focus Manual Zoom Manual
Minimum Illumination	Color (day): 0.8 lux, SENS 8X: 0.2 lux, B-W (night): 0.08 lux, SENS 8X: 0.02 lux (F1.0, 40 IRE, AGC on, 75% scene reflectance) Color (day): 0.15 lux, B-W (night): 0.015 lux (F1.0, 40 IRE, AGC on, 75% scene reflectance) Color (day): 0.8 lux, SENS 8X: 0.2 lux (F1.0, 40 IRE, AGC on, 75% scene reflectance) 0.2 lux (F1.0, 40 IRE, AGC on, 75% scene reflectance)
Compression	MPEG-4, MJPEG in Web viewing mode
Video Streams	3, simultaneous
Video Resolutions	NTSC PAL 4CIF 704 x 480 704 x 576 2CIF 704 x 240 704 x 288 CIF 352 x 240 352 x 288 QCIF 176 x 120 176 x 144
Bit Rate	Configurable, 20 kbps to 2 Mpbs per stream
Web User Interface	
Environment	Low temperature, indoor/outdoor
Connectors	RJ-45 for 100BASE-TX, Auto MDI/MDI-X
Cabling	CAT5 cable or better for 100BASE-TX
Input Voltage	24 VAC (18-36) or PoE input voltage
Power Consumption	7.5 Watts, 13 Watts with heaters 24VAC: 0.5 Amps, 0.9 Amps with heaters
Alarm Input	10 VDC maximum, 5 mA maximum
Alarm Output	0 to 15 VDC maximum, 75 mA maximum
Service Connector	Internal to housing for 2.5 mm connector for NTSC/PAL video outputs
Service Connector	3-conductor, 2.5 mm connector for video output to optional (IS-SC cable)
Pan/Tilt Adjustment	Pan 360°, tilt 80° (20° to 100° range), and rotation 360°

Light Attenuation	smoked bubble, f/1.5 light loss; clear bubble, zero light loss
CERTIFICATIONS	CE, Class B UL Listed Meets NEMA Type 4X and IP66 standards

4. Accessories
   a. Pendant mount
   b. Wall mount for pendant
   c. Corner adapter for wall mount
   d. Pole adapter for wall mount

R. Megapixel High Definition Integrated Digital Network Camera
1. The network camera shall offer dual video streams with up to 3.1 megapixel resolution (2048 x 1536) in progressive scan format.
2. An alarm input and relay output shall be built in for integration with hard wired external sensors.
3. The network camera shall be capable of firmware upgrades through a network using a software-based device utility.
4. The network camera shall offer auto back focus (ABF) functionality through a push button on the camera. ABF parameters shall also be configurable through a standard Web browser interface.
5. The network camera shall offer a video output port providing an NTSC/PAL analog video output signal for adjusting field of view and focus at the camera.
6. The network camera shall provide advanced low-light capabilities for color and day/night models with sensitivity down to 0.12 lux in color and 0.03 lux in black-white (B-W).
7. The network camera shall have removable IR cut filter mechanism for increased sensitivity in low-light installations. The sensitivity of IR cut filter removal shall be configurable through a Web browser.
8. The network camera shall support two simultaneous, configurable video streams. H.264 and MJPEG compression formats shall be available for primary and secondary streams with selectable unicast and multicast protocols. The streams shall be configurable in a variety of frame rates and bit rates.
9. The network camera shall support industry standard Power over Ethernet (PoE)
10. IEEE 802.3af to supply power to the camera over the network. The network camera shall also offer a 24 VAC power input for optional use.
11. The network camera shall use a standard Web browser interface for remote administration and configuration of camera parameters.
12. The network camera shall have a window blanking feature to conceal user-defined privacy areas that cannot be viewed by an operator. The network camera shall support up to four blanked windows. A blanked area shall appear on the screen as a solid gray window.
13. The network camera shall support standard IT protocols.
14. The network camera shall support open architecture best practices with a published API available to third-party network video recording and management systems.
15. Megapixel High Definition Integrated Digital Network Camera Technical Specifications:

Imaging Device	1/3-inch, effective
Imager Type	CMOS, Progressive scan
Maximum Resolution	2048 x 1536
Signal-to-Noise Ratio	50 dB
Auto Iris Lens Type	DC drive

Electronic Shutter Range	1~1/100,000 sec
Wide Dynamic Range	60 dB
White Balance Range	2,000° to 10,000°K
Sensitivity	f/1.2; 2,850K; SNR, 24dB Color (1x/33ms) 0.50 lux Color SENS (15x/500 ms) 0.12 lux Mono SENS (15x/500 ms) Mono (1x/33ms)0.25 lux 0.03 lux
Dome Attenuation	Clear Zero light loss Smoke f/1.0 light loss
Compression	H.264 in base profile and MJPEG
Video Streams	Up to 2 simultaneous streams, the second Stream variable based on the setup of the primary stream
Frame Rate	Up to 30, 25, 24, 15, 12.5, 12, 10, 8, 7.5, 6.5, 4, 3, 2, and 1 (depending upon coding, resolution, and stream configuration
Available Resolutions	3.1 MPx2048 x 1536; 4:3 aspect ratio; 2.0 ips max., 10.0 Mbps bit rate for MJPEG; 3.0 ips max., 2.6 Mbps bit rate H.264 2.1 MPx1920 x 1080; 16:9 aspect ratio: 15.0 ips max.,10.0 Mbps bit rate for MJPEG; 5.0 ips max., 2.7 Mbps bit rate H.264 3.1.9 MPx1600 x 1200; 4:3 aspect ratio; 15.0 ips max.,10.0 Mbps bit rate for MJPEG; 6.0 ips max., 2.6 Mbps bit rate H.264 1.3 MPx1280 x 1024; 5:4 aspect ratio; 15.0 ips max.,10.0 Mbps bit rate for MJPEG; 8.0 ips max., 2.5 Mbps bit rate H.264 1.2 MPx1280 x 960; 4:3 aspect ratio; 15.0 ips max., 9.8 Mbps bit rate for MJPEG; 9.8 ips max., 8.5 Mbps bit rate H.264 6.0.9 MPx1280 x 720; 16:9 aspect ratio; 30.0 ips max.,10.0 Mbps bit rate for MJPEG; 12.5 ips max., 2.5 Mbps bit rate H.264 0.5 MPx800 x 600; 4:3 aspect ratio; 30.0 ips max., 5.8 Mbps bit rate for MJPEG; 25.0 ips max., 2.0 Mbps bit rate H.264 8.0.3 MPx640 x 480; 4:3 aspect ratio; 30.0 ips max., 3.7 Mbps bit rate for MJPEG; 30.0 ips max.,1.6 Mbps bit rate H.264 0.1 MPx320 x 240; 4:3 aspect ratio; 30.0 ips max., 0.9 Mbps bit rate for MJPEG; 30.0 ips max., 0.4 Mbps bit rate H.264 Additional640 x 512, 640 x 352, 480 x 368, 480 x 272, 320 x 256, 320 x 176
Supported Protocols	TCP/IP, UDP/IP (Unicast, Multicast IGMP), UPnP, DNS, DHCP, RTP, RTSP, NTP,IPv4, SNMP, QoS, HTTP, HTTPS, LDAP(client),

	SSH, SSL, STMP, FTP, MDNS(Bonjour), and 802.1x (EAP)
Security Access	Password protected
Software Interface	Web browser view and setup, up to 16 cameras
Connectors	RJ-45 for 100Base-TX, Auto MDI/MDI-X
Cable	Cat5 cable or better for 100Base-TX
Input Voltage	24 VAC or PoE (IEEE802.3af class 3)
Power Consumption	6 W
Current Consumption	PoE 200 mA maximum 24 VAC, 295 mA nominal; 390 mA maximum
Alarm Input	10 VDC maximum, 5 mA maximum
Alarm Output	0 to 15 VDC maximum, 75 mA maximum
Lens Mount	CS mount, adjustable
Pan/Tilt Adjustment	Pan 368° Tilt 160° (10° to 170°) Rotate 355°

16. Accessories
    a. Pendant mount
    b. Wall mount for pendant
    c. Corner adapter for wall mount
    d. Pole adapter for wall mount

17. Recommended Lenses
    a. Megapixel lens, varifocal, 2.2~6.0 mm, f/1.3~2.0
    b. Megapixel lens, varifocal, 2.8~8.0 mm,f/1.1~1.9
    c. Megapixel lens, varifocal, 2.8~12.0 mm, f/1.4~2.7
    d. Megapixel lens, varifocal, 15.0~50.0 mm, f/1.5~2.1

S. Indoor/Outdoor Camera Dome System
1. The indoor/outdoor camera dome system shall include a built-in 100Base-TX network interface for live streaming to a standard Web browser.
2. The indoor/outdoor camera dome system shall operate in openv architecture connectivity for third-party software recording solutions.
3. The indoor/outdoor VASS camera dome system shall be a discreet camera dome system consisting of a dome drive with a variable speed/high speed pan/tilt drive unit with continuous 360° rotation; 1/4-inch high resolution color, or color/black-white CCD camera; motorized zoom lens with optical and digital zoom; auto focus; and an enclosure consisting of a back box, lower dome, and a quick-install mounting.
4. Indoor/Outdoor fixed dome system technical specifications:

Imaging Device	1/4-inch CCD
Picture Elements	NTSC/PAL 768 x 494/752 x 582
Dynamic Range	102 dB typical/120 dB maximum (DW/CW models only)
Scanning System	2:1 interlace
Synchronization	Internal

Electronic Shutter Range	Auto (1/15–1/22,000)
Lens Type	Lens f/1.4 (focal length, 3.4~119 mm; 35X optical zoom, 12X digital zoom)
Focus	Automatic with manual override
Pan Speed	Variable between 400□ per second continuous pan to 0.1° per second
Vertical Tilt	Unobstructed tilt of +2□ to -92□
Manual Control Speed	Pan speed of 0.1□ to 80□ per second, and pan at 150□ per second in turbo mode. Tilt operation shall range from 0.1□ to 40□ per second
Automatic Preset Speed	Pan speed of 400□ and a tilt speed of 200□ per second
Presets	256 positions with a 20-character label available for each position; programmable camera settings, including selectable auto focus modes, iris level, LowLight™ limit, and backlight compensation for each preset; command to copy camera settings from one preset to another; and preset programming through control keyboard or through dome system on-screen menu 128 positions with a 20-character label available for each position; programmable camera settings, including selectable auto focus modes, iris level, LowLight limit, and backlight compensation for each preset; command to copy camera settings from one preset to another; and preset programming through control keyboard or through dome system on-screen menu
Preset Accuracy	± 0.1
Zones	8 zones with up to 20-character labeling for each, with the ability to blank the video in the zone
Limit Stops	Programmable for manual panning, auto/random scanning, and frame scanning
Alarm Inputs	7
Alarm Output Programming	Auxiliary outputs can be alternately programmed to operate on alarm
Alarm Action	Individually programmed for 3 priority levels, initiating a stored pattern or going to a preassigned preset position
Resume after Alarm	After completion of alarm, dome returns to previously programmed state or its previous position

Window Blanking	8, four-sided user-defined shapes, each side with different lengths; window blanking setting to turn off at user-defined zoom ratio; window blanking set to opaque gray or translucent smear; blank all video above user-defined tilt angle; blank all video below user-defined tilt angle
Patterns	8 user-defined programmable patterns including pan/tilt/zoom and preset functions, and pattern programming through control keyboard or through dome system on-screen menu
Scheduler	Internal scheduling system for programming presets, patterns, window blanks, alarms, and auxiliary functions based on internal clock settings
Auto Flip	Rotates dome 180° at bottom of tilt travel
Password Protection	Programmable settings with optional password protection
Compass Display	On-screen display of compass heading and user-definable compass setup
Camera Title Overlay	20 user-definable characters on the screen camera title display
Video Output Level	User-selectable for normal or high output levels to compensate for long video wire runs
Motion Detection	User-definable motion detection settings for each preset scene, can activate auxiliary outputs, and contains three sensitivity levels per zone
Electronic Image Stabilization	Electronic compensation for external vibration sources that cause image blurring; user selectable for 2 frequency ranges, 5 Hz (3-7 Hz) and 10 Hz (8-12 Hz)
Wide Dynamic Range	128X
Video Output	1 Vp-p, 75 ohms
Minimum Illumination	NTSC/EIA 0.55 lux at 1/60 sec shutter speed (color), 0.063 lux at 1/4 sec shutter speed (color), 0.00018 lux at 1/2 sec shutter speed (B-W) PAL/CCIR 0.55 lux at 1/50 sec shutter speed (color), 0.063 lux at 1/3 sec shutter speed (color), 0.00018 lux at 1/1.5 sec shutter speed (B-W)
Compression	MPEG-4, MJPEG
Video Streams	3, simultaneous
Video Resolutions	NTSC PAL 4CIF 704 x 480 704 x 576

	2CIF 704 x 240 704 x 288 CIF 352 x 240 352 x 288 QCIF 176 x 120 176 x 144
Bit Rate	Configurable, MPEG-4 30 ips, 2 Mbps for primary stream, MJPEG 15 ips, 3 Mbps, MJPEG
Web User Interface	
Environment	Low temperature, indoor/outdoor
Connectors	RJ-45 for 100BASE-TX, Auto MDI/MDI-X
Cabling	CAT5 cable or better for 100BASE-TX
Input Voltage	T. 18 to 32 VAC; 24 VAC nominal U. 22 to 27 VDC; 24 VDC nominal
Power Consumption	24 VAC 23 VA nominal (without heater);73 VA nominal (with heater) 24 VDC 0.7 A nominal (without heater);3 A nominal (with heater)
Alarm Input	7
Alarm Output	1
CERTIFICATIONS	CE, Class B UL Listed Meets NEMA Type 4X and IP66 standards

5. Accessories
   a. Pendant mount
   b. Wall mount for pendant
   c. Corner adapter for wall mount
   d. Pole adapter for wall mount

V. Reinforced Fixed Dome Camera
1. The dome camera shall be a high-resolution color video camera with wide dynamic range capturing capability.
2. The camera shall meet or exceed the following specifications:
   a. The camera shall have the form factor as typical of a traditional VASS dome video camera.
   b. The image capturing device shall be a 1/3-inch image sensor designed for capturing wide dynamic images.
3. The camera shall optimize each pixel independently.
4. The camera shall have onscreen display menus for programming of the camera's settings.
5. The signal system shall be NTSC or PAL selectable.
6. The resolution that the camera provides shall be 470 television lines horizontal and 460 television lines vertical.
7. The camera shall have 720 horizontal and 540 vertical picture elements.
8. The scanning system shall be 525/60 lines NTSC or 625/50 lines PAL.
9. The synchronizing system shall be internal/AC line-lock.
10. The sensitivity shall be 0.6 lux at f1.2, 30 IRE.
11. The signal-to-noise ratio shall be 50 dB.
12. The electronic shutter shall have automatic adjustment, and operate from 1/60 NTSC to 1/100,000 second, automatic.

13. The camera shall have an automatic white balance range of 2800 to 11000 K.
14. The camera shall have automatic gain control.
15. The camera shall include a shroud to conceal the camera's position inside the dome.
16. The camera shall have composite video output.
17. The housing shall have the following specifications:
    a. Construction: Aluminum
    b. The housing shall be heavy duty and tamper resistant.
    c. Dome housing construction: 0.13-in polycarbonate.
    d. Finish: Powder coat
18. The camera shall come with a manual varifocal 4 to 9 mm lens.
19. The electrical specifications for the camera shall be as follows:
    a. Input voltage shall be 24 VAC or 12 VDC.
    b. Power consumption shall be 12 VDC, 455 mA; or 24 VAC, 160 mA.
    c. Power source shall be universal 18 to 30 VAC or 10 to 30 VDC.
    d. Video output shall be composite: 1.0 volts peak-to-peak at 75-ohm load.
20. The environmental specifications for the camera shall be as follows: Operating temperature shall be -10 to 45 degrees Celsius or 14 to 113 degrees Fahrenheit.
21. Accessories shall include:
    a. Surface mount adapter
    b. Wall mount adapter
    c. Flush mount adapter

W. Indoor/Outdoor Fixed Mini Dome System
1. The indoor/outdoor fixed mini dome system shall include a built-in 100Base-TX network interface for live streaming to a standard Web browser.
2. The network mini dome shall be integrated into the back box design to accept multiple camera options without modification. The network mini dome shall operate in open architecture connectivity for third-party software recording solutions.
3. The indoor/outdoor fixed mini dome system shall meet or exceed the following design and performance specifications.

Imaging Device	1/3-inch imager
Picture Elements	NTSC/PAL 720 (H) x 540 (V) 720 (H) x 540 (V)
Dynamic Range	102 dB typical/120 dB maximum (DW/CW models only)
Scanning System	2:1 interlace (progressive option on CW/DW models only
Synchronization	Internal
Electronic Shutter Range	Auto (1/15–1/22,000)
Lens Type	Varifocal with auto iris
Format Size	1/3-inch
Focal Length	3.0 mm–9.5 mm 9.0 mm–22.0 mm
Operation	Iris Auto (DC-drive) Focus Manual Zoom Manual

Minimum Illumination	Color (day): 0.8 lux, SENS 8X: 0.2 lux, B-W (night): 0.08 lux, SENS 8X: 0.02 lux (F1.0, 40 IRE, AGC on, 75% scene reflectance) Color (day): 0.15 lux, B-W (night): 0.015 lux (F1.0, 40 IRE, AGC on, 75% scene reflectance) Color (day): 0.8 lux, SENS 8X: 0.2 lux (F1.0, 40 IRE, AGC on, 75% scene reflectance) 0.2 lux (F1.0, 40 IRE, AGC on, 75% scene reflectance)
Compression	MPEG-4, MJPEG in Web viewing mode
Video Streams	3, simultaneous
Video Resolutions	NTSC / PAL 4CIF 704 x 480 / 704 x 576 2CIF 704 x 240 / 704 x 288 CIF 352 x 240 / 352 x 288 QCIF 176 x 120 / 176 x 144
Bit Rate	Configurable, 20 kbps to 2 Mpbs per stream
Web User Interface	
Environment	Low temperature, indoor/outdoor
Connectors	RJ-45 for 100BASE-TX, Auto MDI/MDI-X
Cabling	CAT5 cable or better for 100BASE-TX
Input Voltage	24 VAC (18-36) or PoE input voltage
Power Consumption	7.5 Watts,13 Watts with heaters 24VAC: 0.5 Amps, 0.9 Amps with heaters
Alarm Input	10 VDC maximum, 5 mA maximum
Alarm Output	0 to 15 VDC maximum, 75 mA maximum
Service Connector	Internal to housing for 2.5 mm connector for NTSC/PAL video outputs
Service Connector	3-conductor, 2.5 mm connector for video output to optional (IS-SC cable)
Pan/Tilt Adjustment	Pan 360°, tilt 80° (20° to 100° range), and rotation 360°
Light Attenuation	smoked bubble, f/1.5 light loss; clear bubble, zero light loss
CERTIFICATIONS	CE, Class B UL Listed Meets NEMA Type 4X and IP66 standards

4. Accessories
   a. Pendant mount
   b. Wall mount for pendant
   c. Corner adapter for wall mount
   d. Pole adapter for wall mount

X. Megapixel High Definition Integrated Digital Network Camera

1. The network camera shall offer dual video streams with up to 3.1 megapixel resolution (2048 x 1536) in progressive scan format.
2. An alarm input and relay output shall be built in for integration with hard wired external sensors.
3. The network camera shall be capable of firmware upgrades through a network using a software-based device utility.
4. The network camera shall offer auto back focus (ABF) functionality through a push button on the camera. ABF parameters shall also be configurable through a standard Web browser interface.
5. The network camera shall offer a video output port providing an NTSC/PAL analog video output signal for adjusting field of view and focus at the camera.
6. The network camera shall provide advanced low-light capabilities for color and day/night models with sensitivity down to 0.12 lux in color and 0.03 lux in black-white (B-W).
7. The network camera shall have removable IR cut filter mechanism for increased sensitivity in low-light installations. The sensitivity of IR cut filter removal shall be configurable through a Web browser.
8. The network camera shall support two simultaneous, configurable video streams. H.264 and MJPEG compression formats shall be available for primary and secondary streams with selectable unicast and multicast protocols. The streams shall be configurable in a variety of frame rates and bit rates.
9. The network camera shall support industry standard Power over Ethernet (PoE)
10. IEEE 802.3af to supply power to the camera over the network. The network camera shall also offer a 24 VAC power input for optional use.
11. The network camera shall use a standard Web browser interface for remote administration and configuration of camera parameters.
12. The network camera shall have a window blanking feature to conceal user-defined privacy areas that cannot be viewed by an operator. The network camera shall support up to four blanked windows. A blanked area shall appear on the screen as a solid gray window.
13. The network camera shall support standard IT protocols.
14. The network camera shall support open architecture best practices with a published API available to third-party network video recording and management systems.

Y. Megapixel High Definition Integrated Digital Network Camera Technical Specifications:

Imaging Device	1/3-inch, effective
Imager Type	CMOS, Progressive scan
Maximum Resolution	2048 x 1536
Signal-to-Noise Ratio	50 dB
Auto Iris Lens Type	DC drive
Electronic Shutter Range	1~1/100,000 sec
Wide Dynamic Range	60 dB
White Balance Range	2,000° to 10,000°K
Sensitivity	f/1.2; 2,850K; SNR, 24dB Color (1x/33ms) 0.50 lux Color SENS (15x/500 ms) 0.12 lux Mono SENS (15x/500 ms) Mono (1x/33ms)0.25 lux 0.03 lux
Dome Attenuation	Clear Zero light loss Smoke f/1.0 light loss
Compression	H.264 in base profile and MJPEG

Video Streams	Up to 2 simultaneous streams, the second Stream variable based on the setup of the primary stream
Frame Rate	Up to 30, 25, 24, 15, 12.5, 12, 10, 8, 7.5, 6.5, 4, 3, 2, and 1 (depending upon coding, resolution, and stream configuration
Available Resolutions	3.1 MPx2048 x 1536; 4:3 aspect ratio; 2.0 ips max., 10.0 Mbps bit rate for MJPEG; 3.0 ips max., 2.6 Mbps bit rate H.264 2.1 MPx1920 x 1080; 16:9 aspect ratio: 15.0 ips max.,10.0 Mbps bit rate for MJPEG; 5.0 ips max., 2.7 Mbps bit rate H.264 3.1.9 MPx1600 x 1200; 4:3 aspect ratio; 15.0 ips max.,10.0 Mbps bit rate for MJPEG; 6.0 ips max., 2.6 Mbps bit rate H.264 1.3 MPx1280 x 1024; 5:4 aspect ratio; 15.0 ips max.,10.0 Mbps bit rate for MJPEG; 8.0 ips max., 2.5 Mbps bit rate H.264 1.2 MPx1280 x 960; 4:3 aspect ratio; 15.0 ips max., 9.8 Mbps bit rate for MJPEG; 9.8 ips max., 8.5 Mbps bit rate H.264 6.0.9 MPx1280 x 720; 16:9 aspect ratio; 30.0 ips max.,10.0 Mbps bit rate for MJPEG; 12.5 ips max., 2.5 Mbps bit rate H.264 0.5 MPx800 x 600; 4:3 aspect ratio; 30.0 ips max., 5.8 Mbps bit rate for MJPEG; 25.0 ips max., 2.0 Mbps bit rate H.264 8.0.3 MPx640 x 480; 4:3 aspect ratio; 30.0 ips max., 3.7 Mbps bit rate for MJPEG; 30.0 ips max.,1.6 Mbps bit rate H.264 0.1 MPx320 x 240; 4:3 aspect ratio; 30.0 ips max., 0.9 Mbps bit rate for MJPEG; 30.0 ips max., 0.4 Mbps bit rate H.264 Additional640 x 512, 640 x 352, 480 x 368, 480 x 272, 320 x 256, 320 x 176
Supported Protocols	TCP/IP, UDP/IP (Unicast, Multicast IGMP), UPnP, DNS, DHCP, RTP, RTSP, NTP,IPv4, SNMP, QoS, HTTP, HTTPS, LDAP(client), SSH, SSL, STMP, FTP, MDNS(Bonjour), and 802.1x (EAP)
Security Access	Password protected
Software Interface	Web browser view and setup, up to 16 cameras
Connectors	RJ-45 for 100Base-TX, Auto MDI/MDI-X
Cable	Cat5 cable or better for 100Base-TX
Input Voltage	24 VAC or PoE (IEEE802.3af class 3)
Power Consumption	6 W
Current Consumption	PoE 200 mA maximum 24 VAC, 295 mA nominal; 390 mA maximum

Alarm Input	10 VDC maximum, 5 mA maximum
Alarm Output	0 to 15 VDC maximum, 75 mA maximum
Lens Mount	CS mount, adjustable
Pan/Tilt Adjustment	Pan 368° Tilt 160° (10° to 170°) Rotate 355°

1. Accessories
   a. Pendant mount
   b. Wall mount for pendant
   c. Corner adapter for wall mount
   d. Pole adapter for wall mount

2. Recommended Lenses
   a. Megapixel lens, varifocal, 2.2~6.0 mm, f/1.3~2.0
   b. Megapixel lens, varifocal, 2.8~8.0 mm,f/1.1~1.9
   c. Megapixel lens, varifocal, 2.8~12.0 mm, f/1.4~2.7
   d. Megapixel lens, varifocal, 15.0~50.0 mm, f/1.5~2.1

Z. NETWORK CAMERAS
1. Shall be IEEE 802.3af compliant.
   a. Shall be utilized for interior and exterior purposes.
   b. A Category CAT6 cable will be the primary source for carrying signals up to 100 m(300 ft.) from a switch hub or network server. If any camera is installed greater than 100 m (300 ft.) from the controlling device then the following will be required:
      1) A local or remote 12 VDC or 24 VAC power source will be required from a Class 2, UL compliant power supply.
      2) A signal converter will be required to convert from a Cat6 cable over to a fiber optic or standard signal cable. The signal will need to be converted back to a CAT6 cable at the controlling device using a signal converter card.
   c. Shall be routed to a controlling device via a network switch.
   d. Shall be of hybrid design with both an Internet Protocol (IP) output and a monitor video output which produces a picture equivalent to an analog camera, and allows simultaneous output of both.
   e. Shall be a programmable IP address that allows for installation of multiple units in the same Local Area Network (LAN) environment.
   f. Incorporate a minimum of Transmission Control Protocol (TCP)/IP, User Datagram Protocol (UDP), Hypertext Transfer Protocol (HTTP), File Transfer Protocol (FTP), Internet Control Message Protocol (ICMP0, Address Resolution Protocol (ARP), Real-Time Transport Protocol (RTP), Dynamic Host Configuration Protocol (DHCP), Network Time Protocol (NTP), Simple Mail Transfer Protocol (SMTP), Internet Group Management Protocol (IGMP), and Differentiated Service Code Point (DSCP) protocols for various network applications.

