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PROJECT SPECIFICATIONS

Department of Veterans Affairs
Alexandria VA Health Care System
Electronic Health Record Modernization (EHRM)
VA Project No. 502-21-222

100% Construction Documents
March 24, 2026

Prepared by:
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VA | U.S. Department of Veterans Affairs

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DEPARTMENT OF VETERANS AFFAIRS
VHA MASTER SPECIFICATIONS

TABLE OF CONTENTS
Section 00 01 10

SECTION NO.	DIVISION AND SECTION TITLES	DATE
	DIVISION 00 - SPECIAL SECTIONS	
00 01 15	List of Drawing Sheets	05-20
	DIVISION 01 - GENERAL REQUIREMENTS	
01 00 00	General Requirements	05-21
01 32 16.15	Project Schedules (Small Projects - Design/Bid/Build)	03-20
01 33 23	Shop Drawings, Product Data, and Samples	06-21
01 35 26	Safety Requirements	07-20
01 42 19	Reference Standards	11-20
01 45 00	Quality Control	02-21
01 45 29	Testing Laboratory Services	11-18
01 45 35	Special Inspections	06-21
01 57 19	Temporary Environmental Controls	01-21
01 58 16	Temporary Interior Signage	07-15
01 74 19	Construction Waste Management	01-21
01 91 00	General Commissioning	10-15
	DIVISION 02 – EXISTING CONDITIONS	
02 41 00	Demolition	08-17
02 41 00.1	Asbestos Report	
	DIVISION 06 – WOOD, PLASTICS AND COMPOSITES	
06 10 00	Rough Carpentry	10-17
	DIVISION 07 - THERMAL AND MOISTURE PROTECTION	
07 84 00	Firestopping	01-21
07 92 00	Joint Sealants	10-17
	DIVISION 08 - OPENINGS	
08 11 13	Hollow Metal Doors and Frames	01-21
08 14 00	Interior Wood Doors	01-21
08 71 00	Door Hardware	01-21
08 87 00	Window Film	02-22
	DIVISION 09 – FINISHES	
09 05 16	Subsurface Preparation for Floor Finishes	01-21
09 22 16	Non-Structural Metal Framing	06-18
09 29 00	Gypsum Board	04-20

SECTION NO.	DIVISION AND SECTION TITLES	DATE
09 51 00	Acoustical Ceilings	12-18
09 65 13	Resilient Base and Accessories	01-21
09 65 19	Resilient Tile Flooring	05-18
09 69 00	Access Flooring	01-21
09 91 00	Painting	01-21
	DIVISION 10 – SPECIALTIES	
10 14 00	Signage	01-21
10 26 00	Wall and Door Protection	01-21
10 44