AA. Fixed Network Camera
1. The fixed network camera shall have following technical characteristics:

Video Standards	MPEG-4; M-JPEG
Video Data Rate	9.6 Kbps - 6 Mbps Constant & variable
Image Resolution	768x494 (NTSC)
Video Resolution	704 x 576/480 (4CIF: 25/30 IPS) 704 x 288/240 (2CIF: 25/30 IPS) 352 x 288/240

	(CIF: 25/30 IPS) 176 x 144/120 (QCIF: 25/30 IPS)
Select Frame Rate	1-25/30 IPS (PAL/NTSC);Field/frame based coding
Network Protocols	RTP, Telnet, UDP, TCP, IP, HTTP, IGMP, ICMP
Software Update	Flash ROM, remote programmable
Configuration	Via web browser, built-in web server interfaces
Video Out	1x Analog composite: NTSC or PAL; BNC connector 75 Ohm
Sensitivity	1 0.65 lux (color) 0.26 lux (NightSense)
Minimum Illumination	0.30 lux (color)0.12 lux (NightSense)
Video Signal-to-Noise Ratio	50 dB
Video Signal Gain	21 dB, (max) Electronic Shutter Automatic, up to 1/150000 sec. (NTSC)
Alarm In	Automatic sensing (2500 - 9000 K)
Input Voltage	+5 V nominal, +40 VDC max VDC: 11-36 V (700 mA) VAC: 12-28 V (700 mA) PoE: IEEE 802.3af compliant

2. Camera accessories shall include:
   a. Surface mount adapter
   b. Wall mount adapter
   c. Flush mount adapter

BB. Wireless Cameras
1. Prior to installation of any wireless camera, ensure operating frequency is given full approval by the VA controlling authority. Wireless cameras shall be utilized as either part of a VASS network or a standard analog system.
2. Power for a wireless camera will be 110 VAC tied into a dedicated circuit breaker on a power panel that is dedicated to the security system and is fed from a power source with back-up in the event primary power to the VASS System is lost. Power will be run to the camera and connected at both ends in accordance with Division 26 of the VA Master Specification FOR NCA Projects, and the VA Electrical Manual. In addition, wireless systems are line of sight dependant and all considerations for environmental layout must be taken into consideration prior to design, engineering, and installation of this type of camera system. Proximity to transmitting and receiving devices, cell phone towers, and any and all electrical devices can also cause interference with the camera signal and must be considered in advance.
3. Shall be located within a minimum of one quarter of a mile from the receiving unit. Repeaters shall be used as required to ensure the strongest possible signal between transmitters and receivers.
4. Shall be Federal Communication Commission (FCC) approved and compliant.
5. If using wireless cameras, the following equipment shall be utilized to ensure operation of the system:
   a. Receiver
   b. Receiver antenna as required
   c. Repeater as required
   d. Mounting Hardware

6. Receivers shall only handle up to four (4) cameras per unit.
7. Technical Characteristics
   a. Wireless Cameras:

Imaging Device	1/3-inch interline transfer CCD
Picture Elements	NTSC 510 (H) x 492 (V)
Sensing Area	6 mm diagonal
Scanning System	NTSC 525 lines, 21 interlace
Synchronization System	AC line lock/internal
Horizontal Resolution	330 TV lines
Iris Control	Selectable on/off
Electronic Shutter Range NTSC	1/60-1/100,000 second
Frequency range	2.41-2.47GHz
Modulation	FM
Video signal/noise ratio	48dB
Audio signal/noise ratio	45db
Minimum Illumination	0.6 lux
Signal to Noise Ratio	50 dB
Automatic Gain Control	On/off switchable
Backlight Compensation	On/off switchable
Auto White Balance	On/off switchable
Video Output	1 Vp-p, 75 ohms
Lens Mount	C/CS mount (adjustable)

   1) Receivers

Frequency range	2.4-2.49GHz
Video output	1Vp-p
Signal/noise ratio	38dB

CC. LENSES
1. Camera Field of View shall be set by the Contractor to produce full view of door or window opening and anyone entering or leaving through it. Follow the project construction drawings for design intent.
2. Camera Lenses shall be of the type supplied with the camera from the manufacture. All cameras which are not supplied with lenses from the factory are specified in this specification. The lens shall be equipped with an auto-iris mechanism unless otherwise specified. Lenses having auto-iris, DC iris, or motor zoom functions shall be supplied with connectors, wiring, receiver/drivers, and controls as needed to operate the lens functions. Lenses shall have sufficient circle of illumination to cover the image sensor evenly. Lenses shall not be used on a camera with an image format larger than the lens is designed to cover. Lenses shall be provided with pre-set capability.
3. Lenses shall have optical-quality coated optics, designed specifically for video surveillance applications, and matched to specified camera. Provide color-corrected

lenses with color cameras, megapixel lenses for megapixel cameras, and lenses with day/night for color/b&w cameras.

4. Auto-Iris Lens: Electrically controlled iris with circuit set to maintain a constant video level in varying lighting conditions.
5. Zoom Lenses: Motorized, remote-controlled units, rated as "quiet operating." Features include the following:
   a. Electrical Leads: Filtered to minimize video signal interference.
   b. Motor Speed: Variable.
   c. Lens shall be available with preset positioning capability to recall the position of specific scenes.
6. Lenses: Shall be utilized in a manner that provides maximum coverage of the area being monitored by the camera. The lenses shall:
   a. Be 1/3” to fit CCD fixed camera.
   b. Be all glass with coated optics.
   c. Have mounts that are compatible with the camera selected.
   d. Be packaged and supplied with the camera.
   e. Have a maximum f-stop of f/1.3 for fixed lenses, and a maximum f-stop of f/1.6 for variable focus lenses.
   f. Be equipped with an auto-iris mechanism.
   g. Have sufficient circle of illumination to cover the image sensor evenly.
   h. Not be used on a camera with an image format larger than the lens is designed to cover.
   i. Be provided with pre-set capability.
7. Two types of lenses shall be utilized for both interior and exterior fixed cameras:
   a. Manual Variable Focus
   b. Auto Iris Fixed
8. Manual Variable Focus:
   a. Shall be utilized in large areas that are being monitored by the camera. Examples of this are perimeter fence lines, vehicle entry points, parking areas, etc.
   b. Shall allow for setting virtually any angle of field, which maximizes surveillance effects.
   c. Technical Characteristics:

Image format	1/3 inch
Focal length	5–50mm
Iris range	F1.4 to close
Focus range	1m (3.3 ft)
Back focus distance	10.05 mm (0.4 in)
Angle view Wide (1/3 in)	53.4 x 40.1
Angle view Tele (1/3 in)	5.3 x 4.1
Iris control	manual
Focus ctrl	manual
Zoom ctrl	manual

DD. CAMERA HOUSINGS AND MOUNTS

1. This section pertains to all interior and exterior housings, domes, and applicable wall, ceiling, corner, pole, and rooftop mounts associated with the housing. Housings and mounts shall be specified in accordance to the type of cameras used.
2. All cameras and lenses shall be enclosed in a tamper resistant housing. Any additional mounting hardware required to install the camera housing at its specified location shall be provided along with the housing.

3. The camera and lens contained inside the housing shall be installed on a camera mount. All additional mounting hardware required to install the camera housing at its specified location shall be provided along with the housing.
4. Shall be manufactured in a manner that are capable of supporting a maximum of three (3) cameras with housings, and meet environmental requirements for the geographical area the camera support equipment is being installed on or within.
5. Environmentally Sealed
   a. Shall be designed in manner that it provides a condensation free environment for correct camera operation.
   b. Shall be operated in a 100 percent condensing humidity atmosphere.
   c. Shall be constructed in a manner that:
      1) Has a fill valve to allow for the introduction of nitrogen into the housing to eliminate existing atmospheric air and pressurize the housing to create moisture free conditions.
      2) Has an overpressure valve to prevent damage to the housing in the event of over pressurization.
      3) Is equipped with a humidity indicator that is visible to the eye to ensure correct atmospheric conditions at all times.
      4) The leak rate of the housing is not to be greater than 13.8kPa or 2 pounds per square inch at sea level within a 90 day period.
      5) It shall contain camera mounts or supports as needed to allow for correct positioning of the camera and lens.
      6) The housing and sunshield are to be white in color.
6. All electrical and signal cables required for correct operations shall be supplied in a hardened carrier system from the controller to the camera.
7. The mounting bracket shall be adjustable to allow for the housing weight of the camera and the housing unit it is placed in.
8. Accessibility to the camera and mounts shall be taken into consideration for maintenance and service purposes.

EE. Indoor Mounts
1. Ceiling Mounts:
   a. This enclosure and mount shall be installed in a finished or suspended ceiling.
   b. The enclosure and mount shall be fastened to the finished ceiling, and shall not depend on the ceiling tile grid for complete support.
   c. Suspended ceiling mounts shall be low profile, and shall be suitable for replacement of 610mm x 610mm (2 foot by 2 foot) ceiling tiles.
2. Wall Mounts:
   a. The enclosure shall be installed in manner that it matches the existing décor and placed at a height that it will be unobtrusive, unable to cause personal harm, and prevents tampering and vandalism.
   b. The mount shall contain a manual pan/tilt head that will provide 360 degrees of horizontal and vertical positioning from a horizontal position, and has a locking bar or screw to maintain its fixed position once it has been adjusted.

FF. Interior Domes
1. The interior dome shall be a pendant mount, pole mount, ceiling mount, surface mount, or corner mounted equipment.
2. The lower portion of the dome that provides camera viewing shall be made of black opaque acrylic and shall have a light attenuation factor of no more that 1 f-stop.
3. The housing shall be equipped with integral pan/tilt capabilities complete with wiring, wiring harness, connectors, receiver/driver, pan/tilt control system, pre-position cards, or any other hardware and equipment as needed to fully provide a fully functional pan/tilt dome.
4. The pan/tilt mechanism shall be:
   a. Constructed of heavy duty bearings and hardened steel gears.

b. Permanently lubricated to ensure smooth and consistent movement of all parts throughout the life of the product.
c. Equipped with motors that are thermally or impedance protected against overload damage.
d. Pan movements shall be 360 degrees and tilt movement shall no be less than +/- 90 degrees.
e. Pan speed shall be a minimum of 10 degrees per second.

GG. Exterior Domes
1. The exterior dome shall meet all requirements outlined in the interior dome paragraph above.
2. The housing shall be constructed to be dust and water tight, and fully operational in 100 percent condensing humidity.

HH. Exterior Wall Mounts
1. Shall have an adjustable head for mounting the camera.
2. Shall be constructed of aluminum, stainless steel, or steel with a corrosion-resistant finish.
3. The head shall be adjustable for not less than plus and minus 90 degrees of pan, and not less than plus and minus 45 degrees of tilt. If the bracket is to be used in conjunction with a pan/tilt, the bracket shall be supplied without the adjustable mounting head, and shall have a bolt-hole pattern to match the pan/tilt base.
4. Shall be installed at a height that allows for maximum coverage of the area being monitored.

II. Explosion Proof Housing
1. This housing shall meet or exceed all requirements of NEMA four (4) standards for hazardous locations.
2. It shall be supplied with the mounting brackets for the specified camera and lens.

2.9 POWER SUPPLIES

A. Power supplies shall be a low-voltage power supplies matched for voltage and current requirements of cameras and accessories, type as recommended by camera, infrared illuminator, and lens manufacturer.

B. Technical specifications:
1. nput: 115VAC, 50/60Hz, 2.7 amps
2. Outputs:
a. Number of outputs, 16
b. Fuse/PTC protected, power limited
c. Output voltage & power:
1) 24VAC @ 12.5 amps (300VA) or 28VAC @ 10 amp (280VA) supply current
3. Illuminated power disconnect circuit breaker with manual reset
4. Surge suppression
5. Camera synchronization
Wall/Rack mount.
6. Enclosure: NEMA 250, Type 1.

2.10 INFRARED ILLUMINATORS

A. Lighting fixtures that emit light only in the infrared spectrum, suitable for use with cameras indicated, for nighttime surveillance, without emitting visible light.
1. Field-Selectable Beam Patterns: Narrow, medium, and wide.
2. Rated Lamp Life: More than 8000 hours
3. Power Supply: 120-VAC.

B. Area Coverage: Illumination to 50 m (150 feet) in a narrow beam pattern.

C. Exterior housings shall be suitable for same environmental conditions as associated camera.

2.11 NETWORK SERVER

A. Allow for the transmission of live video, data, and audio over either an existing Ethernet network or a dedicated security system network, requiring an IP address or Internet Explorer 5.5 or higher, or shall work as an analog-to-Ethernet “bridge” controlling matrices, multiplexers, and pan/tilt/zoom cameras. The network shall operate in a box-to-box configuration allowing for encoded video to be decoded and displayed on an analog monitor.

B. If a VASS System network is going to be utilized as the primary means of monitoring, operating, and recording cameras then the following equipment shall be required as part of the system:
   1. System Server
   2. Computer Workstation
   3. Recording Device
   4. Encoder/Decoder
   5. Monitor
   6. Hub/Switch
   7. Router
   8. Encryptor

C. Shall provide overall control, programming, monitoring, and recording of all cameras and associated devices within the VASS System.

D. All equipment on the network shall be IP addressable.

E. The VASS System network shall meet or exceed the following design and performance specifications or similar to Black Box VX-HDMI-4KIP-TX and RX:
   1. Two MPEG-4 video streams for a total of 40 images per second will be provided.
   2. PC Software that manages the installation and maintenance of all hardware transmitters and receivers on the network shall be provided.
   3. Video Source that supports any NTSC video source to the computer network shall be addressed.
   4. Receivers that could be used to display the video on a standard analog NTSC or PAL monitor will be addressed.

F. The system shall support the following network protocols:
   1. Internet connections: RTP, Real Time Control Protocol (RTCP), UDP, IP, TCP, ICMP, HTTP, Simple Network Management Protocol (SNMP), IGMP, DHCP, and ARP.
   2. Video Display: MPEG-4, M-JPEG in server push mode only.
   3. Have the ability to adjust bandwidth, image quality and image rate.
   4. Support image sizes of either 704 x 576 pixels or 352 x 288 pixels.
   5. Have an audio coding format of G.711 or G.728.
   6. Provide a video frame rate of at least 30 images per second.
   7. Support LAN Interface Ethernet 10/100BaseT and be auto sensing.
   8. Have a LAN Data Rate of 9.6 Kbps to 5.0 Mbps.
   9. Utilize data interface RS-232/RS-422/RS-485.

G. All connections within the system shall be via CAT-6a cable and RJ-45 jacks. If analog equipment is used as part of the system, then either an encoder or a decoder will be utilized to convert the analog signal to a digital one.

H. The VASS network system shall conform to all VA agency wide security standards for administrator and operator use.

I. Server Technical Characteristics:

Hardware	Personal Computer
CPU	Pentium IV, 3.0 GHz or better
Hard Disk Interface	IDE or better

RAM	256 MB
OS	Windows XP Home/XP Professional
Graphic Card	NVIDIA GeForce 6600 NVIDIA Quadro FX 1400 ATI RADEON X600/X800 or better
J. Ethernet Card	K. 100 Mb
L. Software	M. DirectX 9.0c
N. Free Memory	O. 120 MB

P. Network Switch Technical Characteristics

Protocol and standard	IEEE802.3 IEEE802.3u IEEE802.3ab
Ports	24 10/100/1000M auto-negotiation RJ-45 ports with auto MDI/MDI-X
Network media	Cat 5 UTP for 1,000Mbps Cat 3 UTP for 10Mbps
Transmission method	store-and-forward
LED	indicator power, act/link, speed

Q. Router Technical Characteristics

Network Standards	IEEE 802.3, 802.3u 10Base-T Ethernet (WAN) 100Base-T Ethernet (LAN) IEEE 802.3x Flow Control IEEE802.1p Priority Queue ANS/IEEE 802.3 NWay auto-negotiation
Protocol	CSMA/CD, TCP, IP, UDP, PPPoE, AND DHCP (client and server)
VPN Supported	PPTP, IPSec pass-through
Management	Browser
Ports	4 x 10/100Base-T Auto sensing RJ45 ports, and an auto uplink RJ45port(s) 1 x 10Base-T RJ45 port, WAN
LEDs	Power, WAN Activity, LAN Link (10/100), LAN Activity

R. Encryptor Technical Characteristics:

Cryptography	Standard - Triple DES 168-bit (ANSI 9.52) Rijndael - AES (128, 192, 256)
Performance	Throughput (end-to-end) @ 100 Mbps line speed: 188 Mbps full duplex (large frames) 200 kfps full duplex (small frames) Latency (end-to-end) @ 100 Mbps
Key Management	Automatic KEK/DEK Exchange Using Signed Diffie-Hellman Unit Authentication Using X.509 Certificates

Physical Interfaces	10BaseT or 10/100BaseT Ethernet (Host and Network Ports) 10BaseT Ethernet Management Port Back and Front-Panel Serial Control Port
Device Management	THALES Element Manager, Front Panel Viewer, and Certificate Manager 10Base T (RJ-45) or 9-pin Serial Control Port SNMP Network Monitoring
Security Features	Tamper Proof Cryptographic Envelope Tamper Evident Chassis Hardware Random Number Generator
Management	Channel Encrypted Using Same Algorithm as Data Traffic
Security Certifications	FIPS 140-2 Level 3 CAPS Baseline and Enhanced Grades Common Criteria EAL4 and EAL5 (under evaluation)
Regulatory	EN60950, FCC, UL, CE, EN 50082-1, and EN 55022

2.12 RECORDING DEVICES

A. All cameras on the VASS System shall be recorded in real time using a Digital Video Recorder (DVR), Network Video Recorder (NVR) Avigilon manufacturer or attached storage. The type of recording device utilized should be determined by the size and type of VASS System designed and installed, and to what extent the system is to be utilized.

B. All recording devices shall be 47.5 cm (19 inch) rack-mountable.

C. All DVR's and NVR's that are viewable over an Intranet or Internet will be routed through an encryptor.

D. Encryptors shall:
1. Comply with FIPS PUB 140-2.
2. Support TCP/IP.
3. Directly interfaces to low-cost commercial routers.
4. Provide packet-based crypto synchronization.
5. Encrypt source and destination IP addresses.
6. Support web browser based management requiring no additional software.
7. Have a high data sustained throughput — 1.544 Mbps (T1) full duplex data rate.
8. Provide for both bridging and routing network architecture support.
9. Support Electronic Key Management System (EKMS) compatible.
10. Have remote management ability.
11. Automatically reconfigure when secure network or wide area network changes.

E. Digital Video Recorder (DVR)
1. Shall record video to a hard drive-based digital storage medium in either NTSC or MPEG format.
2. Shall meet the following minimum requirements:
   a. Record at minimum rate of 30 images per second (IPS).
   b. Have a minimum of eight (8) to 16 looping inputs.
   c. Have a minimum of eight (8) to 16 alarm inputs and two (2) relay outputs.
   d. Shall provide instantaneous playback of all recorded images.
   e. Be IP addressable, if part of a VASS network.
   f. Have built-in digital motion detection with masking and sensitivity adjustments.
   g. Provide easy playback and forward/reverse search capabilities.

h. Complete audit trail database, with minimum of a six-month history that tracks all events related to the alarm; specifically who, what, where and when.
i. DVR management capability providing automatic video routing to a back-up spare recorder in case of failure.
j. Accessible locally and remotely via the Internet, Intranet, or a personal digital assistant (PDA).
k. Records all alarm events in real time, ensuring 60 seconds before and after the event are included in the recording.
l. Utilize RS-232 or fiber optic connections for integration with the SMS computer station via a remote port on a network hub.
m. Allow for independently adjustable frame rate settings.
n. Be compatible with the matrix switcher utilized to operate the cameras. The DVR could be utilized as a matrix switcher only if it meets all of the requirements listed in the matrix switcher section.

3. Technical Characteristics:

Compression	MPEG-4
Internal Storage Capacities.	2 TB. Available USB hard drive up to 250 GB. Optional internal DVD available
Digital Recording	Up to 16 video and 8 audio channels, or 8 video and 4 audio channels.
Full real-time video recording	Up to 400 IPS@352 x 288: PAL Up to 200 IPS@352 x 288: PAL
Multiple simultaneous functions	Live viewing, Recording, playback, network transmission, back-up
Search functions	Date/time search, event search, bookmark search, smart (pixel) Search
PTZ Control	Third party PTZ control
User ID security	3 levels
Connectivity to external devices:	Eight 8 or sixteen 16 video input and looping output channels. VGA and dual monitor BNC outputs. Four 4 or eight 8 audio inputs and one 1 audio output. Ethernet 10/100BaseT network connection. Eight 8 to sixteen 16 alarm inputs and four 4 or eight 8 relay outputs. Biphase connection to control Bosch PTZ cameras. Third party PTZ control via RS-422/RS-485 connection. Front and back USB connectors to connect to a PC mouse, or archive video to a USB memory stick or similar device.
PC requirements	Windows 2000 or above; DirectX 8.1 or above. Intel Pentium III or above, AMD Athlon with 800 MHz or faster CPU. 512 MB or more RAM. 50 MB hard drive.

	AGP VGA with 64 MB video RAM or above. 10/100-BaseT network interface.
Electrical	Power Input: 100 to 240 VAC; 50/60 Hz Power consumption: 120W Max. 1.2 A
Video	Video standard: PAL or NTSC selectable. Resolution: 704 x 576 PAL, 704 x 480 NTSC Compression: MPEG-4 Inputs: 8 or 16 composite video 0.5-2 Vpp, 75 Ohm automatic termination. Outputs 8 or 16 composite video 1 Vpp, 75 Ohm.
Audio	Inputs: 4 or 8 line in, 30 kOhm Output: 1 line, 100 kOhm
Monitors	VGA: analog RGB 800x600 MON A: CVBS 1 Vpp□0.1 V, 75 Ohm, BNC Monitor A multi-screen (VGA or CVBS) MON B: CVBS 1 Vpp□0.1 V, 75 Ohm, BNC Monitor B spot/alarm
Frame Rate and Resolution	16-channels PAL: Up to 400 IPS@352x288, up to 200 IPS@704x288, up to 100 IPS@704x576.
Alarm inputs	16 configurable NO/NC, max. input 5 VDC.
Alarm outputs	4 or 8 relay outputs, configurable NO/NC, max. rated 1A, 125 VAC.
Connections	Ethernet: RJ45 modular jack 8 pins shielded, 10/100 Base-T. Biphase: Screw terminal connector (5 outputs). Maximum 5 controllable cameras per Biphase output. PTZ control interfaces: RS485/RS422. Serial interface: RS232 output signal, DB9 male connector Keyboard: RJ11 modular jack 6 pins
Network:	Transmission speed: up to 120 IPS@352x240 Bandwidth control: Automatic Remote users: Maximum 5 simultaneous connected Control Center users.

Processor	Intel Pentium III 750 MHz
Memory	256 MB RAM
Operating System	Windows 98, NT, ME, 2000, and XP
Video Card	4 MB of RAM capable of 24-bit true color display
Free Hard Disk Space	160 MB for software installation

Network Card	10Base-T network for LAN operation
Archiving	80 GB, 160 GB, 320 GB and 640 GB Hard Drive; CD-RW
Video Input	1.0 Vpp (signal 714mV, sync 286mV) 75 ohms (BNC unbalanced)
Video Output Level	1.0 Vpp +/-10%,75 ohms(BNC unbalanced)
Impedance	75 ohms/Hi- impedance x 16 switchable
Network Interface	Ethernet (RJ-45, 10/100M)
Network Protocol	TCP/IP, DHCP, HTTP, UDP
Network Capabilities	Live/Playback/P/T/Z control
Recording Rate	30 ips for 720 x 240 (NTSC)
Password Protection	Menu Setup, Remote Access
Recording Capacity	160 (1 or 2 fixed HDD) 1 CD-RW
Power Interrupt	Auto recovered to recording mode

F. Network Video Recorder (NVR)
1. Shall record video to a hard drive-based digital storage medium in MPEG, MPEG4 or H.264 format.
2. Shall meet the following minimum requirements:
   a. Record at minimum rate of 30 IPS.
   b. Have a minimum of eight (8) to 16 looping inputs.
   c. Have a minimum of eight (8) to 16 alarm inputs and two (2) relay outputs.
   d. Shall provide instantaneous playback of all recorded images.
   e. Be IP addressable, if part of a VASS network.
   f. Have built-in digital motion detection with masking and sensitivity adjustments.
   g. Easy playback and forward/reverse search capabilities.
   h. Complete audit trail database, with minimum of a six-month history that tracks all events related to the alarm; specifically who, what, where and when.
   i. NVR management capability providing automatic video routing to a back-up spare recorder in case of failure.
   j. Accessible locally and remotely via the internet, intranet, or a personal digital assistant (PDA).
   k. Records all alarm events in real time, ensuring 60 seconds before and after the event are included in the recording.
   l. Utilize RS-232 or fiber optic connections for integration with the SMS computer station via a remote port on a network hub.
   m. Allow for independently adjustable frame rate settings.
   n. Be compatible with the matrix switcher utilized to operate the cameras.
3. Technical Characteristics:

Hardware/CPU	Pentium III Xeon or IV, 1.8 GHz
HDD Interface	IDE or better; optional: SCSI II, SCSI Ultra, or Fiber Channel
RAM	1024 MB
Operating System	Windows 2000/XP Professional/Server 2003 Standard
Graphic	Card VGA
Ethernet Card	100/1000 MB

Memory	20 MB
Software Setup	Centralized setup from each authorized PC; access via integrated web server
Storage Media	All storage media possible (e.g., HD, RAID), depending on operating system
Storage Mode	Linear mode, ring mode (capacity-based)
Recording Configuration	Camera name assignment, bandwidth limit, frame rate, video quality
Recording Content	Video and/or audio data
Search Parameters	Time, date, event
Playback	Playback via any IP network (LAN/WAN) simultaneous recording, playback, and backup
Network Interface	Ethernet (RJ-45, 10/100M)
Network Protocol	TCP/IP, DHCP, HTTP, UDP
Network Capabilities	Live/Playback/P/T/Z control
Recording Rate	30 ips for 720 x 240 (NTSC)
Password Protection	Menu Setup, Remote Access
Recording Capacity	160 (1 or 2 fixed HDD) 1 CD-RW
Power Interrupt	Auto recovered to recording mode

2.13 WIRES AND CABLES

A. Shall meet or exceed the manufactures recommendation for power and signal.

B. Will be carried in an enclosed conduit system, utilizing electromagnetic tubing (EMT) to include the equivalent in flexible metal, rigid galvanized steel (RGS) to include the equivalent of liquid tight, polyvinylchloride (PVC) schedule 40 or 80.

C. All conduits will be sized and installed per the NEC. All security system signal and power cables that traverse or originate in a high security office space will contained in either EMT or RGS conduit.

D. All conduit, pull boxes, and junction boxes shall be clearly marked with colored permanent tape or paint that will allow it to be distinguished from all other conduit and infrastructure.

E. Conduit fills shall not exceed 50 percent unless otherwise documented.

F. A pull string shall be pulled along and provided with signal and power cables to assist in future installations.

G. At all locations where there is a wall penetration or core drilling is conducted to allow for conduit to be installed, fire stopping materials shall be applied to that area

H. High voltage and signal cables shall not share the same conduit and shall be kept separate up to the point of connection. High voltage for the security system shall be defined as any cable or sets of cables carrying 30 VDC/VAC or higher.

I. For all equipment that is carrying digital data between the Physical Access Control System and Database Management or at a remote monitoring station, shall not be less that 20 AWG and stranded copper wire for each conductor. The cable or each individual conductor within the

cable shall have a shield that provides 100% coverage. Cables with a single overall shield shall have a tinned copper shield drain wire.

J. All cables and conductors, except fiber optic cables, that act as a control, communication, or signal lines shall include surge protection. Surge protection shall be furnished at the equipment end and additional triple electrode gas surge protectors rated for the application on each wire line circuit shall be installed within 1 m. (3 ft.) of the building cable entrance. The inputs and outputs shall be tested in both normal and common mode using the following wave forms:
   1. A 10 microsecond rise time by 1000 microsecond pulse width waveform with a peak voltage of 1500 watts and peak current of 60 amperes.
   2. An 8 microsecond rise time by 20 microsecond pulse width wave form with a peak voltage of 1000 volts and peak current of 500 amperes.

K. The surge suppression device shall not attenuate or reduce the video or sync signal under normal conditions. Fuses and relays shall not be used as a means of surge protection.

L. Coaxial Cables
   1. All video signal cables for the VASS System, with exception to the PoE cameras, shall be a coaxial cable and have a characteristic impedance of 75 ohms plus or minus 3 ohms.
   2. For runs up to 750 feet use of an RG-59/U is required. The RG-59/U shall be shielded which provides a minimum of 95 percent coverage, with a stranded copper center conductor of a minimum 23 AWG, polyethylene insulation, and black non-conductive polyvinylchloride (PVC) jacket.
   3. For runs between 750 feet and 1250 feet, RG-6/U is required. RG-6/U shall be shielded which provides a minimum of 95 percent coverage, with a stranded copper center conductor of a minimum 18 AWG, polyethylene insulation, and black non-conductive polyvinylchloride (PVC) jacket.
   4. For runs of 1250 to 2750 feet, RG-11/U is required. RG-11/U shall be shielded which provides a minimum of 95 percent coverage, with a stranded copper center conductor of a minimum 14 AWG, polyethylene insulation, and black non-conductive polyvinylchloride (PVC) jacket.
   5. All runs greater than 2750 feet will be substituted with a fiber optic cable. If using fiber optics as a signal carrier then the following equipment will be utilized:
      a. Multimode fiber optic cable a minimum size of 62 microns
      b. Video transmitter, installed at the camera that utilizes 12 VDC or 24 VAC for power.
      c. Video receiver, installed at the switcher.
   6. RG-59/U Technical Characteristics

AWG	22
Stranding	7x29
Conductor Diameter	.031 in.
Conductor Material	BCC
Insulation Material	Gas-injected FHDPE
Insulation Diameter	.145 in.
Outer Shield Type	Braid/Braid
Outer Jacket Material	PVC
Overall Nominal Diameter	.242 in.
UL Temperature Rating	75°C
Nom. Characteristic Impedance	75 Ohms

Nom. Inductance	0.094 µH/ft
Nom. Capacitance	Conductor to Shield 17.0 pF/ft
Nom. Velocity of Propagation	80 %
Nom. Delay	1.3 ns/ft
Nom. Conductor DC Resistance @ 20°C	12.2 Ohms/1000 ft
Nom. Outer Shield DC Resistance @ 20°C	2.4 Ohms/1000 ft
Max. Operating Voltage	UL 300 V RMS

7. RG-6/U Technical Characteristics:

AWG	18
Stranding	7x27
Conductor Diameter	.040 in.
Conductor Material	BC
Insulation Material	Gas-injected FHDPE
Insulation Diameter	.180 in.
Outer Shield Material	Trade Name Duofoil
Outer Shield Type	Tape/Braid
Outer Shield %Coverage	100 %
Outer Jacket Material	PVC
Overall Nominal Diameter	.274 in.
Nom. Characteristic Impedance	75 Ohms
Nom. Inductance	0.106 µH/ft
Nom. Capacitance	Conductor to Shield 16.2 pF/ft
Nom. Velocity of Propagation	82 %
Nom. Delay	1.24 ns/ft
Nom. Conductor DC Resistance	6.4 Ohms/1000 ft
Nominal Outer Shield DC Resistance @ 20°C	2.8 Ohms/1000 ft
Max. Operating Voltage	UL 300 V RMS

8. RG-11/U Technical Characteristics:

AWG	15
Stranding	19x27
Conductor Diameter	.064 in.
Conductor Material	BC
Insulation Material	Gas-injected FHDPE

Insulation Diameter	.312 in.
Inner Shield Type	Braid
Inner Shield Material	BC - Bare Copper
Inner Shield %Coverage	95 %
Inner Jacket Material	PE – Polyethylene
Inner Jacket Diameter	.391 in.
Outer Shield Type	Braid
Outer Shield Material	BC - Bare Copper
Outer Shield %Coverage	95 %
Outer Jacket Material	Trade Name Belflex
Outer Jacket Material	PVC Blend
Overall Nominal Diameter	.520 in.
Operating Temperature Range	-35°C To +75°C
Non-UL Temperature Rating	75°C
Nom. Characteristic Impedance	75 Ohms
Nom. Inductance	0.097 µH/ft
Nom. Capacitance	Conductor to Shield 17.3 pF/ft
Nom. Velocity of Propagation	78 %
Nom. Delay	1.30 ns/ft
Nom. Conductor DC Resistance	3.1 Ohms/1000 ft
Nom. Inner Shield DC Resistance	1.8 Ohms/1000 ft
Nom. Outer Shield DC Resistance	1.4 Ohms/1000 ft
Max. Operating Voltage Non-UL	300 V RMS

9. Signal Cables:
   a. Signal wiring for PoE cameras depends on the distance the camera is being installed from either a hub or the server.
   b. If the camera is up to 300 ft from a hub or the server, then use a shielded UTP category 5 (CAT-V) cable a with standard RJ-45 connector at each end. The cable with comply with the Power over Ethernet, IEEE802.3af, Standard.
   c. If the camera is over 300 ft from a hub or server then utilize a multimode fiber optic cable with a minimum size of 62 microns.
   d. Provide a separate cable for power.
   e. CAT-5 Technical Characteristics:

Number of Pairs	4
Total Number of Conductors	8
AWG	24
Stranding	Solid
Conductor Material	BC - Bare Copper
Insulation Material	PO – Polyolefin

Overall Nominal Diameter	.230 in.
IEC Specification	11801 Category 5
TIA/EIA Specification	568-B.2 Category 6a
Max. Capacitance Unbalance	(pF/100 m) 150 pF/100 m
Nom. Velocity of Propagation	70 %
Max. Delay	(ns/100 m) 538 @ 100MHz
Max. Delay Skew	(ns/100m) 45 ns/100 m
Max. Conductor DC Resistance	9.38 Ohms/100
Max. DCR Unbalance@ 20°C	3 %
Max. Operating Voltage	UL 300 V RMS

10. Fiber Optic Cables Technical Characteristics:

Fiber Type	62.5 Micron
Number of Fibers	4
Core Diameter 6	2.5 +/- 2.5 microns
Core Non-Circularity	5% Maximum
Clad Diameter	125 +/- 2 microns
Clad Non-Circularity	1% Maximum
Core-clad Offset	1.5 Microns Maximum
Primary Coating Material	Acrylate
Primary Coating Diameter	245 +/- 10 microns
Secondary Coating Material	Engineering Thermoplastic
Secondary Coating Diameter	900 +/- 50 microns
Strength Member Material	Aramid Yarn
Outer Jacket Material	PVC
Outer Jacket Color	Orange
Overall Diameter	.200 in.
Numerical Aperture	.275
Maximum Gigabit Ethernet	300 meters
Maximum Gigabit Ethernet	550 meters

11. Power Cables
    a. Will be sized accordingly and shall comply with the NEC. High voltage power cables will be a minimum of three conductors, 14 AWG, stranded, and coated with a non-conductive polyvinylchloride (PVC) jacket. Low voltage cables will be a minimum of 18 AWG, stranded and non-conductive polyvinylchloride (PVC) jacket.
    b. Will be utilized for all components of the VASS System that require either a 110 VAC 60 Hz or 220 VAC 50 Hz input. Each feed will be connected to a dedicated circuit breaker at a power panel that is primarily for the security system.

c. All equipment connected to AC power shall be protected from surges. Equipment protection shall withstand surge test waveforms described in IEEE C62.41. Fuses shall not be used as a means of surge protection.
d. Shall be rated for either 110 or 220 VAC, 50 or 60 Hz, and shall comply with VA Master Spec 26 05 21 Low Voltage Electrical Power Conductors and Cables (600 Volts and Below).
e. Low Voltage Power Cables
   1) Shall be a minimum of 18 AWG, Stranded and have a polyvinylchloride outer jacket.
   2) Cable size shall determined using a basic voltage over distance calculation and shall comply with the NEC's requirements for low voltage cables

PART 3 - EXECUTION

3.1 GENERAL

A. Installation: The Contractor shall install all system components including Owner furnished equipment, and appurtenances in accordance with the manufacturer's instructions, ANSI C2 and as shown, and shall furnish all necessary connectors, terminators, interconnections, services, and adjustments required for a complete and operable data transmission system.

B. Identification and Labeling: The Contractor shall supply permanent identification labels for each cable at each end that will appear on the as-built drawings. The labeling format shall be identified and a complete record shall be provided to the Owner with the final documentation. Each cable shall be identified by type or signal being carried and termination points. The labels shall be printed on letter size label sheets that are self laminated vinyl that can be printed from a computer data base or spread sheet. The labels shall be E-Z code WES12112 or equivalent.
   1. The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all testing.

C. Transient Voltage Surge Suppressors (TVSS): The Contractor shall mount TVSS within 3 m (118 in) of equipment to be protected inside terminal cabinets or suitable NEMA 1 enclosures. Terminate off-premise conductors on input side of device. Connect the output side of the device to the equipment to be protected. Connect ground lug to a low impedance earth ground (less than 10 ohms) via Number 12 AWG insulated, stranded copper conductor.

D. Contractor's Field Test: The Contractor shall verify the complete operation of the data transmission system during the Contractor's Field Testing. Field test shall include a bit error rate test. The Contractor shall perform the test by sending a minimum of 1,000,000 bits of data on each DTM circuit and measuring the bit error rate. The bit error rate shall not be greater than one (1) bit out of each 100,000 bits sent for each dial-up DTM circuit, and one (1) bit out of 1,000,000 bits sent for each leased or private DTM circuit. The Contractor shall submit a report containing results of the field test.

E. Acceptance Test and Endurance Test: The wire line data transmission system shall be tested as a part of the completed IDS and EECS during the Acceptance test and Endurance Test as specified.

F. Identification and Labeling: The Contractor shall supply identification tags or labels for each cable. Cable shall be labeled at both end points and at intermediate hand holes, manholes, and junction boxes. The labeling format shall be identified and a complete record shall be provided to the Owner with the final documentation. Each cable shall be identified with type of signal being carried and termination points.

3.2 INSTALLATION

A. System installation shall be in accordance with NECA 303, manufacturer and related documents and references, for each type of security subsystem designed, engineered and installed.

B. Components shall be configured with appropriate “service points” to pinpoint system trouble in less than 30 minutes.

C. The Contractor shall install all system components including Government furnished equipment, and appurtenances in accordance with the manufacturer's instructions, documentation listed in Sections 1.5 of this document, and shall furnish all necessary connectors, terminators, interconnections, services, and adjustments required for a complete and operable system.

D. The VASS System will be designed, engineered, installed, and tested to ensure all components are fully compatible as a system and can be integrated with all associated security subsystems, whether the system is a stand alone or a complete network.

E. For integration purposes, the VASS System shall be integrated where appropriate with the following associated security subsystems:
   1. PACS:
      a. Provide 24 hour coverage of all entry points to the perimeter and agency buildings, as well as all emergency exits utilizing a fixed color camera.
      b. Record cameras on a 24 hours basis.
      c. Be programmed go into an alarm state when an emergency exit is opened, and notify the Physical Access Control System and Database Management of an alarm event.
   2. IDS:
      a. Provide a recorded alarm event via a color camera that is connected to the IDS system by either direct hardwire or a security system computer network.
      b. Record cameras on a 24 hours basis.
      c. Be programmed to go into an alarm state when an IDS device is put into an alarm state, and notify the PACS.
   3. Security Access Detection:
      a. Provide full coverage of all vehicle and lobby entrance screening areas utilizing a fixed color camera.
      b. Record cameras on a 24 hours basis.
      c. The VASS System should have facial recognition software to assist in identifying individuals for current and future purposes.
   4. EPPS:
      a. Provide a recorded alarm event via a color camera that is connected to the EPPS system by either direct hardwire or a security system computer network.
      b. Record cameras on a 24 hours basis.
      c. Be programmed to go into an alarm state when an emergency call box or duress alarm/panic device is activated, and notify the Physical Access Control System and Database Management of an alarm event.

F. Integration with these security subsystems shall be achieved by computer programming or the direct hardwiring of the systems.

G. For programming purposes refer to the manufacturers requirements for correct system operations. Ensure computers being utilized for system integration meet or exceed the minimum system requirements outlined on the systems software packages.

H. A complete VASS System shall be comprised of, but not limited to, the following components:
   1. Cameras
   2. Lenses
   3. Video Display Equipment
   4. Camera Housings and Mounts
   5. Controlling Equipment
   6. Recording Devices
   7. Wiring and Cables

I. The Contractor shall visit the site and verify that site conditions are in agreement/compliance with the design package. The Contractor shall report all changes to the site or conditions that

will affect performance of the system to the Contracting Officer in the form of a report. The Contractor shall not take any corrective action without written permission received from the Contracting Officer.

J. Existing Equipment
   1. The Contractor shall connect to and utilize existing video equipment, video and control signal transmission lines, and devices as outlined in the design package. Video equipment and signal lines that are usable in their original configuration without modification may be reused with Contracting Officer approval.
   2. The Contractor shall perform a field survey, including testing and inspection of all existing video equipment and signal lines intended to be incorporated into the VASS System, and furnish a report to the Contracting Officer as part of the site survey report. For those items considered nonfunctioning, provide (with the report) specification sheets, or written functional requirements to support the findings and the estimated cost to correct the deficiency. As part of the report, the Contractor shall include a schedule for connection to all existing equipment.
   3. The Contractor shall make written requests and obtain approval prior to disconnecting any signal lines and equipment, and creating equipment downtime. Such work shall proceed only after receiving Contracting Officer approval of these requests. If any device fails after the Contractor has commenced work on that device, signal or control line, the Contractor shall diagnose the failure and perform any necessary corrections to the equipment.
   4. The Contractor shall be held responsible for repair costs due to Contractor negligence, abuse, or incorrect installation of equipment.
   5. The Contracting Officer shall be provided a full list of all equipment that is to be removed or replaced by the Contractor, to include description and serial/manufacturer numbers where possible. The Contractor shall dispose of all equipment that has been removed or replaced based upon approval of the Contracting Officer after reviewing the equipment removal list. In all areas where equipment is removed or replaced the Contractor shall repair those areas to match the current existing conditions.

K. Enclosure Penetrations: All enclosure penetrations shall be from the bottom of the enclosure unless the system design requires penetrations from other directions. Penetrations of interior enclosures involving transitions of conduit from interior to exterior, and all penetrations on exterior enclosures shall be sealed with rubber silicone sealant to preclude the entry of water and will comply with VA Master Specification 07 84 00, Firestopping. The conduit riser shall terminate in a hot-dipped galvanized metal cable terminator. The terminator shall be filled with an approved sealant as recommended by the cable manufacturer and in such a manner that the cable is not damaged.

L. Cold Galvanizing: All field welds and brazing on factory galvanized boxes, enclosures, and conduits shall be coated with a cold galvanized paint containing at least 95 percent zinc by weight.

M. Interconnection of Console Video Equipment: The Contractor shall connect signal paths between video equipment as specified by the OEM. Cables shall be as short as practicable for each signal path without causing strain at the connectors. Rack mounted equipment on slide mounts shall have cables of sufficient length to allow full extension of the slide rails from the rack.

N. Cameras:
   1. Install the cameras with the focal length lens as indicated for each zone.
   2. Connect power and signal lines to the camera.
   3. Aim camera to give field of view as needed to cover the alarm zone.
   4. Aim fixed mounted cameras installed outdoors facing the rising or setting sun sufficiently below the horizon to preclude the camera looking directly at the sun.
   5. Focus the lens to give a sharp picture (to include checking for day and night focus and image quality) over the entire field of view

6. Synchronize all cameras so the picture does not roll on the monitor when cameras are selected.
7. PTZ cameras shall have all preset positions and privacy areas defined and programmed.

O. Monitors:
1. Install the monitors as shown and specified in design and construction documents.
2. Connect all signal inputs and outputs as shown and specified.
3. Terminate video input signals as required.
4. Connect the monitor to AC power.

P. Switcher:
1. Install the switcher as shown in the design and construction documents, and according to the OEM.
2. Connect all subassemblies as specified by the manufacturer and as shown.
3. Connect video signal inputs and outputs as shown and specified; terminate video inputs as required.
4. Connect alarm signal inputs and outputs as shown and specified; connect control signal inputs and outputs for ancillary equipment or secondary control/monitoring sites as specified by the manufacturer and as shown.
5. Connect the switcher CPU and switcher subassemblies to AC power.
6. Load all software as specified and required for an operational VASS System configured for the site and building requirements, including data bases, operational parameters, and system, command, and application programs.
7. Provide the original and 2 backup copies for all accepted software upon successful completion of the endurance test.
8. Program the video annotation for each camera.

Q. Video Encoder/Decoder
1. Install the Video Encoder/Decoder per design and construction documents, and as specified by the OEM.
2. Connect analog camera inputs to video encoder.
3. Connect network camera to video decoder.
4. Connect video encoder to VASS network.
5. Connect video decoder to video matrix, DVR, monitor etc.
6. Connect unit to AC power (UPS).
7. Configure the video encoder/decoder per manufacturer’s recommendation and project requirements.

R. Video Server:
1. Install the video server per design and construction documents, and as specified by the OEM.
2. Connect video server to AC power (UPS).
3. Connect to VASS network.
4. Install operating system and Video Management Software.
5. Provide Video Management Software programming per VA guidance and the requirements provided by the Owner. Programming shall include:
   a. Camera names
   b. Screen views
   c. Camera recording schedules (continuous and event) driven recording. Events include alarms from other systems (sensors), manual input, and video motion detection.
   d. Video detection zones for each camera requiring video motion detection
   e. Alarm interface
   f. f. Alarm outputs
   g. GUI maps, views, icons and actions
   h. PTZ controls (presets, time schedules for privacy zones etc.)
   i. Reports

S. Video Workstation:
1. Install the video workstation per design and construction documents, and as specified by the OEM.
2. Connect video workstation to AC power (UPS).
3. Connect to VASS network.
4. Install operating system and application software.
5. Provide application software programming per VA guidance and the requirements provided by the Owner. Programming shall include:
   a. Screen views
   b. Graphical User Interface (GUI) maps, views, icons and actions
   c. Alarm outputs
   d. Reports

T. Network Switch:
1. Install the network switch per design and construction documents, and as specified by the OEM.
2. Connect network switch to AC power (UPS).
3. Connect network cameras to network switch.
4. Configure the network switch per manufacturer's recommendation and project requirements.

U. Network Recording Equipment
1. Install the NVR or video storage unit as shown in the design and construction documents, and as specified by the OEM.
2. Connect recording device to AC power (UPS).
3. Connect recording device to network switch as shown and specified.
4. Configure network connections
5. Provide recording unit programming per VA guidance and the requirements provided by the Owner. Programming shall include:
   a. Camera names
   b. Screen views
   c. Camera recording schedules (continuous and event) driven recording. Events include alarms from other systems (sensors), manual input, and video motion detection.
   d. Video detection zones for each camera requiring video motion detection
   e. Alarm interface
   f. Alarm outputs
   g. GUI maps, views, icons and actions
   h. PTZ controls (presets, time schedules for privacy zones etc.)
   i. Reports

V. Video Recording Equipment:
1. Install the video recording equipment as shown in the design and construction documents, and as specified by the OEM.
2. Connect video signal inputs and outputs as shown and specified.
3. Connect alarm signal inputs and outputs as shown and specified.
4. Connect video recording equipment to AC power.
5. Program the video recording equipment;
   a. Recording schedules
   b. Camera caption

W. Video Signal Equipment:
1. Install the video signal equipment as shown in the design and construction documents, and as specified by the OEM.
2. Connect video or signal inputs and outputs as shown and specified.
3. Terminate video inputs as required.
4. Connect alarm signal inputs and outputs as required.
5. Connect control signal inputs and outputs as required

6. Connect electrically powered equipment to AC power.

X. Camera Housings, Mounts, and Poles:
1. Install the camera housings and mounts as specified by the manufacturer and as shown, provide mounting hardware sized appropriately to secure each camera, housing and mount with maximum wind and ice loading encountered at the site.
2. Provide a foundation for each camera pole as specified and shown.
3. Provide a ground rod for each camera pole and connect the camera pole to the ground rod as specified in Division 26 of the VA Master Specification and the VA Electrical Manual 730.
4. Provide electrical and signal transmission cabling to the mount location via a hardened carrier system from the Physical Access Control System and Database Management to the device.
5. Connect signal lines and AC power to the housing interfaces.
6. Connect pole wiring harness to camera.

3.3 SYSTEM START-UP

A. The Contractor shall not apply power to the VASS System until the following items have been completed:
1. VASS System equipment items and have been set up in accordance with manufacturer's instructions.
2. A visual inspection of the VASS System has been conducted to ensure that defective equipment items have not been installed and that there are no loose connections.
3. System wiring has been tested and verified as correctly connected as indicated.
4. All system grounding and transient protection systems have been verified as installed and connected as indicated.
5. Power supplies to be connected to the VASS System have been verified as the correct voltage, phasing, and frequency as indicated.

B. The Commissioning Agent will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the Resident Engineer and Commissioning Agent. Provide a minimum of 7 days prior notice.

C. Satisfaction of the above requirements shall not relieve the Contractor of responsibility for incorrect installation, defective equipment items, or collateral damage as a result of Contractor work efforts.

3.4 SUPLEMENTAL CONTRACTOR QUIALITY CONTROL

A. The Contractor shall provide the services of technical representatives who are familiar with all components and installation procedures of the installed VASS System; and are approved by the Contracting Officer.

B. The Contractor will be present on the job site during the preparatory and initial phases of quality control to provide technical assistance.

C. The Contractor shall also be available on an as needed basis to provide assistance with follow-up phases of quality control.

D. The Contractor shall participate in the testing and validation of the system and shall provide certification that the system installed is fully operational as all construction document requirements have been fulfilled.

3.5 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 28 08 00 – COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS for all inspection, start up, and contractor testing required above and required by the System Readiness Checklist provided by the Commissioning Agent.

B. Components provided under this section of the specification will be tested as part of a larger system. Refer to Section 28 08 00 – “COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS” and related sections for contractor responsibilities for system commissioning.

3.6 DEMONSTRATION AND TRAINING

A. All testing and training shall be compliant with the VA General Requirements, Section 01 00 00, “GENERAL REQUIREMENTS”.

B. Provide services of manufacturer’s technical representative for four hours to instruct VA personnel in operation and maintenance of units.

C. Submit training plans and instructor qualifications in accordance with the requirements of Section 28 08 00 – “COMMISSIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS”.

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SECTION 28 31 00

FIRE DETECTION AND ALARM

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section of the specifications includes the furnishing, installation, and connection of the fire alarm equipment to form a complete coordinated system ready for operation. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, control units, fire safety control devices, annunciators, power supplies, and wiring as shown on the drawings and specified. The fire alarm system shall not be combined with other systems such as building automation, energy management, security, etc.

B. Fire alarm systems shall comply with requirements of the most recent VA FIRE PROTECTION DESIGN MANUAL and NFPA 72 unless variations to NFPA 72 are specifically identified within these contract documents by the following notation: "variation". The design, system layout, document submittal preparation, and supervision of installation and testing shall be provided by a technician that is certified NICET level III or a registered fire protection engineer. The NICET certified technician shall be on site for the supervision and testing of the system. Factory engineers from the equipment manufacturer, thoroughly familiar and knowledgeable with all equipment utilized, shall provide additional technical support at the site as required by the COR or his authorized representative. Installers shall have a minimum of 2 years experience installing fire alarm systems.

C. Fire alarm signals:
1. Building(s) identify which buildings shall have an automatic digitized voice fire alarm signal with emergency manual voice override to notify occupants to evacuate. The digitized voice message shall identify the area of the building (smoke zone) from which the alarm was initiated.
2. Building(s) identify which buildings shall have a general evacuation fire alarm signal in accordance with ASA S3.41 to notify all occupants in the respective building to evacuate.

D. Alarm signals (by device), supervisory signals (by device) and system trouble signals (by device not reporting) shall be distinctly transmitted to the main fire alarm system control unit located in the security office.

E. The main fire alarm control unit shall automatically transmit alarm signals to a listed central station using a digital alarm communicator transmitter in accordance with NFPA 72.

1.2 SCOPE

A. A fully addressable fire alarm system shall be designed and installed in accordance with the specifications and drawings. Device location and wiring runs shown on the drawings are for reference only unless specifically dimensioned. Actual locations shall be in accordance with NFPA 72 and this specification.

B. All existing fire alarm equipment, wiring, devices and sub-systems that are not shown to be reused shall be removed. All existing fire alarm conduit not reused shall be removed.

C. Existing fire alarm bells, chimes, door holders, 120VAC duct smoke detectors, valve tamper switches and waterflow/pressure switches may be reused only as specifically indicated on the drawings and provided the equipment:
1. Meets this specification section
2. Is UL listed or FM approved
3. Is compatible with new equipment being installed

4. Is verified as operable through contractor testing and inspection
5. Is warranted as new by the contractor.

D. Existing 120 VAC duct smoke detectors, waterflow/pressure switches, and valve tamper switches reused by the Contractor shall be equipped with an addressable interface device compatible with the new equipment being installed.

E. Existing reused equipment shall be covered as new equipment under the Warranty specified herein.

F. Basic Performance:
1. Alarm and trouble signals from each building fire alarm control panel shall be digitally encoded by UL listed electronic devices onto a multiplexed communication system.
2. Response time between alarm initiation (contact closure) and recording at the main fire alarm control unit (appearance on alphanumeric read out) shall not exceed 5 seconds.
3. The signaling line circuits (SLC) between building fire alarm control units shall be wired Style 7 in accordance with NFPA 72. Isolation shall be provided so that no more than one building can be lost due to a short circuit fault.
4. Initiating device circuits (IDC) shall be wired Style C in accordance with NFPA 72.
5. Signaling line circuits (SLC) within buildings shall be wired Style 4 in accordance with NFPA 72. Individual signaling line circuits shall be limited to covering 22,500 square feet (2,090 square meters) of floor space or 3 floors whichever is less.
6. Notification appliance circuits (NAC) shall be wired Style Y in accordance with NFPA 72.

1.3 RELATED WORK

A. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

Requirements for procedures for submittals.

B. Section 07 84 00 - FIRESTOPPING. Requirements for fire proofing wall penetrations.

C. Section 08 71 00 - DOOR HARDWARE. For combination Closer-Holders.

D. Section 21 13 13 - WET-PIPE SPRINKLER SYSTEMS. Requirements for sprinkler systems.

E. Section 28 05 00 – COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY. Requirements for general requirements that are common to more than one section in Division 28.

F. Section 28 05 13 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for conductors and cables.

G. Section 28 05 26 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY. Requirements for grounding of equipment.

H. Section 28 05 28.33 - CONDUITS AND BACKBOXES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for infrastructure.

J. Section 28 08 00, COMMISIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS. Requirements for commissioning - systems readiness checklists, and training.

K. Section 28 13 00, PHYSICAL ACCESS CONTROL SYSTEMS (PACS). Requirements for integration with physical access control system.

1.4 SUBMITTALS

A. General: Submit 5 copies in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, and Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

B. Drawings:

1. Prepare drawings using AutoCAD Release 14 software and include all contractors information. Layering shall be by VA criteria as provided by the Contracting Officer's Technical Representative (COR). Bid drawing files on AutoCAD will be provided to the Contractor at the pre-construction meeting. The contractor shall be responsible for verifying all critical dimensions shown on the drawings provided by VA.
2. Floor plans: Provide locations of all devices (with device number at each addressable device corresponding to control unit programming), appliances, panels, equipment, junction/terminal cabinets/boxes, risers, electrical power connections, individual circuits and raceway routing, system zoning; number, size, and type of raceways and conductors in each raceway; conduit fill calculations with cross section area percent fill for each type and size of conductor and raceway. Only those devices connected and incorporated into the final system shall be on these floor plans. Do not show any removed devices on the floor plans. Show all interfaces for all fire safety functions.
3. Riser diagrams: Provide, for the entire system, the number, size and type of riser raceways and conductors in each riser raceway and number of each type device per floor and zone. Show door holder interface, elevator control interface, HVAC shutdown interface, fire extinguishing system interface, and all other fire safety interfaces. Show wiring Styles on the riser diagram for all circuits. Provide diagrams both on a per building and campus wide basis.
4. Detailed wiring diagrams: Provide for control panels, modules, power supplies, electrical power connections, auxiliary relays and annunciators showing termination identifications, size and type conductors, circuit boards, LED lamps, indicators, adjustable controls, switches, ribbon connectors, wiring harnesses, terminal strips and connectors, spare zones/circuits. Diagrams shall be drawn to a scale sufficient to show spatial relationships between components, enclosures and equipment configuration.
5. Two weeks prior to final inspection, the Contractor shall deliver to the COR 3 sets of as-built drawings and one set of the as-built drawing computer files (using AutoCAD 2007 or later). As-built drawings (floor plans) shall show all new and/or existing conduit used for the fire alarm system.

C. Manuals:

1. Submit simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals including technical data sheets for all items used in the system, power requirements, device wiring diagrams, dimensions, and information for ordering replacement parts.
   a. Wiring diagrams shall have their terminals identified to facilitate installation, operation, expansion and maintenance.
   b. Wiring diagrams shall indicate internal wiring for each item of equipment and the interconnections between the items of equipment.
   c. Include complete listing of all software used and installation and operation instructions including the input/output matrix chart.
   d. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate, inspect, test and maintain the equipment and system. Provide all manufacturer's installation limitations including but not limited to circuit length limitations.
   e. Complete listing of all digitized voice messages.
   f. Provide standby battery calculations under normal operating and alarm modes. Battery calculations shall include the magnets for holding the doors open for one minute.

g. Include information indicating who will provide emergency service and perform post contract maintenance.

h. Provide a replacement parts list with current prices. Include a list of recommended spare parts, tools, and instruments for testing and maintenance purposes.

i. A computerized preventive maintenance schedule for all equipment. The schedule shall be provided on disk in a computer format acceptable to the VAMC and shall describe the protocol for preventive maintenance of all equipment. The schedule shall include the required times for systematic examination, adjustment and cleaning of all equipment. A print out of the schedule shall also be provided in the manual. Provide the disk in a pocket within the manual.

j. Furnish manuals in 3 ring loose-leaf binder or manufacturer's standard binder.

k. A print out for all devices proposed on each signaling line circuit with spare capacity indicated.

2. Two weeks prior to final inspection, deliver 4 copies of the final updated maintenance and operating manual to the COR.

a. The manual shall be updated to include any information necessitated by the maintenance and operating manual approval.

b. Complete "As installed" wiring and schematic diagrams shall be included that shows all items of equipment and their interconnecting wiring. Show all final terminal identifications.

c. Complete listing of all programming information, including all control events per device including an updated input/output matrix.

d. Certificate of Installation as required by NFPA 72 for each building. The certificate shall identify any variations from the National Fire Alarm Code.

e. Certificate from equipment manufacturer assuring compliance with all manufacturers installation requirements and satisfactory system operation.

D. Certifications:

1. Together with the shop drawing submittal, submit the technician's NICET level III fire alarm certification as well as certification from the control unit manufacturer that the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include in the certification the names and addresses of the proposed supervisor of installation and the proposed performer of contract maintenance. Also include the name and title of the manufacturer’s representative who makes the certification.

2. Together with the shop drawing submittal, submit a certification from either the control unit manufacturer or the manufacturer of each component (e.g., smoke detector) that the components being furnished are compatible with the control unit.

3. Together with the shop drawing submittal, submit a certification from the major equipment manufacturer that the wiring and connection diagrams meet this specification, UL and NFPA 72 requirements.

1.5 WARRANTY

All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of one year from the date of acceptance of the entire installation by the Contracting Officer.

1.6 GUARANTY PERIOD SERVICES

A. Complete inspection, testing, maintenance and repair service for the fire alarm system shall be provided by a factory trained authorized representative of the manufacturer of the major equipment for a period of 5 years from the date of acceptance of the entire installation by the Contracting Officer.

B. Contractor shall provide all necessary test equipment, parts and labor to perform required inspection, testing, maintenance and repair.

C. All inspection, testing, maintenance and permanent records required by NFPA 72, and recommended by the equipment manufacturer shall be provided by the contractor. Work shall include operation of sprinkler system alarm and supervisory devices. It shall include all interfaced equipment including but not limited to elevators, HVAC shutdown, and extinguishing systems.

D. Maintenance and testing shall be performed in accordance with NFPA 72. A computerized preventive maintenance schedule shall be provided and shall describe the protocol for preventive maintenance of equipment. The schedule shall include a systematic examination, adjustment and cleaning of all equipment.

E. Non-included Work: Repair service shall not include the performance of any work due to improper use, accidents, or negligence for which the contractor is not responsible.

F. Service and emergency personnel shall report to the Engineering Office or their authorized representative upon arrival at the hospital and again upon the completion of the required work. A copy of the work ticket containing a complete description of the work performed and parts replaced shall be provided to the VA COR or his authorized representative.

G. Emergency Service:

1. Warranty Period Service: Service other than the preventative maintenance, inspection, and testing required by NFPA 72 shall be considered emergency call-back service and covered under the warranty of the installation during the first year of the warranty period, unless the required service is a result of abuse or misuse by the Government. Written notification shall not be required for emergency warranty period service and the contractor shall respond as outlined in the following sections on Normal and Overtime Emergency Call-Back Service. Warranty period service can be required during normal or overtime emergency call-back service time periods at the discretion of the COR or his authorized representative.
2. Normal and overtime emergency call-back service shall consist of an on-site response within 2 hours of notification of a system trouble.
3. Normal emergency call-back service times are between the hours of 7:30 a.m. and 4:00 p.m., Monday through Friday, exclusive of federal holidays. Service performed during all other times shall be considered to be overtime emergency call-back service. The cost of all normal emergency call-back service for years 2 through 5 shall be included in the cost of this contract.
4. Overtime emergency call-back service shall be provided for the system when requested by the Government. The cost of the first 40 manhours per year of overtime call-back service during years 2 through 5 of this contract shall be provided under this contract. Payment for overtime emergency call-back service in excess of the 40 man hours per year requirement will be handled through separate purchase orders. The method of calculating overtime emergency call-back hours is based on actual time spent on site and does not include travel time.

H. The contractor shall maintain a log at each fire alarm control unit. The log shall list the date and time of all examinations and trouble calls, condition of the system, and name of the technician. Each trouble call shall be fully described, including the nature of the trouble, necessary correction performed, and parts replaced.

1.7 APPLICABLE PUBLICATIONS

A. The publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. The publications are referenced in text by the basic designation only and the latest editions of these publications shall be applicable.

B. National Fire Protection Association (NFPA):
NFPA 13 .....Standard for the Installation of Sprinkler Systems, 2010 edition

NFPA 14 ..... Standard for the Installation of Standpipes and Hose Systems, 2010 edition

NFPA 20 ..... Standard for the Installation of Stationary Pumps for Fire Protection, 2010 edition

NFPA 70.....National Electrical Code (NEC), 2010 edition

NFPA 72.....National Fire Alarm Code, 2010 edition

NFPA 90A .....Standard for the Installation of Air Conditioning and Ventilating Systems, 2009 edition

NFPA 101.....Life Safety Code, 2009 edition

C. Underwriters Laboratories, Inc. (UL): Fire Protection Equipment Directory

D. Factory Mutual Research Corp (FM): Approval Guide, 2007-2011

E. American National Standards Institute (ANSI):
S3.41 .....Audible Emergency Evacuation Signal, 1990 edition, reaffirmed 2008

F. International Code Council, International Building Code (IBC), 2009 edition

PART 2 A- PRODUCTS

2.1 EQUIPMENT AND MATERIALS, GENERAL

A. Basis of Design: Notifier Non-Proprietary Addressable System with Mass Evacuation – required to match and continue existing station systems -no substitutions.

B. All equipment and components shall be new and the manufacturer's current model. All equipment shall be tested and listed by Underwriters Laboratories, Inc. or Factory Mutual Research Corporation for use as part of a fire alarm system. The authorized representative of the manufacturer of the major equipment shall certify that the installation complies with all manufacturers' requirements and that satisfactory total system operation has been achieved.

2.2 CONDUIT, BOXES, AND WIRE

A. Conduit shall be in accordance with Section 28 05 28.33 CONDUIT AND BACKBOXES FOR ELECTRONIC SAFETY AND SECURITY and as follows:

1. All new conduits shall be installed in accordance with NFPA 70.
2. Conduit fill shall not exceed 40 percent of interior cross sectional area.
3. All new conduits shall be 3/4 inch (19 mm) minimum.

B. Wire:

1. Wiring shall be in accordance with NEC article 760, Section 28 05 13, CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY, and as recommended by the manufacturer of the fire alarm system. All wires shall be color coded. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG for initiating device circuits and 14 AWG for notification device circuits.
2. Addressable circuits and wiring used for the multiplex communication loop shall be twisted and shielded unless specifically excepted by the fire alarm equipment manufacturer in writing.
3. Any fire alarm system wiring that extends outside of a building shall have additional power surge protection to protect equipment from physical damage and false signals due to lightning, voltage and current induced transients. Protection devices shall be shown on the submittal drawings and shall be UL listed or in accordance with written manufacturer's requirements.

4. All wire or cable used in underground conduits including those in concrete shall be listed for wet locations.

C. Terminal Boxes, Junction Boxes, and Cabinets:
1. Shall be galvanized steel in accordance with UL requirements.
2. All boxes shall be sized and installed in accordance with NFPA 70.
3. covers shall be repainted red in accordance with Section 09 91 00, PAINTING and shall be identified with white markings as "FA" for junction boxes and as "FIRE ALARM SYSTEM" for cabinets and terminal boxes. Lettering shall be a minimum of 3/4 inch (19 mm) high.
4. Terminal boxes and cabinets shall have a volume 50 percent greater than required by the NFPA 70. Minimum sized wire shall be considered as 14 AWG for calculation purposes.
5. Terminal boxes and cabinets shall have identified pressure type terminal strips and shall be located at the base of each riser. Terminal strips shall be labeled as specified or as approved by the COR.

2.3 FIRE ALARM CONTROL UNIT

A. General:
1. Each building shall be provided with a fire alarm control unit and shall operate as a supervised zoned fire alarm system.
2. Each power source shall be supervised from the other source for loss of power.
3. All circuits shall be monitored for integrity.
4. Visually and audibly annunciate any trouble condition including, but not limited to main power failure, grounds and system wiring derangement.
5. Transmit digital alarm information to the main fire alarm control unit.

B. Enclosure:
1. The control unit shall be housed in a cabinet suitable for both recessed and surface mounting. Cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.
2. Cabinet shall contain all necessary relays, terminals, lamps, and legend plates to provide control for the system.

C. Operator terminal at main control unit:
1. Operator terminal shall consist of the central processing unit, display screen, keyboard and printer.
2. Display screen shall have a minimum 15-inch (380 mm) diagonal non-glare screen capable of displaying 24 lines of 80 characters each.
3. Keyboard shall consist of 60 alpha numeric and 12 user/functional control keys.
4. Printer shall be the automatic type, printing the date, time and location for all alarm, supervisory, and trouble conditions.

D. Power Supply:
1. The control unit shall derive its normal power from a 120 volt, 60 Hz dedicated supply connected to the emergency power system. Standby power shall be provided by a 24 volt DC battery as hereinafter specified. The normal power shall be transformed, rectified, coordinated, and interfaced with the standby battery and charger.
2. The door holder power shall be arranged so that momentary or sustained loss of main operating power shall not cause the release of any door.
3. Power supply for smoke detectors shall be taken from the fire alarm control unit.
4. Provide protectors to protect the fire alarm equipment from damage due to lightning or voltage and current transients.
5. Provide new separate and direct ground lines to the outside to protect the equipment from unwanted grounds.

E. Circuit Supervision: Each alarm initiating device circuit, signaling line circuit, and notification appliance circuit, shall be supervised against the occurrence of a break or ground

fault condition in the field wiring. These conditions shall cause a trouble signal to sound in the control unit until manually silenced by an off switch.

F. Supervisory Devices: All sprinkler system valves, standpipe control valves, post indicator valves (PIV), and main gate valves shall be supervised for off-normal position. Closing a valve shall sound a supervisory signal at the control unit until silenced by an off switch. The specific location of all closed valves shall be identified at the control unit. Valve operation shall not cause an alarm signal. Low air pressure switches and duct detectors shall be monitored as supervisory signals. The power supply to the elevator shunt trip breaker shall be monitored by the fire alarm system as a supervisory signal.

G. Trouble signals:
1. Arrange the trouble signals for automatic reset (non-latching).
2. System trouble switch off and on lamps shall be visible through the control unit door.

H. Function Switches: Provide the following switches in addition to any other switches required for the system:
1. Remote Alarm Transmission By-pass Switch: Shall prevent transmission of all signals to the main fire alarm control unit when in the "off" position. A system trouble signal shall be energized when switch is in the off position.
2. Alarm Off Switch: Shall disconnect power to alarm notification circuits on the local building alarm system. A system trouble signal shall be activated when switch is in the off position.
3. Trouble Silence Switch: Shall silence the trouble signal whenever the trouble silence switch is operated. This switch shall not reset the trouble signal.
4. Reset Switch: Shall reset the system after an alarm, provided the initiating device has been reset. The system shall lock in alarm until reset.
5. Lamp Test Switch: A test switch or other approved convenient means shall be provided to test the indicator lamps.
6. Drill Switch: Shall activate all notification devices without tripping the remote alarm transmitter. This switch is required only for general evacuation systems specified herein.
7. Door Holder By-Pass Switch: Shall prevent doors from releasing during fire alarm tests. A system trouble alarm shall be energized when switch is in the abnormal position.
8. Elevator recall By-Pass Switch: Shall prevent the elevators from recalling upon operation of any of the devices installed to perform that function. A system trouble alarm shall be energized when the switch is in the abnormal position.
9. HVAC/Smoke Damper By-Pass: Provide a means to disable HVAC fans from shutting down and/or smoke dampers from closing upon operation of an initiating device designed to interconnect with these devices.

I. Remote Transmissions:
1. Provide capability and equipment for transmission of alarm, supervisory and trouble signals to the main fire alarm control unit.
2. Transmitters shall be compatible with the systems and equipment they are connected to such as timing, operation and other required features.

J. Remote Control Capability: Each building fire alarm control unit shall be installed and programmed so that each must be reset locally after an alarm, before the main fire alarm control unit can be reset. After the local building fire alarm control unit has been reset, then the all system acknowledge, reset, silence or disabling functions can be operated by the main fire alarm control unit

K. System Expansion: Design the control units and enclosures so that the system can be expanded in the future (to include the addition of 20 percent more alarm initiating, alarm notification and door holder circuits) without disruption or replacement of the existing control unit and secondary power supply.

2.4 STANDBY POWER SUPPLY

A. Uninterrupted Power Supply (UPS):
1. The UPS system shall be comprised of a static inverter, a precision battery float charger, and sealed maintenance free batteries.
2. Under normal operating conditions, the load shall be filtered through a ferroresonant transformer.
3. When normal AC power fails, the inverter shall supply AC power to the transformer from the battery source. There shall be no break in output of the system during transfer of the system from normal to battery supply or back to normal.
4. Batteries shall be sealed, gel cell type.
5. UPS system shall be sized to operate the central processor, CRT, printer, and all other directly connected equipment for 5 minutes upon a normal AC power failure.

B. Batteries:
1. Battery shall be of the sealed, maintenance free type, 24-volt nominal.
2. Battery shall have sufficient capacity to power the fire alarm system for not less than 24 hours plus 5 minutes of alarm to an end voltage of 1.14 volts per cell, upon a normal AC power failure.
3. Battery racks shall be steel with an alkali-resistant finish. Batteries shall be secured in seismic areas 2B, 3, or 4 as defined by the Uniform Building Code.

C. Battery Charger:
1. Shall be completely automatic, with constant potential charger maintaining the battery fully charged under all service conditions. Charger shall operate from a 120-volt, 60 hertz emergency power source.
2. Shall be rated for fully charging a completely discharged battery within 48 hours while simultaneously supplying any loads connected to the battery.
3. Shall have protection to prevent discharge through the charger.
4. Shall have protection for overloads and short circuits on both AC and DC sides.
5. A trouble condition shall actuate the fire alarm trouble signal.
6. Charger shall have automatic AC line voltage regulation, automatic current-limiting features, and adjustable voltage controls.

2.5 ANNUNCIATION

A. Annunciator, Alphanumeric Type (System):
1. Shall be a supervised, LCD display containing a minimum of 2 lines of 40 characters for alarm annunciation in clear English text.
2. Message shall identify building number, floor, zone, etc on the first line and device description and status (pull station, smoke detector, waterflow alarm or trouble condition) on the second line.
3. The initial alarm received shall be indicated as such.
4. A selector switch shall be provided for viewing subsequent alarm messages.
5. The display shall be UL listed for fire alarm application.
6. Annunciators shall display information for all buildings connected to the system. Local building annunciators, for general evacuation system buildings, shall be permitted when shown on the drawings and approved by the COR.

B. Printers:
1. System printers shall be high reliability digital input devices, UL approved, for fire alarm applications. The printers shall operate at a minimum speed of 30 characters per second. The printer shall be continually supervised.
2. Printers shall be programmable to either alarm only or event logging output.
   a. Alarm printers shall provide a permanent (printed) record of all alarm information that occurs within the fire alarm system. Alarm information shall include the date, time, building number, floor, zone, device type, device address, and condition.

b. Event logging printers shall provide a permanent (printed) record of every change of status that occurs within the fire alarm system. Status information shall include date, time, building number, floor, zone, device type, device address and change of status (alarm, trouble, supervisory, reset/return to normal).

3. System printers shall provide tractor drive feed pins for conventional fan fold 8-1/2" x 11" (213 mm x 275 mm) paper.

4. The printers shall provide a printing and non-printing self test feature.

5. Power supply for printers shall be taken from and coordinated with the building emergency service.

6. Each printer shall be provided with a stand for the printer and paper.

7. Spare paper and ribbons for printers shall be stocked and maintained as part of the one year guarantee period services in addition to the one installed after the approval of the final acceptance test.

2.6 VOICE COMMUNICATION SYSTEM (VCS)

A. General:
1. An emergency voice communication system shall be installed throughout Identify Buildings.
2. Upon receipt of an alarm signal from the building fire alarm system, the VCS shall automatically transmit a pre-recorded fire alarm message throughout the building.
3. A digitized voice module shall be used to store each prerecorded message.
4. The VCS shall be arranged as a dual channel system capable of transmitting 2 different messages simultaneously.
5. The VCS shall supervise all speaker circuits, control equipment, remote audio control equipment, and amplifiers.

B. Speaker Circuit Control Unit:
1. The speaker circuit control unit shall include switches to manually activate or deactivate speaker circuits grouped by floor in the system.
2. Speaker circuit control switches shall provide on, off, and automatic positions and indications.
3. The speaker circuit control unit shall include visual indication of active or trouble status for each group of speaker circuits in the system.
4. A trouble indication shall be provided if a speaker circuit group is disabled.
5. A lamp test switch shall be provided to test all indicator lamps.
6. A single "all call" switch shall be provided to activate all speaker circuit groups simultaneously.
7. A push-to-talk microphone shall be provided for manual voice messages.
8. Remote microphones shall be provided in the identify location of 24 hour manned location such as security office and/or telephone operators area/boiler plant/ fire department.
9. A voice message disconnect switch shall be provided to disconnect automatic digitized voice messages from the system. The system shall be arranged to allow manual voice messages and indicate a system trouble condition when activated.

C. Speaker Circuit Arrangement:
1. Speaker circuits shall be arranged such that there is one speaker circuit per smoke zone.
2. Audio amplifiers and control equipment shall be electrically supervised for normal and abnormal conditions.
3. Speaker circuits shall be either 25 VRMS or 70.7 VRMS with a minimum of 50 percent spare power available.
4. Speaker circuits and control equipment shall be arranged such that loss of any one speaker circuit will not cause the loss of any other speaker circuit in the system.

D. Digitized Voice Module (DVM):
1. The Digitized Voice Module shall provide prerecorded digitized evacuation and instructional messages. The messages shall be professionally recorded and approved by the COR prior to programming.
2. The DVM shall be configured to automatically output to the desired circuits following a 10-second slow whoop alert tone.
3. Prerecorded magnetic taped messages and tape players are not permitted.
4. The digitized message capacity shall be no less than 15 second in length.
5. The digitized message shall be transmitted 3 times.
6. The DVM shall be supervised for operational status.
7. Failure of the DVM shall result in the transmission of a constant alarm tone.
8. The DVM memory shall have a minimum 50 percent spare capacity after those messages identified in this section are recorded. Multiple DVM's may be used to obtain the required capacity.

E. Audio Amplifiers:

1. Audio Amplifiers shall provide a minimum of 50 Watts at either 25 or 70.7 VRMS output voltage levels.
2. Amplifiers shall be continuously supervised for operational status.
3. Amplifiers shall be configured for either single or dual channel application.
4. Each audio output circuit connection shall be configurable for Style X.
5. A minimum of 50 percent spare output capacity shall be available for each amplifier.

F. Tone Generator(s):
1. Tone Generator(s) shall be capable of providing a distinctive 3-pulse temporal pattern fire alarm signal as well as a slow whoop.
2. Tone Generator(s) shall be continuously supervised for operational status.

2.7 ALARM NOTIFICATION APPLIANCES

A. Bells:
1. Shall be electric, single-stroke or vibrating, heavy-duty, under-dome, solenoid type.
2. Unless otherwise shown on the drawings, shall be 6 inches (150 mm) diameter and have a minimum nominal rating of 80 dBA at 10 feet (3,000 mm).
3. Mount on removable adapter plates on outlet boxes.
4. Bells located outdoors shall be weatherproof type with metal housing and protective grille.
5. Each bell circuit shall have a minimum of 20 percent spare capacity.

B. Speakers:
1. Shall operate on either 25 VRMS or 70.7 VRMS with field selectable output taps from 0.5 to 2.0W and originally installed at the 1/2 watt tap. Speakers shall provide a minimum sound output of 80 dBA at 10 feet (3,000 mm) with the 1/2 watt tap.
2. Frequency response shall be a minimum of 400 HZ to 4,000 HZ.
3. Four inches (100 mm) or 8 inches (200 mm) cone type speakers ceiling mounted with white colored baffles in areas with suspended ceilings and wall mounted in areas without ceilings.

C. Strobes:
1. Xenon flash tube type minimum 15 candela in toilet rooms and 75 candela in all other areas with a flash rate of 1 HZ. Strobes shall be synchronized where required by the National Fire Alarm Code (NFPA 72).
2. Backplate shall be red with 1/2 inch (13 mm) permanent red letters. Lettering to read "Fire", be oriented on the wall or ceiling properly, and be visible from all viewing directions.
3. Each strobe circuit shall have a minimum of 20 percent spare capacity.
4. Strobes may be combined with the audible notification appliances specified herein.

D. Fire Alarm Horns:
1. Shall be electric, utilizing solid state electronic technology operating on a nominal 24 VDC.
2. Shall be a minimum nominal rating of 80 dBA at 10 feet (3,000 mm).
3. Mount on removable adapter plates on conduit boxes.
4. Horns located outdoors shall be of weatherproof type with metal housing and protective grille.
5. Each horn circuit shall have a minimum of 20 percent spare capacity.

2.8 ALARM INITIATING DEVICES

A. Manual Fire Alarm Stations:
1. Shall be non-breakglass, address reporting type.
2. Station front shall be constructed of a durable material such as cast or extruded metal or high impact plastic. Stations shall be semi-flush type.

3. Stations shall be of single action pull down type with suitable operating instructions provided on front in raised or depressed letters, and clearly labeled "FIRE."
4. Operating handles shall be constructed of a durable material. On operation, the lever shall lock in alarm position and remain so until reset. A key shall be required to gain front access for resetting, or conducting tests and drills.
5. Unless otherwise specified, all exposed parts shall be red in color and have a smooth, hard, durable finish.

B. Smoke Detectors:
1. Smoke detectors shall be photoelectric type and UL listed for use with the fire alarm control unit being furnished.
2. Smoke detectors shall be addressable type complying with applicable UL Standards for system type detectors. Smoke detectors shall be installed in accordance with the manufacturer's recommendations and NFPA 72.
3. Detectors shall have an indication lamp to denote an alarm condition. Provide remote indicator lamps and identification plates where detectors are concealed from view. Locate the remote indicator lamps and identification plates flush mounted on walls so they can be observed from a normal standing position.
4. All spot type and duct type detectors installed shall be of the photoelectric type.
5. Photoelectric detectors shall be factory calibrated and readily field adjustable. The sensitivity of any photoelectric detector shall be factory set at 3.0 plus or minus 0.25 percent obscuration per foot.
6. Detectors shall provide a visual trouble indication if they drift out of sensitivity range or fail internal diagnostics. Detectors shall also provide visual indication of sensitivity level upon testing. Detectors, along with the fire alarm control units shall be UL listed for testing the sensitivity of the detectors.

C. Heat Detectors:
1. Heat detectors shall be of the addressable restorable rate compensated fixed-temperature spot type.
2. Detectors shall have a minimum smooth ceiling rating of 2,500 square feet (230 square meters).
3. Ordinary temperature (135 degrees F (57 degrees C)) heat detectors shall be utilized Intermediate temperature rated (200 degrees F (93 degrees C)) heat detectors shall be utilized in all other areas.
4. Provide a remote indicator lamp, key test station and identification nameplate (e.g. “Heat Detector - Elevator P-) for each elevator group. Locate key test station in plain view on elevator machine room wall.

D. Water Flow and Pressure Switches:
1. Wet pipe water flow switches and dry pipe alarm pressure switches for sprinkler systems shall be connected to the fire alarm system by way of an address reporting interface device.
2. All new water flow switches shall be of a single manufacturer and series and non-accumulative retard type.
3. All new switches shall have an alarm transmission delay time that is conveniently adjustable from 0 to 60 seconds. Initial settings shall be 30-45 seconds. Timing shall be recorded and documented during testing.

E. Extinguishing System Connections:
1. Kitchen Range Hood and Duct Suppression Systems:
a. Each suppression system shall be equipped with a micro-switch connected to the building fire alarm control unit. Discharge of a suppression system shall automatically send a alarm signal to the building fire detection and alarm system for annunciation.
b. Operation of this suppression system shall also automatically shut off all sources of fuel and heat to all equipment requiring protection under the same hood.

2. Each gaseous suppression system shall be monitored for system alarm and system trouble conditions via addressable interface devices.

2.9 SUPERVISORY DEVICES

A. Duct Smoke Detectors:
1. Duct smoke detectors shall be provided and connected by way of an address reporting interface device. Detectors shall be provided with an approved duct housing mounted exterior to the duct, and shall have perforated sampling tubes extending across the full width of the duct (wall to wall). Detector placement shall be such that there is uniform airflow in the cross section of the duct.
2. Interlocking with fans shall be provided in accordance with NFPA 90A and as specified hereinafter under Part 3.2, "TYPICAL OPERATION".
3. Provide remote indicator lamps, key test stations and identification nameplates (e.g. "DUCT SMOKE DETECTOR AHU-X") for all duct detectors. Locate key test stations in plain view on walls or ceilings so that they can be observed and operated from a normal standing position.

B. Sprinkler and Standpipe System Supervisory Switches:
1. Each sprinkler system water supply control valve, riser valve or zone control valve, and each standpipe system riser control valve shall be equipped with a supervisory switch. Standpipe hose valves, and test and drain valves shall not be equipped with supervisory switches.
2. PIV (post indicator valve) or main gate valve shall be equipped with a supervisory switch.
3. Valve supervisory switches shall be connected to the fire alarm system by way of address reporting interface device. See Section 21 13 13, WET-PIPE SPRINKLER SYSTEMS for new switches to be added. Connect tamper switches for all control valves shown on the approved shop drawings.
4. The mechanism shall be contained in a weatherproof die-cast aluminum housing that shall provide a 3/4 inch (19 mm) tapped conduit entrance and incorporate the necessary facilities for attachment to the valves.
5. The entire installed assembly shall be tamper-proof and arranged to cause a switch operation if the housing cover is removed or if the unit is removed from its mounting.
6. Where dry-pipe sprinkler systems are installed, high and low air pressure switches shall be provided and monitored by way of an address reporting interface devices.

2.10 ADDRESS REPORTING INTERFACE DEVICE

A. Shall have unique addresses that reports directly to the building fire alarm panel.

B. Shall be configurable to monitor normally open or normally closed devices for both alarm and trouble conditions.

C. Shall have terminal designations clearly differentiating between the circuit to which they are reporting from and the device that they are monitoring.

D. Shall be UL listed for fire alarm use and compatibility with the panel to which they are connected.

E. Shall be mounted in weatherproof housings if mounted exterior to a building.

2.11 SMOKE BARRIER DOOR CONTROL

A. Electromagnetic Door Holders:
1. New Door Holders shall be standard wall mounted electromagnetic type. In locations where doors do not come in contact with the wall when in the full open position, an extension post shall be added to the door bracket.

2. Operation shall be by 24 volt DC supplied from a battery located at the fire alarm control unit. Door holders shall be coordinated as to voltage, ampere drain, and voltage drop with the battery, battery charger, wiring and fire alarm system for operation as specified.

B. A maximum of twelve door holders shall be provided for each circuit. Door holders shall be wired to allow releasing doors by smoke zone.

C. Door holder control circuits shall be electrically supervised.

D. Smoke detectors shall not be incorporated as an integral part of door holders.

2.12 UTILITY LOCKS AND KEYS:

A. All key operated test switches, control units, annunciator panels and lockable cabinets shall be provided with a single standardized utility lock and key.

B. Key-operated manual fire alarm stations shall have a single standardized lock and key separate from the control equipment.

C. All keys shall be delivered to the COR.

2.13 SPARE AND REPLACEMENT PARTS

A. Provide spare and replacement parts as follows:
1. Manual pull stations - 5
2. Heat detectors - 2 of each type
3. Fire alarm strobes - 5
4. Fire alarm bells - 5
5. Fire alarm speakers - 5
6. Smoke detectors - 20
7. Duct smoke detectors with all appurtenances - 1
8. Sprinkler system water flow switch - 1 of each size
9. Sprinkler system water pressure switch - 1 of each type
10. Sprinkler valve tamper switch - 1 of each type
11. Control equipment utility locksets - 5
12. Control equipment keys - 25
13. 2.5 oz containers aerosol smoke - 12
14. Printer paper - 3 boxes
15. Printer replacement ribbons - 3
16. Monitor modules - 3
17. Control modules - 3
18. Fire alarm SLC cable (same as installed) – 500 feet (152 m)

C. Spare and replacement parts shall be in original packaging and submitted to the COR.

D. Furnish and install a storage cabinet of sufficient size and suitable for storing spare equipment. Doors shall include a pad locking device. Padlock to be provided by the VA. Location of cabinet to be determined by the COR.

E. Provide to the VA, all hardware, software, programming tools, license and documentation necessary to permanently modify the fire alarm system on site. The minimum level of modification includes addition and deletion of devices, circuits, zones and changes to system description, system operation, and digitized evacuation and instructional messages.

2.14 INSTRUCTION CHART:

C. Provide typewritten instruction card mounted behind a Lexan plastic or glass cover in a stainless steel or aluminum frame with a backplate. Install the frame in a conspicuous location observable from each control unit where operations are performed. The card shall show those steps to be taken by an operator when a signal is received under all conditions, normal, alarm, supervisory, and trouble. Provide an additional copy with the binder

for the input output matrix for the sequence of operation. The instructions shall be approved by the COR before being posted.

2.8 SUPERVISORY DEVICES

A. Duct Smoke Detectors:

1. Duct smoke detectors shall be provided and connected by way of an address reporting interface device. Detectors shall be provided with an approved duct housing mounted exterior to the duct, and shall have perforated sampling tubes extending across the full width of the duct (wall to wall). Detector placement shall be such that there is uniform airflow in the cross section of the duct.
2. Interlocking with fans shall be provided in accordance with NFPA 90A and as specified hereinafter under Part 3.2, "TYPICAL OPERATION".
3. Provide remote indicator lamps, key test stations and identification nameplates (e.g. "DUCT SMOKE DETECTOR AHU-X") for all duct detectors. Locate key test stations in plain view on walls or ceilings so that they can be observed and operated from a normal standing position.

B. Sprinkler and Standpipe System Supervisory Switches:

1. Each sprinkler system water supply control valve, riser valve or zone control valve, and each standpipe system riser control valve shall be equipped with a supervisory switch. Standpipe hose valves, and test and drain valves shall not be equipped with supervisory switches.
2. PIV (post indicator valve) or main gate valve shall be equipped with a supervisory switch.
3. Valve supervisory switches shall be connected to the fire alarm system by way of address reporting interface device. See Section 21 13 13, WET-PIPE SPRINKLER SYSTEMS for new switches to be added. Connect tamper switches for all control valves shown on the approved shop drawings.
4. The mechanism shall be contained in a weatherproof die-cast aluminum housing that shall provide a 3/4 inch (19 mm) tapped conduit entrance and incorporate the necessary facilities for attachment to the valves.
5. The entire installed assembly shall be tamper-proof and arranged to cause a switch operation if the housing cover is removed or if the unit is removed from its mounting.
6. Where dry-pipe sprinkler systems are installed, high and low air pressure switches shall be provided and monitored by way of an address reporting interface devices.

2.9 ADDRESS REPORTING INTERFACE DEVICE

A. Shall have unique addresses that reports directly to the addressable fire alarm panel.

B. Shall be configurable to monitor normally open or normally closed devices for both alarm and trouble conditions.

C. Shall have terminal designations clearly differentiating between the circuit to which they are reporting from and the device that they are monitoring.

D. Shall be UL listed for fire alarm use and compatibility with the panel to which they are connected.

E. Shall be mounted in weatherproof housings if mounted exterior to a building.

2.10 SMOKE BARRIER DOOR CONTROL

A. Electromagnetic Door Holders:

1. New Door Holders shall be standard wall mounted electromagnetic type. In locations where doors do not come in contact with the wall when in the full open position, an extension post shall be added to the door bracket.

2. Operation shall be by 24 volt DC supplied from a battery located at the fire alarm control unit. Door holders shall be coordinated as to voltage, ampere drain, and voltage drop with the battery, battery charger, wiring and fire alarm system for operation as specified.

B. A maximum of twelve door holders shall be provided for each circuit. Door holders shall be wired to allow releasing doors by smoke zone.

C. Door holder control circuits shall be electrically supervised.

D. Smoke detectors shall not be incorporated as an integral part of door holders.

2.11 UTILITY LOCKS AND KEYS:

A. All key operated test switches, control units, annunciator panels and lockable cabinets shall be provided with a single standardized utility lock and key.

B. Key-operated manual fire alarm stations shall have a single standardized lock and key separate from the control equipment.

C. All keys shall be delivered to the COR.

2.12 SPARE AND REPLACEMENT PARTS

A. Provide spare and replacement parts as follows:
1. Manual pull stations - 5
2. Heat detectors - 2 of each type
3. Fire alarm strobes - 5
4. Fire alarm bells - 5
5. Smoke detectors - 20
6. Duct smoke detectors with all appurtenances - 1
7. Sprinkler system water flow switch - 1 of each size
8. Sprinkler system water pressure switch - 1 of each type
9. Sprinkler valve tamper switch - 1 of each type
10. Control equipment utility locksets - 5
11. Control equipment keys - 25
12. 2.5 oz containers aerosol smoke - 12
13. Monitor modules - 3
14. Control modules - 3
15. Fire alarm SLC cable (same as installed) – 500 feet (152 m)

C. Spare and replacement parts shall be in original packaging and submitted to the COR.

D. Furnish and install a storage cabinet of sufficient size and suitable for storing spare equipment. Doors shall include a pad locking device. Padlock to be provided by the VA. Location of cabinet to be determined by the COR.

E. Provide to the VA, all hardware, software, programming tools, license and documentation necessary to permanently modify the fire alarm system on site. The minimum level of modification includes addition and deletion of devices, circuits, zones and changes to system description, system operation, and digitized evacuation and instructional messages.

2.13 INSTRUCTION CHART:

A. Provide a typewritten instruction card mounted behind a Lexan plastic or glass cover in a stainless steel or aluminum frame with a backplate. Install the frame in a conspicuous location observable from each control unit where operations are performed. The card shall show those steps to be taken by an operator when a signal is received under all conditions, normal, alarm, supervisory, and trouble. Provide an additional copy with the binder for the input output matrix for the sequence of operation. The instructions shall be approved by the COR before being posted.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Installation shall be in accordance with NFPA 70, 72, 90A, and 101 as shown on the drawings, and as recommended by the major equipment manufacturer. Fire alarm wiring shall be installed in conduit. All conduit and wire shall be installed in accordance with, Section 28 05 13 CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY, Section 28 05 26 GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY, Section 28 05 28.33 CONDUIT AND BACKBOXES FOR ELECTRONIC SAFETY AND SECURITY, and all penetrations of smoke and fire barriers shall be protected as required by Section 07 84 00, FIRESTOPPING.

B. All conduits, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas.

C. All new and reused exposed conduits shall be painted in accordance with Section 09 91 00, PAINTING to match surrounding finished areas and red in unfinished areas.

D. All fire detection and alarm system devices, control units and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas. Exact locations are to be approved by the COR.

E. Speakers shall be ceiling mounted and fully recessed in areas with suspended ceilings. Speakers shall be wall mounted and recessed in finished areas without suspended ceilings. Speakers may be surface mounted in unfinished areas.

F. Strobes shall be flush wall mounted with the bottom of the unit located 80 inches (2,000 mm) above the floor or 6 inches (150 mm) below ceiling, whichever is lower. Locate and mount to maintain a minimum 36 inches (900 mm) clearance from side obstructions.

G. Manual pull stations shall be installed not less than 42 inches (1,050 mm) or more than 48 inches (1,200 mm) from finished floor to bottom of device and within 60 inches (1,500 mm) of a stairway or an exit door.

J. Where possible, locate water flow and pressure switches a minimum of 12 inches (300 mm) from a fitting that changes the direction of the flow and a minimum of 36 inches (900 mm) from a valve.

K. Mount valve tamper switches so as not to interfere with the normal operation of the valve and adjust to operate within 2 revolutions toward the closed position of the valve control, or when the stem has moved no more than 1/5 of the distance from its normal position.

L. Connect flow and tamper switches installed under Section 21 13 13, WET-PIPE SPRINKLER SYSTEMS.

3.2 TYPICAL OPERATION

A. Activation of any manual pull station, water flow or pressure switch, heat detector, kitchen hood suppression system, gaseous suppression system, or smoke detector shall cause the following operations to occur:

1. Operate the emergency voice communication system in Buildings indicate buildings. For sprinkler protected buildings, flash strobes continuously only in the zone of alarm. For buildings without sprinkler protection throughout, flash strobes continuously only on the floor of alarm.
2. Continuously sound a temporal pattern general alarm and flash all strobes in the building in alarm until reset at the local fire alarm control unit in Buildings indicate buildings.
3. Release only the magnetic door holders in the smoke zone after the alert signal.
4. Transmit a separate alarm signal, via the main fire alarm control unit to the fire department.
5. Unlock the electrically locked exit doors within the zone of alarm.

B. Operation of a smoke detector at a corridor door used for automatic closing shall also release only the magnetic door holders in that smoke zone.

C. Operation of duct smoke detectors shall cause a system supervisory condition and shut down the ventilation system and close the associated smoke dampers as appropriate.

D. Operation of any sprinkler or standpipe system valve supervisory switch, high/low air pressure switch, or fire pump alarm switch shall cause a system supervisory condition.

E. Alarm verification shall not be used for smoke detectors installed for the purpose of early warning.

3.3 TESTS

A. Provide the service of a NICET level III, competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system. Make all adjustments and tests in the presence of the COR.

B. When the systems have been completed and prior to the scheduling of the final inspection, furnish testing equipment and perform the following tests in the presence of the COR. When any defects are detected, make repairs or install replacement components, and repeat the tests until such time that the complete fire alarm systems meets all contract requirements. After the system has passed the initial test and been approved by the COR, the contractor may request a final inspection.

1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
2. Test the insulation on all installed cable and wiring by standard methods as recommended by the equipment manufacturer.
3. Run water through all flow switches. Check time delay on water flow switches. Submit a report listing all water flow switch operations and their retard time in seconds.
4. Open each alarm initiating and notification circuit to see if trouble signal actuates.
5. Ground each alarm initiation and notification circuit and verify response of trouble signals.

3.4 FINAL INSPECTION AND ACCEPTANCE

A. Prior to final acceptance a minimum 30 day "burn-in" period shall be provided. The purpose shall be to allow equipment to stabilize and potential installation and software problems and equipment malfunctions to be identified and corrected. During this diagnostic period, all system operations and malfunctions shall be recorded. Final acceptance will be made upon successful completion of the "burn-in" period and where the last 14 days is without a system or equipment malfunction.

B. At the final inspection a factory trained representative of the manufacturer of the major equipment shall repeat the tests in Article 3.3 TESTS and those required by NFPA 72. In addition the representative shall demonstrate that the systems function properly in every respect. The demonstration shall be made in the presence of a VA representative.

3.5 INSTRUCTION

A. The manufacturer's authorized representative shall provide instruction and training to the VA as follows:

1. Six 1-hour sessions to engineering staff, security police and central attendant personnel for simple operation of the system. Two sessions at the start of installation, 2 sessions at the completion of installation and 2 sessions 3 months after the completion of installation.
2. Four 2-hour sessions to engineering staff for detailed operation of the system. Two sessions at the completion of installation and 2 sessions 3 months after the completion of installation.

3. Three 8-hour sessions to electrical technicians for maintaining, programming, modifying, and repairing the system at the completion of installation and one 8-hour refresher session 3 months after the completion of installation.

B. The Contractor and/or the Systems Manufacturer's representative shall provide a typewritten "Sequence of Operation" including a trouble shooting guide of the entire system for submittal to the VA. The sequence of operation will be shown for each input in the system in a matrix format and provided in a loose leaf binder. When reading the sequence of operation, the reader will be able to quickly and easily determine what output will occur upon activation of any input in the system. The INPUT/OUTPUT matrix format shall be as shown in Appendix A to NFPA 72.

C. Furnish the services of a competent instructor for instructing personnel in the programming requirements necessary for system expansion. Such programming shall include addition or deletion of devices, zones, indicating circuits and printer/display text.

PART 4 - SCHEDULES

4.1 SMOKE ZONE DESCRIPTIONS:

4.2 DIGITIZED VOICE MESSAGES:

A. Digitized voice messages shall be provided for each smoke zone of Buildings indicate buildings. The messages shall be arranged with a 3 second alert tone, a message and a description of the fire alarm area (building number, floor, level and smoke zone). A sample of such a message is as follows:

1. Alert Tone
2. Code Red
3. Building One, Second Floor, East Wing
4. Code Red
5. Building One, Second Floor, East Wing
6. Code Red
7. Building One, Second Floor, East Wing

4.3 LOCATION OF VOICE MESSAGES:

A. Upon receipt of an alarm signal from the building fire alarm system, the voice communication system shall automatically transmit a 3 second tone alert and a pre-recorded fire alarm message throughout the building.

- - END - -

SECTION 31 20 11

EARTHWORK (SHORT FORM)

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies the requirements for furnishing all equipment, materials, labor and techniques for earthwork including excavation, fill, backfill and site restoration utilizing fertilizer, seed and/or sod.

1.2 DEFINITIONS:

A. Unsuitable Materials:
   1. Fills: Topsoil, frozen materials; construction materials and materials subject to decomposition; clods of clay and stones larger than 75 mm (3 inches); organic materials, including silts, which are unstable; and inorganic materials, including silts, too wet to be stable; existing previously placed and undocumented fill that wasn't reworked and improved by compaction.
   2. Existing Subgrade (except footings): Same materials as above paragraph, that are not capable of direct support of slabs, pavement, and similar items, with the possible exception of improvement by compaction, proofrolling, or similar methods of improvement.
   3. Existing Subgrade (footings only): Same as Paragraph 1, but no fill or backfill. If materials differ from design requirements, excavate to acceptable strata subject to COR's approval.

B. Earthwork: Earthwork operations required within the new construction area. It also includes earthwork required for auxiliary structures and buildings and sewer and other trenchwork throughout the job site.

C. Degree of Compaction: Degree of compaction is expressed as a percentage of maximum density obtained by the test procedure presented in ASTM D698 or D1557 .

D. The term fill means fill or backfill as appropriate.

1.3 RELATED WORK:

A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.

B. Protection of existing utilities, fire protection services, existing equipment, roads, and pavements: Section 01 00 00, GENERAL REQUIREMENTS.

C. Subsurface Investigation: Section 01 00 00, GENERAL REQUIREMENTS, Article, PHYSICAL DATA.

1.4 CLASSIFICATION OF EXCAVATION:

A. Unclassified Excavation: Removal and disposal of pavements and other man-made obstructions visible on the surface; utilities, and other items including underground structures indicated to be demolished and removed; together with any type of materials regardless of character of material and obstructions encountered.

B. Classified Excavation: Removal and disposal of all material not defined as rock.

C. Rock Excavation:
   1. Solid ledge rock (igneous, metamorphic, and sedimentary rock).
   2. Bedded or conglomerate deposits so cemented as to present characteristics of solid rock which cannot be excavated without blasting; or the use of a modern power excavator (shovel, backhoe, or similar power excavators) of no less than 0.75 m3 (1 cubic yard) capacity, properly used, having adequate power and in good running condition.

3. Boulders or other detached stones each having a volume of 0.4 m3 (1/2 cubic yard) or more.
4. Trenches and Pits: Removal and disposal of solid, homogenous, interlocking crystalline material with firmly cemented, laminated, or foliated masses or conglomerate deposits that cannot be excavated with a late-model, track-mounted hydraulic excavator; equipped with a 1050 mm (42 inch) wide, short-tip-radius rock bucket; rated at not less than 103 kW (138 hp) flywheel power with bucket-curling force of not less than 125 kN (28,090 lbf) and stick-crowd force of not less than 84.5 kN (19,000 lbf); measured according to SAE J-1179. Trenches in excess of 3000 mm (10 feet) wide and pits in excess of 9000 mm (30 feet) in either length or width are classified as open excavation.
5. Open Excavation: Removal and disposal of solid, homogenous, interlocking crystalline material firmly cemented, laminated, or foliated masses or conglomerate deposits that cannot be dislodged and excavated with a late-model, track-mounted loader; rated at not less than 157 kW (210 hp) flywheel power and developing a minimum of 216 kN (48,510 lbf) breakout force; measured according to SAE J-732.
6. Other types of materials classified as rock are unstratified masses, conglomerated deposits and boulders of rock material exceeding 0.76 m3 (1 cubic yard) for open excavation, or 0.57 m3 (3/4 cubic yard) for footing and trench excavation that cannot be removed by rock excavating equipment equivalent to the above in size and performance ratings, without systematic drilling, ram hammering, or ripping, when permitted. Estimated Rock excavation refer to Civil Drawings and Geotechnical report.
7. Blasting: Removal and disposal of solid, homogenous, interlocking crystalline material firmly cemented, laminated, or foliated masses or conglomerate deposits that cannot be removed with conventional methods may not be performed by blasting.
8. Definitions of rock and guidelines for equipment are presented for general information purposes only. The Contractor is expected to use the information presented in the Geotechnical Engineering Report to evaluate the extent and competency of the rock and to determine both quantity estimations and removal equipment and efforts.

1.5 MEASUREMENT AND PAYMENT FOR EXCAVATION:

A. Measurement: The unit of measurement for excavation and borrow will be the cubic yard, computed by the average end area method from cross sections taken before and after the excavation and borrow operations, including the excavation for ditches, gutters, and channel changes, when the material is acceptably utilized or disposed of as herein specified. Quantities should be computed by a Registered Professional Land Surveyor or Registered Civil Engineer, specified in Section 01 00 00, GENERAL REQUIREMENTS. The measurement will include authorized excavation for rock, authorized excavation of satisfactory subgrade soil, and the volume of loose, scattered rocks and boulders collected within the limits of the work; allowance will be made on the same basis for selected backfill ordered as replacement. The measurement will not include the volume of subgrade material or other material used for purposes other than directed. The volume of overburden stripped from borrow pits and the volume of excavation for ditches to drain borrow its, unless used as borrow material, will not be measured for payment. The measurement will not include the volume of any excavation performed prior to taking of elevations and measurements of the undisturbed grade.

1.6 MEASUREMENT AND PAYMENT FOR ROCK EXCAVATION:

A. Measurement: The unit of measurement for rock excavation will be by the cubic yard, computed by the average end area method from cross sections taken before and after the rock excavation when the material is acceptably utilized or disposed of as herein specified. Quantities are to be computed by a Registered Professional Land Surveyor or Registered Civil Engineer, specified in Section 01 00 00, GENERAL REQUIREMENTS. Do not measure quantities beyond the following limits:
1. 300 mm (12 inches) outside of the perimeter of formed footings.
2. 600 mm (24 inches) outside the face of concrete work for which forms are required, except for footings.

3. 150 mm (6 inches) below the bottom of pipe and not more than the pipe diameter plus 600 mm (24 inches) in width for pipe trenches.
4. The outside dimensions of concrete work for which no forms are required (trenches, conduits, and similar items not requiring forms).

B. Payment: No separate payment shall be made for rock excavation quantities shown. The contract price and time will be adjusted for overruns or underruns in accordance with Articles, of the GENERAL CONDITIONS as applicable.

1.7 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Rock Excavation Report:
1. Certification of rock quantities excavated.
2. Excavation method.
3. Labor.
4. Equipment.
5. Land Surveyor's or Civil Engineer's name and official registration stamp.
6. Plot plan showing elevations.

C. Contractor shall submit procedure and location for disposal of unused satisfactory material. Proposed source of borrow material. Notification of encountering rock in the project. Advance notice on the opening of excavation or borrow areas. Advance notice on shoulder construction for rigid pavements.

D. Furnish to Resident Engineer, soil samples, suitable for laboratory tests, of proposed off site or on site fill material.

E. Qualifications of the commercial testing laboratory or Contractor’s Testing facility shall be submitted.

1.8 APPLICABLE PUBLICATIONS:

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. American Nursery and Landscape Association (ANLA):
2004 ..... American Standard for Nursery Stock

C. American Association of State Highway and Transportation Officials (AASHTO):
T99-10 ..... Moisture-Density Relations of Soils Using a 2.5 kg (5.5 lb) Rammer and a 305 mm (12 inch) Drop

T180-10 ..... Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg 10 lb Rammer and a 457 mm (18 inch) Drop

D. American Society for Testing and Materials (ASTM):
C33-03..... Concrete Aggregate

D698-12..... Laboratory Compaction Characteristics of Soil Using Standard Effort

D1140-00..... Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve

D1556-00..... Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method

D1557-12..... Laboratory Compaction Characteristics of Soil Using Modified Effort

D2167-94 (2001) ..... Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method

D2487-06..... Standard Classification of Soil for Engineering Purposes (Unified Soil Classification System)

D6938-10..... Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

E. Standard Specifications of New York State

Department of Transportation, latest revision.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Fills: Materials approved from on site and off site sources having a minimum dry density of 1760 kg/m3 (110 pcf), a maximum Plasticity Index of 6, and a maximum Liquid Limit of 30.

B. Granular Fill:
1. Under concrete slab, granular fill shall consist of clean, poorly graded crushed rock, crushed gravel, or uncrushed gravel placed beneath a building slab with or without a vapor barrier to cut off the capillary flow of pore water to the area immediately below. Fine aggregate grading shall conform to ASTM C33 with a maximum of 3 percent by weight passing ASTM D1140, 75 micrometers (No. 200) sieveor37.5 mm (1-1/2 inches) and no more than 2 percent by weight passing the 4.75 mm (No. 4) size sieve for coarse aggregate Size 57, 67, or 77.
2. Bedding for sanitary and storm sewer pipe, crushed stone or gravel graded from 13 mm (1/2 inch) to 4.75 mm (No. 4).

C. Fertilizer: (5-10-5) delivered to site in unopened containers that clearly display the manufacturer's label, indicating the analysis of the contents.

D. Seed: Grass mixture comparable to existing turf delivered to site in unopened containers that clearly display the manufacturer's label, indicating the analysis of the contents.

E. Sod: Comparable species with existing turf. Use State Certified or State Approved sod when available. Deliver sod to site immediately after cutting and in a moist condition. Thickness of cut must be 19 mm to 32 mm (3/4 inch to 1 1/4 inches) excluding top growth. There shall be no broken pads and torn or uneven ends

F. Requirements For Offsite Soils: Offsite soils brought in for use as backfill shall be tested for TPH, BTEX and full TCLP including ignitability, corrosivity and reactivity. Backfill shall contain less than 100 parts per million (ppm) of total hydrocarbons (TPH) and less than 10 ppm of the sum of Benzene, Toleune, Ethyl Benzene, and Xylene (BTEX)and shall not fail the TCLP test. TPH concentrations shall be determined by using EPA 600/4-79/020 Method 418.1. BTEX concentrations shall be determined by using EPA SW-846.3-3a Method5030/8020. TCLP shall be performed in accordance with EPA SW-846.3-3a Method 1311. Provide Borrow Site Testing for TPH, BTEX and TCLP from a composite sample of material from the borrow site, with at least one test from each borrow site. Material shall not be brought on site until tests have been approved by the Resident Engineer.

G. Buried Warning and Identification Tape: Polyethylene plastic and metallic core or metallic-faced, acid- and alkali-resistant polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3 inch minimum width, color coded as specific below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, “CAUTION, BURIED (intended service) LINE BELOW” or similar wording. Color and printing shall be permanent, Unaffected by moisture or soil. Warning tape color codes:
1. Red: Electric

2.	Yellow:	Gas, Oil, Dangerous Materials
3.	Orange:	Telephone and Other Communications
4.	Blue:	Water Systems
5.	Green:	Sewer Systems
6.	White:	Steam Systems
7.	Gray:	Compressed Air

H. Warning Tape for Metallic Piping: Acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of tape shall be 0.076 mm (0.003 inch). Tape shall have a minimum strength of 10.3 MPa (1500 psi) lengthwise, and 8.6 MPa (1250 psi) crosswise, with a maximum 350 percent elongation.

I. Detectable Warning Tape for Non-Metallic Piping: Polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of the tape shall be 0.102 mm (0.004 inch). Tape shall have a minimum strength of 10.3 MPa (1500 psi) lengthwise and 8.6 MPa (1250 psi) crosswise. Tape shall be manufactured with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 0.9 m(3 feet) deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

J. Detection Wire For Non-Metallic Piping: Detection wire shall be Insulated single strand, solid copper with a minimum of 12 AWG.

PART 3 - EXECUTION

3.1 SITE PREPARATION:

A. Clearing: Clearing within the limits of earthwork operations as described or designated by the Resident Engineer. Work includes removal of trees, shrubs, fences, foundations, incidental structures, paving, debris, trash and any other obstructions. Remove materials from the Medical Center.

B. Grubbing: Remove stumps and roots 75 mm (3 inches) and larger diameter. Undisturbed sound stumps, roots up to 75 mm (3 inches) diameter, and nonperishable solid objects which will be a minimum of 900 mm (3 feet) below subgrade or finished embankment may be left

C. Trees and Shrubs: Trees and shrubs, not shown for removal, may be removed from the areas within 4500 mm (15 feet) of new construction and 2250 mm (7’-6”) of utility lines if such removal is approved in advance by the Resident Engineer. Remove materials from the Medical Center Property. Building materials shall not be stored closer to trees and shrubs that are to remain, than the farthest extension of their limbs.

D. Stripping Topsoil: Unless otherwise indicated on the drawings, the limits of earthwork operations shall extend anywhere the existing grade is filled or cut or where construction operations have compacted or otherwise disturbed the existing grade or turf. Strip topsoil as defined herein, or as indicated in the geotechnical report, from within the limits of earthwork operations as specified above unless specifically indicated or specified elsewhere in the specifications or shown on the drawings. Topsoil shall be fertile, friable, natural topsoil of loamy character and characteristic of the locality. Topsoil shall be capable of growing healthy horticultural crops of grasses. Stockpile topsoil and protect as directed by the Resident Engineer. Eliminate foreign material, such as weeds, roots, stones, subsoil, frozen clods, and similar foreign materials, larger than 0.014 m3 (1/2 cubic foot) in volume, from soil as it is stockpiled. Retain topsoil on the station. Remove foreign materials larger than 50 mm (2 inches) in any dimension from topsoil used in final grading. Topsoil work, such as stripping, stockpiling, and similar topsoil work, shall not, under any circumstances, be carried out when the soil is wet so that the tilth of the soil will be destroyed.

1. SPEC WRITER NOTE: Modify the specifications for topsoil, whether on site or imported to the site, to contain the minimum organic content and constituents identified in the geotechnical report. If there no such recommendations, follow the specifications adopted

by the closest State Department of Transportation (DOT) for topsoil. If the onsite topsoil does not meet the minimum requirements of the geotechnical report or DOT standards, whichever is greater, then the soil shall either be amended to meet the requirements, or topsoil shall be imported that does meet the requirements. Edit the specifications or add notes on the drawings requiring that the analysis of the topsoil and plans for achieving the stated constituents and characteristics for the topsoil are submitted to COR Concrete Slabs and Paving: Score deeply or saw cut to insure a neat, straight cut, sections of existing concrete slabs and paving to be removed where excavation or trenching occurs. Extend pavement section to be removed a minimum of 300 mm (12 inches) on each side of widest part of trench excavation and insure final score lines are approximately parallel unless otherwise indicated. Remove material from the Medical Center .

E. Disposal: All materials removed from the property shall be disposed of at a legally approved site, for the specific materials, and all removals shall be in accordance with all applicable Federal, State and local regulations. No burning of materials is permitted onsite.

3.2 EXCAVATION:

A. Shoring, Sheeting and Bracing: Shore, brace, or slope to it's angle of repose banks of excavations to protect workmen, banks, adjacent paving, structures, and utilities, in compliance with OSHA requirements.
   1. Extend shoring and bracing to the bottom of the excavation. Shore excavations that are carried below the elevations of adjacent existing foundations.
   2. If the bearing of any foundation is disturbed by excavating, improper shoring or removal of shoring, placing of backfill, and similar operations, provide a concrete fill support in compliance with Specification Section 31 23 23.33, FLOWABLE FILL, under disturbed foundations, as directed by Resident Engineer, at no additional cost to the Government. Do not remove shoring until permanent work in excavation has been inspected and approved by Resident Engineer.

B. Excavation Drainage: Operate pumping equipment, and/or provide other materials, means and equipment as required, to keep excavations free of water and subgrades dry, firm, and undisturbed until approval of permanent work has been received from COR. COR When subgrade for foundations has been disturbed by water, remove the disturbed material to firm undisturbed material after the water is brought under control. Replace disturbed subgrade in trenches by mechanically tamped sand or gravel. When removed disturbed material is located where it is not possible to install and properly compact disturbed subgrade material with mechanically compacted sand or gravel, the COR should be contacted to consider the use of lean concrete or flowable fill. Groundwater flowing toward or into excavations shall be controlled to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. French drains, sumps, ditches or trenches will not be permitted within 0.9 m (3 feet) of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Control measures shall be taken by the time the excavation reaches the water level in order to maintain the integrity of the in situ material. While the excavation is open, the water level shall be maintained continuously, at least 0.5 m (1.64 feet) below the working level. Operate dewatering system continuously until construction work below existing water levels is complete. Submit performance records weekly. Measure and record performance of dewatering system at same time each day by use of observation wells or piezometers installed in conjunction with the dewatering system. Relieve hydrostatic head in pervious zones below subgrade elevation in layered soils to prevent uplift.

C. Blasting: Blasting shall not be permitted.

D. Building Earthwork:
   1. Excavation shall be accomplished as required by drawings and specifications.
   2. Excavate foundation excavations to solid undisturbed subgrade.
   3. Remove loose or soft material to solid bottom.

4. Fill excess cut under footings or foundations with 25 MPa (3000 psi) concrete, poured separately from the footings.
5. Do not tamp earth for backfilling in footing bottoms, except as specified.

E. Trench Earthwork:
1. Utility trenches (except sanitary and storm sewer):
   a. Excavate to a width as necessary for sheeting and bracing and proper performance of the work.
   b. Grade bottom of trenches with bell-holes, scooped-out to provide a uniform bearing.
   c. Support piping on suitable undisturbed earth unless a mechanical support is shown. Unstable material removed from the bottom of the trench or excavation shall be replaced with select granular material placed in layers not exceeding 150 mm (6 inches) loose thickness.
   d. The length of open trench in advance of pipe laying shall not be greater than is authorized by the Resident Engineer.
   e. Provide buried utility lines with utility identification tape. Bury tape 300 mm (12 inches) below finished grade; under pavements and slabs, bury tape 150 mm (6 inches) below top of subgrade
   f. Bury detection wire directly above non-metallic piping at a distance not to exceed 300 mm (12 inches) above the top of pipe. The wire shall extend continuously and unbroken, from manhole to manhole. The ends of the wire shall terminate inside the manholes at each end of the pipe, with a minimum of 0.9 m (3 feet) of wire, coiled, remaining accessible in each manhole. The wire shall remain insulated over it's entire length. The wire shall enter manholes between the top of the corbel and the frame, and extend up through the chimney seal between the frame and the chimney seal. For force mains, the wire shall terminate in the valve pit at the pump station end of the pipe.
   g. Bedding shall be of the type and thickness shown. Initial backfill material shall be placed and compacted with approved tampers to a height of at least one foot above the utility pipe or conduit. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe. Except as specified otherwise in the individual piping section, provide bedding for buried piping in accordance with AWWA C600, Type 4, except as specified herein. Backfill to top of pipe shall be compacted to 95 percent of ASTM D 698 maximum dry density. Plastic piping shall have bedding to spring line of pipe. Provide materials as follows:
      1) Class I: Angular, 6 to 40 mm (0.25 to 1.5 inches), graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shells.
      2) Class II: Coarse sands and gravels with maximum particle size of 40 mm (1.5 inches), including various graded sands and gravels containing small percentages of fines, generally granular and non-cohesive, either wet or dry. Soil Types GW, GP, SW, and SP are included in this class as specified in ASTM D 2487.
2. Sanitary and storm sewer trenches:
   a. Trench width below a point 150 mm (6 inches) above top of the pipe shall be 600 mm (24 inches) for up to and including 300 mm (12 inches) diameter and four-thirds diameter of pipe plus 200 mm (8 inches) for pipe larger than 300 mm (l2 inches). Width of trench above that level shall be as necessary for sheeting and bracing and proper performance of the work.
   b. The bottom quadrant of the pipe shall be bedded on suitable undisturbed soil or granular fill. Unstable material removed from the bottom of the trench or excavation shall be replaced with select granular material placed in layers not exceeding 150 mm (6 inches) loose thickness.

1) Undisturbed: Bell holes shall be no larger than necessary for jointing. Backfill up to a point 300 mm (12 inches) above top of pipe shall be clean earth placed and tamped by hand.
2) Granular Fill: Depth of fill shall be a minimum of 75 mm (3 inches) plus one-sixth of pipe diameter below the pipe of 300 mm (12 inches) above top of pipe. Place and tamp fill material by hand.

c. Place and compact as specified the remainder of backfill using acceptable excavated materials. Do not use unsuitable materials.

d. Use granular fill for bedding where rock or rocky materials are excavated.

e. Provide buried utility lines with utility identification tape. Bury tape 300 mm (12 inches) below finished grade; under pavements and slabs, bury tape 150 mm (6 inches) below top of subgrade

f. Bury detection wire directly above non-metallic piping at a distance not to exceed 300 mm (12 inches) above the top of pipe. The wire shall extend continuously and unbroken, from manhole to manhole. The ends of the wire shall terminate inside the manholes at each end of the pipe, with a minimum of 0.9 m (3 feet) of wire, coiled, remaining accessible in each manhole. The wire shall remain insulated over its entire length. The wire shall enter manholes between the top of the corbel and the frame, and extend up through the chimney seal between the frame and the chimney seal. For force mains, the wire shall terminate in the valve pit at the pump station end of the pipe.

g. Bedding shall be of the type and thickness shown. Initial backfill material shall be placed and compacted with approved tampers to a height of at least one foot above the utility pipe or conduit. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe. Except as specified otherwise in the individual piping section, provide bedding for buried piping in accordance with AWWA C600, Type 4, except as specified herein. Backfill to top of pipe shall be compacted to 95 percent of ASTM D698 maximum dry density. Plastic piping shall have bedding to spring line of pipe. Provide materials as follows:
1) Class I: Angular, 6 to 40 mm (0.25 to 1.5 inches), graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shells.
2) Class II: Coarse sands and gravels with maximum particle size of 40 mm (1.5 inches), including various graded sands and gravels containing small percentages of fines, generally granular and non-cohesive, either wet or dry. Soil Types GW, GP, SW, and SP are included in this class as specified in ASTM D2487.

F. Site Earthwork: Excavation shall be accomplished as required by drawings and specifications. Remove subgrade materials that are determined by the COR as unsuitable, and replace with acceptable material. If there is a question as to whether material is unsuitable or not, the Contractor shall obtain samples of the material, under the direction of the Resident Engineer, and the materials shall be examined by an independent testing laboratory for soil classification to determine whether it is unsuitable or not. When unsuitable material is encountered and removed, the contract price and time will be adjusted in accordance with Articles, DIFFERING SITE CONDITIONS, CHANGES and CHANGES-SUPPLEMENT of the GENERAL CONDITIONS as applicable. Adjustments to be based on meters (yardage) in cut section only.

G. Finished elevation of subgrade shall be as follows:
1. Pavement Areas - bottom of the pavement or base course as applicable.
2. Planting and Lawn Areas - 100 mm (4 inches) below the finished grade, unless otherwise specified or indicated on the drawings.

3.3 FILLING AND BACKFILLING:

A. General: Do not fill or backfill until all debris, unsatisfactory soil materials, obstructions, and deleterious materials have been removed from the excavation. Proof-roll exposed subgrades with a fully loaded dump truck. Use excavated materials or borrow for fill and backfill, as applicable. Do not use unsuitable excavated materials. Do not backfill until foundation walls have been completed above grade and adequately braced, waterproofing or damp proofing applied, and pipes coming in contact with backfill have been installed, and inspected and approved by the COR.

B. Placing: Place material in horizontal layers not exceeding 200 mm (8 inches) in loose depth and then compacted using heavy, self-propelled compaction equipment. Do not place material on surfaces that are muddy, frozen, or contain frost.

C. Compaction: Use approved equipment (hand or mechanical) well suited to the type of material being compacted. Do not operate mechanized vibratory compaction equipment within 3000 mm (10 feet) of new or existing building walls without the prior approval of the Resident Engineer. Moisten or aerate material as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used. Compact each layer to not less than 95 percent of the maximum density determined in accordance with the following test ASTM D1557 . Backfill adjacent to any and all types of structures shall be placed and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials to prevent wedging action or eccentric loading upon or against the structure.

D. Borrow Material: Borrow material shall be selected to meet the requirements and conditions of the particular fill or embankment for which it is to be used. Borrow material shall be obtained from the borrow areas from approved private sources. Unless otherwise provided in the contract, the Contractor shall obtain from the owners the right to procure material, pay royalties and other charges involved, and bear the expense of developing the sources, including rights-of-way for hauling. Borrow material from approved sources on Government-controlled land may be obtained without payment of royalties. Unless specifically provided, no borrow shall be obtained within the limits of the project site without prior written approval. Necessary clearing, grubbing, and satisfactory drainage of borrow pits and the disposal of debris thereon shall be considered related operations to the borrow excavation.

E. Opening and Drainage of Excavation and Borrow Pits: The Contractor shall notify the COR sufficiently in advance of the opening of any excavation or borrow pit to permit elevations and measurements of the undisturbed ground surface to be taken. Except as otherwise permitted, borrow pits and other excavation areas shall be excavated providing adequate drainage. Overburden and other spoil material shall be transported to designated spoil areas or otherwise disposed of as directed. Borrow pits shall be neatly trimmed and drained after the excavation is completed. The Contractor shall ensure that excavation of any area, operation of borrow pits, or dumping of spoil material results in minimum detrimental effects on natural environmental conditions.

3.4 GRADING:

A. General: Uniformly grade the areas within the limits of this section, including adjacent transition areas. Smooth the finished surface within specified tolerance. Provide uniform levels or slopes between points where elevations are indicated, or between such points and existing finished grades. Provide a smooth transition between abrupt changes in slope.

B. Cut rough or sloping rock to level beds for foundations. In unfinished areas fill low spots and level off with coarse sand or fine gravel.

C. Slope backfill outside the building away from the building walls for a minimum distance of 3000 mm (10 feet) at a minimum five percent (5%) slope.

D. The finished grade shall be 150 mm (6 inches) below bottom line of windows or other building wall openings unless greater depth is shown.

E. Place crushed stone or gravel fill under concrete slabs on grade tamped and leveled. The thickness of the fill shall be 150 mm (6 inches), unless otherwise indicated.

F. Finish subgrade in a condition acceptable to the COR at least one day in advance of the paving operations. Maintain finished subgrade in a smooth and compacted condition until the succeeding operation has been accomplished. Scarify, compact, and grade the subgrade prior to further construction when approved compacted subgrade is disturbed by contractor's subsequent operations or adverse weather.

G. Grading for Paved Areas: Provide final grades for both subgrade and base course to +/- 6 mm (0.25 inches) of indicated grades.

3.5 LAWN AREAS:

A. General: Harrow and till to a depth of 100 mm (4 inches), new or existing lawn areas to remain, which are disturbed during construction. Establish existing or design grades by dragging or similar operations. Do not carry out lawn areas earthwork out when the soil is wet so that the tilth of the soil will be destroyed. Plant bed must be approved by COR before seeding or sodding operation begins.

B. Finished Grading: Begin finish grading after rough grading has had sufficient time for settlement. Scarify subgrade surface in lawn areas to a depth of 100 mm (4 inches). Apply topsoil so that after normal compaction, dragging and raking operations (to bring surface to indicated finish grades) there will be a minimum of 100 mm (4 inches) of topsoil over all lawn areas; make smooth, even surface and true grades, which will not allow water to stand at any point. Shape top and bottom of banks to form reverse curves in section; make junctions with undisturbed areas to conform to existing topography. Solid lines within grading limits indicate finished contours. Existing contours, indicated by broken lines are believed approximately correct but are not guaranteed.

C. Fertilizing: Incorporate fertilizer into the soil to a depth of 100 mm (4 inches) at a rate of 12 kg/100 m2 (25 pounds per 1000 square feet).

D. Seeding: Seed at a rate of 2 kg/100 m2 (4 pounds per 1000 square feet) and accomplished only during periods when uniform distribution may be assured. Lightly rake seed into bed immediately after seeding. Roll seeded area immediately with a roller not to exceed 225 kg/m (150 pounds per foot) of roller width.

E. Sodding: Topsoil shall be firmed by rolling and during periods of high temperature the topsoil shall be watered lightly immediately prior to laying sod. Sod strips shall be tightly butted at the ends and staggered in a running bond fashion. Placement on slopes shall be from the bottom to top of slope with sod strips running across slope. Secure sodded slopes by pegging or other approved methods. Roll sodded area with a roller not to exceed 225 kg/m (150 pounds per foot) of the roller width to improve contact of sod with the soil.

F. Watering: The COR is responsible for having adequate water available at the site. As sodding is completed in any one section, the entire sodded area shall be thoroughly irrigated by the contractor, to a sufficient depth, that the underside of the new sod pad and soil, immediately below sod, is thoroughly wet. COR will be responsible for sod after installation and acceptance.

3.6 DISPOSAL OF UNSUITABLE AND EXCESS EXCAVATED MATERIAL:

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Medical Center property.

B. Place excess excavated materials suitable for fill and/or backfill on site where directed.

C. Remove from site and dispose of any excess excavated materials after all fill and backfill operations have been completed.

D. Segregate all excavated contaminated soil designated by the COR from all other excavated soils, and stockpile on site on two 0.15 mm (6 mil) polyethylene sheets with a polyethylene

cover. A designated area shall be selected for this purpose. Dispose of excavated contaminated material in accordance with State and Local requirements.

3.7 CLEAN-UP:

A. Upon completion of earthwork operations, clean areas within contract limits, remove tools, and equipment. Provide site clear, clean, free of debris, and suitable for subsequent construction operations. Remove debris, rubbish, and excess material from the Medical Center Property.

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SECTION 31 23 19
DEWATERING

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies performance of dewatering required to lower and control ground water table levels and hydrostatic pressures to permit excavation, backfill, and construction to be performed in the dry. Control of surface water shall be considered as part of the work under this specification.

1.2 SUMMARY:

A. The work to be completed by the Contractor includes, but is not necessarily limited to the following:
   1. Implementation of the Erosion and Sedimentation Control Plan.
   2. Dewater excavations, including seepage and precipitation.

B. The Contractor shall be responsible for providing all materials, equipment, labor, and services necessary for care of water and erosion control. Excavation work shall not begin before the Erosion and Sedimentation Control Plan is in place.

1.3 REQUIREMENT:

A. Dewatering system shall be of sufficient size and capacity necessary to lower and maintain ground water table to an elevation at least 1 foot) below lowest foundation subgrade or bottom of pipe trench and to allow material to be excavated in a reasonably dry condition. Materials to be removed shall be sufficiently dry to permit excavation to grades shown and to stabilize excavation slopes where sheeting is not required. Operate dewatering system continuously until backfill work has been completed.

B. Reduce hydrostatic head below any excavation to the extent that water level in the construction area is a minimum of 1 foot below prevailing excavation surface.

C. Prevent loss of fines, seepage, boils, quick conditions or softening of foundation strata.

D. Maintain stability of sides and bottom of excavation.

E. Construction operations are performed in the dry.

F. Control of surface and subsurface water is part of dewatering requirements. Maintain adequate control so that:
   1. The stability of excavated and constructed slopes are not adversely affected by saturated soil, including water entering prepared subbase and subgrades where underlying materials are not free draining or are subject to swelling or freeze-thaw action.
   2. Erosion is controlled.
   3. Flooding of excavations or damage to structures does not occur.
   4. Surface water drains away from excavations.
   5. Excavations are protected from becoming wet from surface water, or insure excavations are dry before additional work is undertaken.

G. Permitting Requirements: The contractor shall comply with and obtain the required State and County permits where the work is performed.

1.4 RELATED WORK:

A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.

B. Submittal requirements as specified in Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Protection of existing utilities, fire protection services, existing equipment, roads, and pavements: Section 01 00 00, GENERAL REQUIREMENTS.

D. Subsurface Investigation: Section 01 00 00, GENERAL REQUIREMENTS, Article 1.11, PHYSICAL DATA.

E. Excavation, backfilling, site grade and utilities: Section 31 20 11, EARTHWORK (Short Form).

1.5 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Drawings and Design Data:
1. Submit drawings and data showing the method to be employed in dewatering excavated areas 30 days before commencement of excavation.
2. Material shall include: location, depth and size of wellpoints, headers, sumps, ditches, size and location of discharge lines, capacities of pumps and standby units, and detailed description of dewatering methods to be employed to convey the water from site to adequate disposal.
3. Include a written report outlining control procedures to be adopted if dewatering problem arises.
4. Capacities of pumps, prime movers, and standby equipment.
5. Design calculations proving adequacy of system and selected equipment. The dewatering system shall be designed using accepted and professional methods of design and engineering consistent with the best modern practice. The dewatering system shall include the deep wells, wellpoints, and other equipment, appurtenances, and related earthwork necessary to perform the function.
6. Detailed description of dewatering procedure and maintenance method.
7. Materials submitted shall be in a format acceptable for inclusion in required permit applications to any and all regulatory agencies for which permits for discharge water from the dewatering system are required due to the discharge reaching regulated bodies of water.

C. Inspection Reports.

D. All required permits.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Install a dewatering system to lower and control ground surface water in order to permit excavation, construction of structure, and placement of backfill materials to be performed under dry conditions. Make the dewatering system adequate to pre-drain the water-bearing strata above and below the bottom of structure foundations, utilities and other excavations.

B. In addition, reduce hydrostatic pressure head in water-bearing strata below structure foundations, utility lines, and other excavations, to extent that water levels in construction area are a minimum of 1 foot below prevailing excavation surface at all times.

3.2 OPERATION:

A. Prior to any excavation below the ground water table, place system into operation to lower water table as required and operate it continuously 24 hours a day, 7 days a week until utilities and structures have been satisfactorily constructed, which includes the placement of backfill materials and dewatering is no longer required.

B. Place an adequate weight of backfill material to prevent buoyancy prior to discontinuing operation of the system.

3.3 WATER DISPOSAL:

A. Dispose of water removed from the excavations in such a manner as:
1. Will not endanger portions of work under construction or completed.
2. Will cause no inconvenience to Government or to others working near site.
3. Will comply with the stipulations of required permits for disposal of water.
4. Will Control Runoff: The Contractor shall be responsible for control of runoff in all work areas including but not limited to: excavations, access roads, parking areas, laydown, and staging areas. The Contractor shall provide, operate, and maintain all ditches, basins, sumps, culverts, site grading, and pumping facilities to divert, collect, and remove all water from the work areas. All water shall be removed from the immediate work areas and shall be disposed of in accordance with applicable permits.

B. Excavation Dewatering:
1. The Contractor shall be responsible for providing all facilities required to divert, collect, control, and remove water from all construction work areas and excavations.
2. Drainage features shall have sufficient capacity to avoid flooding of work areas.
3. Drainage features shall be so arranged and altered as required to avoid degradation of the final excavated surface(s).
4. The Contractor shall utilize all necessary erosion and sediment control measures as described herein to avoid construction related degradation of the natural water quality.

C. Dewatering equipment shall be provided to remove and dispose of all surface and ground water entering excavations, trenches, or other parts of the work during construction. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built, or the pipe to be installed therein, is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.

3.4 STANDBY EQUIPMENT:

A. Provide complete standby equipment, installed and available for immediate operation, as may be required to adequately maintain de-watering on a continuous basis and in the event that all or any part of the system may become inadequate or fail.

3.5 CORRECTIVE ACTION:

A. If dewatering requirements are not satisfied due to inadequacy or failure of the dewatering system (loosening of the foundation strata, or instability of slopes, or damage to foundations or structures), perform work necessary for reinstatement of foundation soil and damaged structure or damages to work in place resulting from such inadequacy or failure by Contractor, at no additional cost to Government.

3.6 DAMAGES:

A. Immediately repair damages to adjacent facilities caused by dewatering operations.

3.7 REMOVAL:

A. Ensure compliance with all conditions of regulating permits and provide such information to the Resident Engineer. Obtain written approval from Resident Engineer before discontinuing operation of dewatering system.

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SECTION 31 23 23.33

FLOWABLE FILL

PART 1 - GENERAL

1.1 INTRODUCTION:

A. Flowable fill refers to a cementitious slurry consisting of a mixture of fine aggregate or filler, water, and cementitious material(s), which is used as a fill or backfill in lieu of compacted earth. This mixture is capable of filling all voids in irregular excavations and hard to reach places (such as under undercuts of existing slabs), is self-leveling, and hardens in a matter of a few hours without the need for compaction in layers. Flowable fill is sometimes referred to as controlled density fill (CDF), controlled low strength material (CLSM), lean concrete slurry, and unshrinkable fill.

B. Flowable fill materials will be used as only as a structural fill replacement on VA projects. Unless otherwise noted, flowable fill installed as a substitution for structural earth fill, shall not be designed to be removed by the use of hand tools. The materials and mix design for the flowable fill should be designed to produce a comparable compressive strength to the surrounding soil after hardening, making excavation at a later time possible to produce the compressive strength indicated for the placed location, as determined by the COR.

1.2 DESCRIPTION:

A. Furnish and place flowable fill in a fluid condition, that sets within the required time and, after curing, obtains the desired strength properties as evidenced by the laboratory testing of the specific mix design, at locations shown on the plans or as directed by the COR, in writing. This section specifies flowable fill for use as structural fill to remain permanently.

1.3 RELATED WORK:

A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.

B. Earthwork, excavation and backfill and compaction requirements: [31 20 00, EARTHWORK][Section 31 20 11, EARTHWORK (SHORT FORM)]

1.4 DEFINITIONS:

A. Flowable fill - Ready-mix Controlled Low Strength Material used as an alternative to compacted soil, and is also known as controlled density fill, and several other names, some of which are trademark names of material suppliers. Flowable fill (Controlled Low Strength Material) differs from portland cement concrete as it contains a low cementitious content to reduce strength development for possible future removal. Unless specifically approved otherwise, by the Resident Engineer, flowable fill shall be designed as a permanent material, not designed for future removal. Design strength for this permanent type flowable fill shall be a compressive strength of 2.1 MPa (300 psi) minimum at 28 days. Chemical admixtures may also be used in flowable fill to modify performance properties of strength, flow, set and permeability.

B. Excavatable Flowable fill – flowable fill designed with a compressive strength that will allow excavation as either machine tool excavatable at compressive strength of 1.5 MPa (200 psi) maximum at 1 year, or hand tool excavatable at compressive strength of 0.7 MPa (100 psi) maximum at 1 year.

1.5 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Flowable fill Mix Design: Provide flowable fill mix design containing cement and water. At the contractor's option, it may also contain fly ash, aggregate, or chemical admixtures in any proportions such that the final product meets the strength and flow consistency, and shrinkage requirements included in this specifications. The mix design should state the sources and proportions of each of the flowable fill constituents. The coefficient of permeability of flowable fill shall be that of uniform fine sand, 4.0 X 10-1 cm/sec (0.16 in/sec) or as indicated to provide a backfill material with permeability equal to or greater than that of the surrounding soil.

1. 1. Test and Performance - Submit the following data:
   a. Flowable fill shall have a minimum strength of 2.1 MPa (300 psi) according to ASTM C 39 at 28 days after placement.
   b. Flowable fill shall have minimal subsidence and bleed water shrinkage. Evaporation of bleed water shall not result in shrinkage of more than 10.4 mm per m (1/8 inch per ft.) of flowable fill depth (for mixes containing high fly ash content). Measurement of a Final Bleeding shall be as measured in Section 10 of ASTM C 940 "Standard Test Method for Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory.
   c. Flowable fill shall have a unit weight of 1900 – 2300 kg/m3 (115 – 145 lb/feet 3) measured at the point of placement after a 60 minute ready-mix truck ride.

C. Provide documentation that the admixture supplier has experience of at least one year, with the products being provided and any equipment required to obtain desired performance of the product.

D. Manufacturer's Certificates: Provide COR with documentation issued by the State Agency responsible for approving materials for burial, indicating conformance with applicable rules and regulations. A certification that the materials incorporated in the flowable fill, following achievement of the required strength, do not represent a threat to groundwater quality.

1.6 APPLICABLE PUBLICATIONS:

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

B. American Society for Testing and Materials (ASTM):

D4832-10.....Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders.

C618-12.....Standard Specifications for Coal Fly Ash and Raw or Calcined Natural Pozzolan for use in Concrete. (Use Fly Ash conforming to the chemical and physical requirements for mineral admixture, Class F listed, including Table 2 (except for Footnote A). Waive the loss on ignition requirement.)

C403/C403M-08.....Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance.

C150/C150M-11.....Standard Specification for Portland Cement

C33/C33M-11a.....Standard Specification for Concrete Aggregates

C94/C94M-12.....Standard Specification for Ready-Mixed Concrete

C494/C494M-11.....Standard Specification for Chemical Admixtures for Concrete

C685/C685M-11.....Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing

C940-10a.....Standard Specification for Expansion and Bleeding of Freshly Mixed Grouts for Preplaced – Aggregate Concrete in the Laboratory

D5971.....Sampling Freshly Mixed Controlled Low Strength Material

D6103.....Flow Consistency of Controlled Low Strength Material

D6023.....Unit Weight, Yield, Cement Content and Air Content (Gravimetric) of Controlled Low Strength Material

C. American Concrete Institute (ACI):
SP-150-94 .....Controlled Low-Strength Materials

1.7 QUALITY ASSURANCE:

A. Manufacturer: Flowable fill shall be manufactured by a ready-mix concrete producer with a minimum of 1 year experience in the production of similar products.

B. Materials: For each type of material required for the work of this Section, provide primary materials that are the products of one manufacturer. If not otherwise specified here, materials shall comply with recommendations of ACI 229, “Controlled Low Strength Materials.”

C. Pre-Approval Procedures: The use of flowable fill during any part of the project shall be restricted to those incidences where, due to field conditions, the Contractor has made the Resident Engineer aware of the conditions for which he recommends the use of the flowable, and the Resident Engineer has confirmed those conditions and approved the use of the flowable fill, in advance. During the submittal process, the contractor shall prepare and submit various flowable fill mix designs corresponding to required conditions or if the contractor desires to use flowable fill due to economics. Approval for the strength of the flowable fill shall be obtained from the Resident Engineer when the contractor desires, or is required, to use flowable fill at specific location(s) within the project. Prior to commencement of field operations the contractor shall establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.

D. Sampling and Acceptance: Flowable fill shall be samples and testing in the field in conformance with either ASTM C 94 or C 685. Samples for tests shall be taken for every 115 cubic meters (150 cubic yards) of material, or fraction thereof, for each day’s placement. Tests shall include temperature reading and four compressive strength cylinders. Compressive strength sampling and testing shall conform to ASTM D 4832 with one specimen tested at 7 days, two at 28 days, and one held for each batch of four specimens. Sampling and testing shall be performed by a qualified, independent commercial testing laboratory. Test results should be submitted within 48 hours of completion of testing.

1.8 DELIVERY, STORAGE, AND HANDLING:

A. Deliver and handle all products and equipment required, in strict compliance with manufacturer’s recommendations. Protect from damage due to weather, excessive temperatures, and construction operations.

1.9 PROJECT CONDITIONS:

A. Perform installation of flowable fill only when approved by the Resident Engineer, and when existing and forecasted weather conditions are within the limits established by the manufacturer of the materials and products used.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Provide flowable fill containing, at a minimum, cementitious materials and water. Cementitious materials shall be portland cement, pozzolanic materials, or other self-cementing materials, or combinations thereof, at the contractor's option and following approval by the COR. The flowable fill mix design may also contain, fine aggregate or filler, and/or chemical admixtures in any proportions such that the final product meets the strength, flow consistency and shrinkage requirements included in this specification, as approved by the Resident Engineer.

B. Portland Cement: ASTM C150, Type 1 or Type 2. Meeting New York State DOT standards.

C. Mixing Water: Fresh, clean, and potable. Meeting New York State DOT standards for use as mix-water for cast-in-place concrete.

D. Air-Entraining Admixture: ASTM C260.

E. Chemical Admixtures: ASTM C494.

F. Aggregate: ASTM C33.

2.2 FLOWABLE FILL MIXTURE:

A. Mix design shall produce a consistency that will result in a flowable product at the time of placement which does not require manual means to move it into place.

B. Flowable fill shall have a minimum strength of 2.1 MPa (300 psi) according to ASTM C39 at 28 days after placement.

C. Flowable fill shall have minimal subsidence and bleed water shrinkage. Evaporation of bleed water shall not result in shrinkage of more than 10.4 mm per m (1/8 inch per foot) of flowable fill depth (for mixes containing high fly ash content). Measurement of a Final Bleeding shall be as measured in Section 10 of ASTM C 940 "Standard Test Method for Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory.

D. Flowable fill shall have a unit weight of 1900 – 2300 kg/m3 (115 – 145 lbs/feet3) measured at the point of placement after a 60 minute ready-mix truck ride. In the absence of strength data the cementitious content shall be a maximum of 90 kg/m3 (150 lbs/cy).

E. Flowable fill shall have an in-place yield of at least 98% of design yield for permanent type a maximum of 110% of design yield for removable types at 1 year.

F. Provide equipment as recommended by the Manufacturer and comply with manufacturer's recommendations for the addition of additives, whether at the production plant or prior to placement at the site.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Examine conditions of substrates and other conditions under which work is to be performed and notify Resident Engineer, in writing, of circumstances detrimental to the proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.2 APPLICATION OF FLOWABLE FILL:

A. Secure tanks, pipes and other members to be encased in flowable fill. Insure that there are no exposed metallic pipes, conduits, or other items that will be in contact with the flowable fill after placement. If so, replace with non-metallic materials or apply manufacturers recommended

coating to protect metallic objects before placing the flowable fill. Replacement or protection of metallic objects is subject to the approval of the Resident Engineer.

3.3 PROTECTION AND CURING:

A. Protect exposed surfaces of flowable fill from premature drying, wash by rain or running water, wind, mechanical injury, and excessively hot or cold temperature. Curing method shall be subject to approval by Resident Engineer.

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SECTION 32 05 23

CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Pedestrian Pavement: Walks,
2. Equipment Pads: transformers, and generator pads .

1.2 RELATED REQUIREMENTS

A. Field Testing: Section 01 45 29, TESTING LABORATORY SERVICES.

B. Step Nosings and Railings: Section 05 50 00, METAL FABRICATIONS.

C. Subgrade Preparation and Subbase Compaction: Section Section 31 20 11, EARTHWORK (SHORT FORM).

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. American Association of State Highway and Transportation Officials (AASHTO):
1. M147-65-UL-04 - Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses.
2. M233-86 - Boiled Linseed Oil Mixture for Treatment of Portland Cement Concrete.

C. American Concrete Institute (ACI):
1. 305R-10 - Guide to Hot Weather Concreting.
2. 306R-10 - Guide to Cold Weather Concreting.

D. American National Standards Institute (ANSI):
1. B101.3 - Wet DOCF of Common Hard Surface Floor Materials (Including Action and Limit Thresholds for the Suitable Assessment of the Measured Values).

E. ASTM International (ASTM):
1. A615/A615M-16 - Deformed and Plain Carbon Steel Bars for Concrete Reinforcement.
2. A996/A996M-15 - Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.
3. A1064/A1064M-16 - Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
4. C33/C33M-16 - Concrete Aggregates.
5. C94/C94M-16 - Ready Mixed Concrete.
6. C143/C143M-15a - Slump of Hydraulic Cement Concrete.
7. C150/C150M-16 - Portland Cement.
8. C171-16 - Sheet Materials for Curing Concrete.
9. C260/C260M-10a - Air Entraining Admixtures for Concrete.
10. C309-11 - Liquid Membrane Forming Compounds for Curing Concrete.
11. C494/C494M-15a - Chemical Admixtures for Concrete.
12. C618-15 - Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
13. C979/C979M-16 - Pigments for Integrally Colored Concrete.
14. C989/C989M-14 - Slag Cement for Use in Concrete and Mortars.
15. C1240-15 - Silica Fume Used in Cementitious Mixtures.
16. D1751-04(2013)e1 - Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
17. D5893/D5893M-10 - Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements.
18. D6690-15 - Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.

1.4 PREINSTALLATION MEETINGS

A. Conduct preinstallation meeting at project site minimum 30 days before beginning Work of this section.
   1. Required Participants:
      a. Contracting Officer's Representative.
      b. Inspection and Testing Agency.
      c. Contractor.
      d. Installer.
      e. Other installers responsible for adjacent and intersecting work, including excavation,
   2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.
      a. Installation schedule.
      b. Installation sequence.
      c. Preparatory work.
      d. Protection before, during, and after installation.
      e. Installation.
      f. Terminations.
      g. Transitions and connections to other work.
      h. Inspecting and testing.
      i. Other items affecting successful completion.
   3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.5 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:
   1. Show size, configuration, and fabrication and installation details.
   2. Show reinforcing.
   3. Include jointing plan for concrete pavements, curbs and gutters.

C. Manufacturer's Literature and Data:
   1. Description of each product.
   2. Installation instructions.

D. Test reports: Certify products comply with specifications.
   1. Concrete materials.
   2. Select subbase materials.
   3. Field test reports.

E. Certificates: Certify products comply with specifications.
   1. Expansion joint filler.
   2. Reinforcement.
   3. Curing materials.
   4. Concrete protective coating.

F. Qualifications: Substantiate qualifications comply with specifications.
   1. Installer with project experience list.
   2. Land surveyor.

G. Concrete mix design.

H. Select subbase job-mix design.

I. Proposed hot and cold weather concreting methods.

J. Land surveyor's construction staking notes, before placing concrete.
   1. Identify discrepancies between field conditions and Drawings.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Regularly installs specified products.
   2. Installed specified products with satisfactory service on five similar installations.
      a. Project Experience List: Provide contact names and addresses for completed projects.

B. Land Surveyor: Professional land surveyor or engineer registered to provide land surveys in jurisdiction where project is located.

C. Preconstruction Testing:
   1. Engage independent testing laboratory to perform tests and submit reports.
      a. Deliver samples to laboratory in number and quantity required for testing.
   2. Concrete mix design.
   3. Select subbase job-mix design. Report the following:
      a. Material sources.
      b. Gradation.
      c. Plasticity index.
      d. Liquid limit.
      e. Laboratory compaction curves indicating maximum density at optimum moisture content.

1.7 DELIVERY

A. Deliver steel reinforcement to prevent damage.

B. Before installation, return or dispose of distorted or damaged steel reinforcement.

C. Bulk Products: Deliver bulk products away from buildings, utilities, pavement, and existing turf and planted areas. Maintain dry bulk product storage away from contaminants.

1.8 STORAGE AND HANDLING

A. Store products indoors in dry, weathertight facility.

B. Protect products from damage during handling and construction operations.

1.9 FIELD CONDITIONS

A. Hot Weather Concreting Procedures: ACI 305R.

B. Cold Weather Concreting Procedures: ACI 306R.
   1. Use non-corrosive, non-chloride accelerator admixture.
   2. Do not use calcium chloride, thiocyanates or admixtures containing more than 0.05 percent chloride ions.

1.10 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or II.

B. Pozzolans:
   1. Fly Ash: ASTM C618, Class C or F including supplementary optional physical requirements.
   2. Slag: ASTM C989/C989M; Grade 80.
   3. Silica Fume: ASTM C1240.

C. Coarse Aggregate: ASTM C33/C33M; size 20mmto suit application.

D. Fine Aggregate: ASTM C33/C33M.

E. Mixing Water: Fresh, clean, and potable.

F. Air-Entraining Admixture: ASTM C260/C260M.

G. Chemical Admixtures: ASTM C494/C494M.

H. Reinforcing Steel: ASTM A615/A615M or ASTM A996/A996M, Grade 420 (60); deformed.

I. Welded Wire Fabric: ASTM A1064/A1064M, sized as indicated.

J. Expansion Joint Filler: ASTM D1751.

K. Sheet Materials for Curing Concrete: ASTM C171.

L. Color Pigment: ASTM C979/C979M, colored and white powder pigments.

2.2 SELECT SUBBASE

A. Subbase: AASHTO M147; Grade B.
   1. Select granular material composed of sand, sand-gravel, crushed stone, crushed or granulated slag, with or without soil binder, or combinations of these materials.

SUBBASE GRADING REQUIREMENTS							
Sieve Size		Percentage Passing by Mass					
		Grades					
(mm)	(in)	A	B	C	D	E	F
50	2	100	100				
25	1		75-95	100	100	100	100
9.5	3/8	30-65	40-75	50-85	60-100		
4.47	No. 4	25-55	30-60	35-65	50-85	55-100	70-100
2.00	No. 10	15-40	20-45	25-50	40-70	40-100	55-100
0.425	No. 40	8-20	15-30	15-30	25-45	20-50	30-70
0.075	No. 200	2-8	5-20	5-15	5-20	6-20	8-25

B. Other Acceptable Gradations: Materials within three to five percent, plus or minus, of specified gradation, or as recommended by the geotechnical engineer and approved by the Contracting Officer's Representative.

2.3 FORMS

A. Forms: Wood, plywood, metal, or other materials, approved by Contracting Officer's Representative, of grade or type suitable to obtain type of finish specified.
   1. Plywood: Exterior grade, free of defects and patches on contact surface.
   2. Lumber: Sound, grade-marked, S4S stress graded softwood, minimum 50 mm (2 inches) thick, free from warp, twist, loose knots, splits, or other defects.
   3. Form Coating: As recommended by Architect/Engineer.

B. Provide forms suitable in cross-section, depth, and strength to resist springing during depositing and consolidating concrete.
   1. Do not use forms varying from straight line more than 3 mm in 3000 mm (1/8 inch in 10 feet), horizontally and vertically.

C. Provide flexible or curved forms for forming radii.

2.4 CONCRETE CURING MATERIALS

A. Concrete curing materials, conform to one of the following:
   1. Burlap: Minimum 233 g/sq. m (7 ounces/sq. yd.) dry.
   2. Sheet Materials for Curing Concrete: ASTM C171.
   3. Curing Compound: ASTM C309, Type 2; liquid membrane forming type, without paraffin or petroleum.

2.5 CONCRETE MIXES

A. Design concrete mixes according to ASTM C94/C94M, Option C.

B. Concrete Type: Air-entrained . See Table I.

TABLE I - CONCRETE TYPES					
Concrete Type	Minimum 28 Day Compressive Strength f'c MPa (psi)	Non-Air-Entrained		Air-Entrained	
		Min. Cement kg/cu. m (lbs./cu. yd.)	Max. Water Cement Ratio	Min. Cement kg/cu. m (lbs./cu. yd.)	Max. Water Cement Ratio
A	35 (5000)1,3	375 (630)	0.45	385 (650)	0.40
B	30 (4000)1,3	325 (550)	0.55	340 (570)	0.50
C	25 (3000)1,3	280 (470)	0.65	290 (490)	0.55
D	25 (3000)1,2	300 (500)	*	310 (520)	*

Footnotes:
1. If trial mixes are used, achieve compressive strength 8.3 MPa (1,200 psi) in excess of f'c. For concrete strengths greater than 35 MPa (5,000 psi), achieve compressive strength 9.7 MPa (1,400 psi) in excess of f'c.
2. For Concrete Exposed to High Sulfate Content Soils: Maximum water cement ratio is 0.44.
3. Laboratory Determined according to ACI 211.1 for normal weight concrete.

C. Maximum Slump: ASTM C143/C143M. See Table II.

TABLE II - MAXIMUM SLUMP	
APPLICATION	MAXIMUM SLUMP
Curb & Gutter	75 mm (3 inches)
Pedestrian Pavement	75 mm (3 inches)
Vehicular Pavement	50 mm (2 inches) Machine Finished 100 mm (4 inches) Hand Finished
Equipment Pad	75 to 100 mm (3 to 4 inches)

2.6 ACCESSORIES

A. Equipment and Tools: Obtain Contracting Officer's Representative's, approval of equipment and tools needed for handling materials and performing work before work begins.

B. Maintain equipment and tools in satisfactory working condition.

C. Sealants:
   1. Concrete Paving Expansion Joints: ASTM D5893/D5893M, Type SL, single component, self-leveling, silicone joint sealant.
   2. Concrete Paving Joints: ASTM D6690, Type IV, hot-applied, single component joint sealant.

D. Concrete Protective Coating: AASHTO M233 linseed oil mixture.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.

B. Protect existing construction and completed work from damage.

C. Prepare, construct, and finish subgrade. See Section Section 31 20 11, EARTHWORK (SHORT FORM).

D. Maintain subgrade in smooth, compacted condition, in conformance with the required section and established grade until the succeeding operation has been accomplished.

3.2 SELECT SUBBASE

A. Placing:
1. Place subbase material on prepared subgrade in uniform layer to required contour and grades, and to maximum 200 mm (8 inches) loose depth.
2. When required compacted thickness exceeds 150 mm (6 inches), place subbase material in equal thickness layers.
3. When subbase elevation is 13 mm (1/2 inch) or more below required grade, excavate subbase minimum 75 mm (3 inches) deep. Place and compact subbase to required grade.

B. Compaction:
1. Perform compaction with approved hand or mechanical equipment well suited to the material being compacted.
2. Maintain subbase at optimum moisture content for compaction.
3. Compact each subbase layer to minimum 95 percent or 100 percent of maximum density as specified in Section Section 31 20 11, EARTHWORK (SHORT FORM).

C. Subbase Tolerances:
1. Variation from Indicated Grade: Maximum 9 mm (3/8 inch).
2. Variation from Indicated Thickness: Maximum 13 mm (1/2 inch).

D. Protection:
1. Protect subbase from damage until concrete is placed.
2. Reconstruct damaged subbase before placing concrete.

3.3 SETTING FORMS

A. Form Substrate:
1. Compact form substrate to uniformly support forms along entire length.
2. Correct substrate imperfections and variations by cutting, filling, and compacting.

B. Form Setting:
1. Set forms to indicated line and grade with tight joints. Rigidly brace forms preventing movement.
2. Remove forms when removal will not damage concrete and when required for finishing.
3. Clean and oil forms before each use.
4. Correct forms, when required, immediately before placing concrete.

C. Land Surveyor: Establish control, alignment, and grade for forms.
1. Notify Contracting Officer's Representative immediately when discrepancies exist between field conditions and drawings.
2. Correct discrepancies greater than 25 mm (1 inch) before placing concrete.

D. Form Tolerances:
1. Variation from Indicated Line: Maximum 6 mm (1/4 inch).
2. Variation from Indicated Grade: Maximum 3 mm in 3000 mm (1/8 inch in 10 feet).

3.4 PLACING REINFORCEMENT

A. Keep reinforcement clean from contamination preventing concrete bond.

B. Install reinforcement shown on drawings.

C. Support and securely tie reinforcing steel to prevent displacement during concrete placement.

D. Obtain Contracting Officer's Representative's reinforcement placement approval before placing concrete.

3.5 JOINTS - GENERAL

A. Place joints, where shown on approved submittal Drawings.
1. Conform to details shown.
2. Install joints perpendicular to finished concrete surface.

B. Make joints straight and continuous from edge to edge of pavement.

3.6 CONSTRUCTION JOINTS

A. Place transverse construction joints of type shown, where indicated, and whenever concrete placement is suspended for more than 30 minutes.

B. .

3.7 CONTRACTION JOINTS

A. Tool or cut joints to width, depth, and radius edge shown on drawings using grooving tool, jointer, or saw.

B. Construct joints in curbs and gutters by inserting 3 mm (1/8 inch) steel plates conforming to curb and gutter cross sections.
   1. Keep plates in place until concrete can hold its shape.

C. Finish joint edges with edging tool.

D. Score pedestrian pavement with grooving tool or jointer.

3.8 EXPANSION JOINTS

A. Form expansion joints with expansion joint filler of thickness shown on drawings.
   1. Locate joints around perimeter of structures and features abutting site work concrete.
   2. Create complete, uniform separation between structure and site work concrete.

B. Extend expansion joint material full depth of concrete with top edge of joint filler below finished concrete surface where sealant is indicated on Drawings.

C. Cut and shape material matching cross section.

D. Anchor with approved devices to prevent displacing during placing and finishing operations.

E. Round joint edges with edging tool.

3.9 PLACING CONCRETE - GENERAL

A. Preparation before Placing Concrete:
   1. Obtain Contracting Officer's Representative approval.
   2. Remove debris and other foreign material.
   3. Uniformly moisten substrate, without standing water.

B. Convey concrete from mixer to final location without segregation or loss of ingredients. Deposit concrete to minimize handling.

C. During placement, consolidate concrete by spading or vibrating to minimize voids, honeycomb, and rock pockets.
   1. Vibrate concrete against forms and along joints.
   2. Avoid excess vibration and handling causing segregation.

D. Place concrete continuously between joints without bulkheads.

E. Install construction joint in concrete placement suspended for more than 30 minutes.

F. Replace concrete with cracks, chips, bird baths, and other defects to nearest joints, approved by Contracting Officer's Representative.

3.10 PLACING CONCRETE FOR PEDESTRIAN PAVEMENT, AND EQUIPMENT PADS

A. Place concrete in one layer conforming to cross section shown on Drawings after consolidating and finishing.

B. Deposit concrete near joints without disturbing joints. Do not place concrete directly onto joint assemblies.

C. Strike concrete surface to proper section ready for consolidation.

D. Consolidate concrete by tamping and spading or with approved mechanical finishing equipment.

E. Finish concrete surface with wood or metal float.

F. Construct concrete pads and pavements with sufficient slope to drain, preventing standing water.

3.11 FORM REMOVAL

A. Keep forms in place minimum 12 hours after concrete placement. Remove forms without damaging concrete.

B. Do not use bars or heavy tools against concrete to remove forms. Repair damage concrete found after form removal.

3.12 CONCRETE FINISHING - GENERAL

A. Follow operation sequence below, unless otherwise indicated on Drawings:
   1. Consolidating, floating, striking, troweling, texturing, and joint edging.

B. Use edging tool with 6 mm (1/4 inch) radius, unless otherwise shown on Drawings.

C. Keep finishing equipment and tools clean and suitable for use.

3.13 CONCRETE FINISHING - PEDESTRIAN PAVEMENT

A. Walks
   1. Finish concrete surfaces with metal float, troweled smooth, and finished with a broom moistened with clear water.
   2. Finish slab edges and formed transverse joints with edger.
   3. Broom surfaces transverse to traffic direction.
      a. Use brooming to eliminate flat surface produced by edger.
      b. Produce uniform corrugations, maximum 1.5 mm (1/16 inch) deep profile.
   4. Provide surface uniform in color and free of surface blemishes, form marks, and tool marks.
   5. Paving Tolerances:
      a. Variation from Indicated Plane: Maximum 5 mm in 3000 mm (3/16 inch in 10 feet).
      b. Variation from Indicated Thickness: Maximum 6 mm (1/4 inch).
   6. Replace paving within joint boundary when paving exceeds specified tolerances.

3.14 CONCRETE FINISHING - EQUIPMENT PADS

A. Strike pad surface to elevation shown on Drawings.

B. Provide smooth, dense float finish, free from depressions or irregularities.

C. Finish pad edges with edger.

D. After removing forms, rub pad edge faces with wood or concrete rubbing block, removing blemishes, form marks, and tool marks and providing uniform color.

E. Pad Tolerances:
   1. Variation from Indicated Plane: Maximum 3 mm in 3000 mm (1/8 inch in 10 feet).
   2. Variation from Indicated Elevation: Maximum 6 mm (1/4 inch).
   3. Variation from Indicated Thickness: Maximum 6 mm (1/4 inch).

F. Replace pads when pads exceed specified tolerances.

3.15 CONCRETE CURING

A. Concrete Protection:
   1. Protect unhardened concrete from rain and flowing water.
   2. Provide sufficient curing and protection materials available and ready for use before concrete placement begins.

3. Protect concrete to prevent pavement cracking from ambient temperature changes during curing period.
   a. Replace pavement damaged by curing method allowing concrete cracking.
   b. Employ another curing method as directed by Contracting Officer's Representative.

B. Cure concrete for minimum 7 days by one of the following methods appropriate to weather conditions preventing moisture loss and rapid temperature change:
   1. Burlap Mat: Provide minimum two layers kept saturated with water during curing period. Overlap Mats at least 150 mm (6 inches).
   2. Sheet Materials:
      a. Wet exposed concrete surface with fine water spray and cover with sheet materials.
      b. Overlap sheets minimum 300 mm (12 inches).
      c. Securely anchor sheet materials preventing displacement.
   3. Curing Compound:
      a. Protect joints indicated to receive sealants preventing contamination from curing compound.
      b. Insert moistened paper or fiber rope into joint or cover joint with waterproof paper.
      c. Apply curing compound before concrete dries.
      d. Apply curing compound in two coats at right angles to each other.
      e. Application Rate: Maximum 5 sq. m/L (200 sq. ft./gallon), both coats.
      f. Immediately reapply curing compound to surfaces damaged during curing period.

3.16 CONCRETE PROTECTIVE COATING

A. Apply protective coating of linseed oil mixture to exposed-to-view concrete surfaces, drainage structures, and features that project through, into, or against concrete exterior improvements to protect the concrete against deicing materials.

B. Complete backfilling and curing operation before applying protective coating.

C. Dry and thoroughly clean concrete before each application.

D. Apply two coats, with maximum coverage of 11 sq. m/L (50 sq. yds./gal.); first coat, and maximum 16 sq. m/L (70 sq. yds./gal.); second coat, except apply commercially prepared mixture according to manufacturer's instructions.

E. Protect coated surfaces from vehicular and pedestrian traffic until dry.

F. Do not heat protective coating, and do not expose protective coating to open flame, sparks, or fire adjacent to open containers or applicators. Do not apply material at temperatures lower than 10 degrees C (50 degrees F).

3.17 FIELD QUALITY CONTROL

A. Field Tests: Performed by testing laboratory specified in Section 01 45 29, TESTING LABORATORY SERVICES.
   1. Compaction.
      a. Pavement subgrade.
      b. Curb, gutter, and sidewalk.
   2. Concrete:
      a. Delivery samples.
      b. Field samples.
   3. Slip Resistance: Steps and pedestrian paving.

3.18 CLEANING

A. After completing curing:
   1. Remove burlap and sheet curing materials.
   2. Sweep concrete clean, removing foreign matter from the joints.
   3. Seal joints as specified.

3.19 PROTECTION

A. Protect exterior improvements from traffic and construction operations.
   1. Prohibit traffic on paving for minimum seven days after placement, or longer as directed by Contracting Officer's Representative.

B. Remove protective materials immediately before acceptance.

C. Repair damage.
   1. Replace concrete containing excessive cracking, fractures, spalling, and other defects within joint boundary, when directed by Contracting Officer's Representative, and at no additional cost to the Government.

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SECTION 32 90 00

PLANTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Plants, soils, edging, turf, and landscape materials.

1.2 RELATED REQUIREMENTS

1.3 DEFINITIONS

A. Pesticide: Any substance or mixture of substances, including biological control agents, that may prevent, destroy, repel, or mitigate pests and is specifically labeled for use by U.S. Environmental Protection Agency (EPA). Also, any substance used as plant regulator, defoliant, disinfectant, or biocide.

B. Stand of Turf: 100 percent of established species.

1.4 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. American National Standards Institute (ANSI):
1. Z60.1-2014 - Nursery Stock.

C. American Society for Testing And Materials (ASTM):
1. B221-14 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
2. B221M-13 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
3. C33/C33M-16-Concrete Aggregates.
4. C136/C136M-14 - Sieve Analysis of Fine and Coarse Aggregates.
5. C602-13a - Agricultural Liming Materials.
6. D977-13e1 - Emulsified Asphalt.
7. D5268-13 - Topsoil Used for Landscaping Purposes.

D. Hortus Third: Concise Dictionary of Plants Cultivated in United States and Canada.

E. Tree Care Industry Association (TCIA):
1. A300P1-2008 - Tree Care Operations - Trees, Shrubs and Other Woody Plant Maintenance Standard Practices (Pruning).
2. Z133.1-2012 - Arboricultural Operations - Safety Requirements.

F. Turfgrass Producers International (TPI):
1. 2006 Guideline Specifications to Turfgrass Sodding.

G. United States Department of Agriculture (USDA):
1. DOA SSIR 42-2014 - Soil Survey Laboratory Methods Manual.
2. Handbook No. 60 - Diagnosis and Improvement of Saline and Alkali Soils.

1.5 PREINSTALLATION MEETINGS

A. Conduct preinstallation meeting at project site minimum 30 days before beginning Work of this section.
1. Required Participants:
a. Contracting Officer's Representative.
b. Contractor.
c. Installer.

2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.
   a. Inspection of planting materials.
   b. Installation schedule.
   c. Installation sequence.
   d. Preparatory work.
   e. Protection before, during, and after installation.
   f. Installation.
   g. Inspecting.
   h. Environmental procedures.
3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.6 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:
   1. Description of each product.
   2. Photographs: Color photographs of each plant species showing actual size and condition of plants to be provided with measuring device included for scale. Where more than 20 plants are required of any species, submit minimum three photographs of average, best, and worst quality plant to be provided. Include on each photograph, plant full scientific name, size, and source nursery.
   3. Installation instructions.
   4. Warranty.

C. Sustainable Construction Submittals:
   1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.
   2. Biobased Content:
      a. Show type and quantity for each product.

D. Test reports: Certify products comply with specifications.

E. Certificates: Certify products comply with specifications.
   1. Plant Materials: Department of Agriculture certification by State Nursery Inspector declaring material to be free from insects and disease.
   2. Seed and Turf Materials: Notarized certificate of product analysis.

F. Qualifications: Substantiate qualifications comply with specifications.
   1. Installer, including supervisor with project experience list.

G. Operation and Maintenance Data:
   1. Care instructions for each plant material.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Regularly installs specified products.
   2. Installed specified products with satisfactory service on five similar installations for minimum five years.
      a. Project Experience List: Provide contact names and addresses for completed projects.
   3. Member in good standing of either Professional Landcare Network or American Nursery and Landscape Association.
   4. Field supervisor certified in one of following categories from Professional Landcare Network and submit one copy of certificate to Contracting Officer’s Representative:
      a. Certified Landscape Technician (CLT) - Exterior, with installation maintenance specialty areas, designated CLT-Exterior.
      b. Certified Landscape Technician (CLT) - Interior, designated CLT-Interior.

c. Certified Ornamental Landscape Professional, designated COLP.

B. Independent or university laboratory, recognized by State Department of Agriculture, with experience and capability to conduct testing indicated and that specializes in types of tests to be performed.

C. Material Test Reports: For existing in-place surface soil and imported or manufactured topsoil.
1. For each unamended soil type, provide soil analysis and written report by qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; sodium absorption ratio; deleterious material; pH; and mineral and plant-nutrient content of soil.
2. Comply with USDA's Handbook No. 60 testing methods and written recommendations.
3. Soil-testing laboratory to oversee soil sampling; with depth, location, and number of samples to be taken per instructions from Contracting Officer’s Representative. Take minimum 3 representative samples from varied locations for each soil to be used or amended for planting purposes.
4. Report suitability of tested soil for plant growth.
5. Based on test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 92.9 sq. m (1000 sq. ft.) or volume per 0.76 cu. m (1 cu. yd.) for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
6. Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide additional recommendations for corrective action.

1.8 DELIVERY

A. Deliver packaged products in manufacturer's original sealed packaging.

B. Bulk Products:
1. Deliver bulk products away from buildings, utilities, pavement, and existing turf and planted areas. Maintain dry bulk product storage away from contaminants.
2. Install erosion control materials to prevent erosion or displacement of bulk products.

1.9 STORAGE AND HANDLING

A. Store bulbs, corms, and tubers in dry location at 16 to 18 degrees C (60 to 65 degrees F) until planting.

B. Store seeds and other packaged materials in dry locations away from contaminants.

C. Root Control Barrier and Weed Control Fabric: Store materials in site in enclosures or under protective covering in dry location out of direct sunlight. Do not store materials directly on ground.

1.10 FIELD CONDITIONS

A. Environment:
1. Coordinate installation of planting materials during optimal planting seasons for each type of plant material required.
2. Restrictions: Do not plant when ground isfrozen, snow covered, muddy, or when air temperature exceed 32 degrees C (90 degrees F).

B. Weather Limitations: Install plantings only during current and forecasted weather conditions that are comply with plant requirements. Apply associated products in compliance with manufacturers' instructions.

1.11 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

B. Manufacturer's Warranty: Warrant plantings and against material defects.

1. Warranty Period: Two years.
2. Plant and Turf Warranty Periods will begin from date of planting completion.
3. Contracting Officer's Representative will reinspect plants and turf at end of Warranty Period. Replace any dead, missing, or defective plant material and turf immediately. Warranty Period will end on date of this inspection provided Contractor has complied with warranty work required by this specification. Comply with following requirements:
   a. Replace any plants more than 25 percent dead, missing or defective plant material before final inspection.
   b. Only one replacement of each plant will be required except when losses or replacements are due to failure to comply with these requirements.
   c. Complete remedial measures directed by Contracting Officer’s Representative to ensure plant and turf survival.
   d. Repair damage caused while making plant or turf replacements.

PART 2 - PRODUCTS

2.1 PRODUCTS - GENERAL

A. Provide each product from one source or manufacturer.

2.2 SOD

A. Sod: Nursery grown, certified and classified in TPI's "Guideline Specifications to Turfgrass Sodding" as GSS. Machine cut sod at uniform thickness of 19 mm (3/4 inch) within tolerance of 6 mm (1/4 inch), excluding top growth and thatch. Each individual sod piece to be strong enough to support its own weight when lifted by ends. Broken pads, irregularly shaped pieces, and torn or uneven ends will not be permitted.

B. Sod Species: Genetically pure, free of weeds, pests, and disease.
   1. Sun and Partial Shade: Proportion grass species as follows:
      a. 50 percent Fine Fescue.
      b. 30 percent Kentucky Bluegrass.
      c. 20 percent Perennial Ryegrass.

2.3 TURF SELECTIONS

A. Grasses for Cool Regions:
   1. Bentgrasses: Redtop (Agrostis alba) and Colonial (Agrostis tenuis).
   2. Bluegrasses: Kentucky (Popratensis), Rough-stalked (Potrivialis) and Canada(Poa compressa).
   3. Fescue: Red (Festucrubra), Meadow (Festucpratensis) and Tall (Festucarundinacea).
   4. Ryegrasses: Perennial (Lolium perenne).

2.4 PLANTING SOILS

A. Planting Soil: Evaluate soil for use as topsoil according to ASTM D5268. From 5 to 10 percent organic matter as determined by topsoil composition tests of Organic Carbon, 6A, Chemical Analysis Method described in USDA DOA SSIR 42. Maximum particle size, 19 mm (3/4 inch), with maximum 3 percent retained on 6 mm (1/4 inch) screen. Mix topsoil with following soil amendments and fertilizers as recommended by soils analysis.

B. Existing Planting Soil: Existing, native surface topsoil formed under natural conditions retained during excavation process and stockpiled on-site. Verify suitability of native surface topsoil to produce viable planting soil. Clean soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
   1. Supplement with planting soil when quantities are insufficient.
   2. Mix existing, native surface topsoil with soil amendments and fertilizers as recommended by soils analysis.

C. Imported Planting Soil: Imported topsoil or manufactured topsoil from off-site sources are acceptable if sufficient topsoil is not available on site to meet specified depth. At least 10 days before topsoil delivery, notify Contracting Officer’s Representative of topsoil sources. Obtain imported topsoil displaced from naturally well-drained construction or mining sites where topsoil is at least 100 mm (4 inches) deep. Topsoil from agricultural land, bogs, or marshes will be rejected.

2.5 INORGANIC SOIL AMENDMENTS

A. Lime: Commercial grade hydrated or burnt limestone containing calcium carbonate equivalent (CCE) specified in ASTM C602 of minimum 80 percent.

B. Sulfur: 100 percent elemental.

C. Iron Sulfate: 100 percent elemental.

D. Aluminum Sulfate: Commercial grade.

E. Perlite: Horticultural grade.

F. Agricultural Gypsum: Coarsely ground from recycled scrap gypsum board comprised of calcium sulfate dehydrate 91 percent, calcium 22 percent, sulfur 17 percent, minimum 96 percent passing through 850 micrometers 20 mesh screen, 100 percent passing through 970 micrometers 16 mesh screen.

G. Coarse Sand: ASTM C33/C33M, clean and free of materials harmful to plants.

H. Vermiculite: Horticultural grade for planters.

I. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.

J. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.6 WATER

A. Water: Source approved by Contracting Officer's Representative and suitable quality for irrigation, containing no elements toxic to plant life, including acids, alkalis, salts, chemical pollutants, and organic matter. Use collected storm water or graywater when available.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive plants for compliance with requirements and conditions affecting installation and performance.
   1. Verify that no materials that would inhibit plant growth are present in planting area. If such materials are present, remove soil and contaminants ad directed by Contracting Officer's Representative and provide new planting soil.
   2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
   3. Suspend soil spreading, grading, and tilling operations if soil moisture becomes excessive. Resume soil preparations when moisture content returns to acceptable level.
   4. If soil is excessively dry, not workable, and too dusty, moisten uniformly.
   5. Special conditions may exist that warrant variance in specified planting dates or conditions. Submit written request to Contracting Officer’s Representative stating special conditions and proposed variance.

B. Proceed with planting operations only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect existing and proposed landscape features, elements, and site construction and completed work from damage. Protect trees, vegetation, and other designated features by erecting high-visibility, reusable construction fencing. Locate fence no closer to trees than drip

line. Plan equipment and vehicle access to minimize and confine soil disturbance and compaction to areas indicated on drawings.

B. Install erosion control materials at all areas inside or outside limits of construction that are disturbed by planting operations. Provide erosion control and seeding with native plant species to protect slopes.

3.3 SODDING

A. Place sod maximum 36 hours after initial harvesting according to TPI GSS, except as modified herein.

B. Finishing: After sodding, blend edges of sodded area smoothly into surrounding area. Eliminate air pockets and provide true and even surface. Trim frayed areas and patch holes and missing areas with sod.

C. Rolling: Immediately after sodding, firm entire area, except slopes in excess of 3: 1, with roller maximum 134 kg (90 lbs.) for each foot of roller width.

D. Watering: Start watering sodded areas as required by daily temperature and wind conditions. Water at rate sufficient to ensure thorough wetting of soil to minimum 150 mm (6 inches) deep. Prevent run-off, puddling, and wilting. Do not drive watering trucks over turf areas, unless otherwise directed. Prevent watering of other adjacent areas or plant materials.

3.4 TURF MAINTENANCE

A. Mow turf to uniform finished height measured from soil. Perform mowing in manner that prevents scalping, rutting, bruising, uneven and rough cutting. Before mowing, remove and dispose of all rubbish, debris, trash, leaves, rocks, paper, and limbs or branches on turf areas. Sweep or vacuum clean adjacent paved areas.

B. Apply fertilizer in manner that promotes health, growth, vigor, color and appearance of cultivated turf areas. Determine method of application, fertilizer type and frequencies by results of laboratory soil analysis. Provide organic fertilizer. If organic fertilizer does not produce desired effect, contact Contracting Officer's Representative for approval before applying synthetic fertilizer. Apply fertilizer by approved methods and according to manufacturer's instructions.

C. Watering: Perform irrigation in manner that promotes health, growth, color, and appearance of cultivated vegetation, complying with Federal, State, and local water agency and authority directives. Prevent overwatering, water run-off, erosion, and ponding due to excessive quantities or rate of application.

D. CLEANING

E. Remove and legally dispose of all excess soil and planting debris.

3.5 PROTECTION

A. Protect plants from traffic and construction operations.

B. Provide temporary fences or enclosures and signage, at planted areas. Maintain fences and enclosures during maintenance period.

C. Remove protective materials immediately before acceptance.

D. Repair damage.

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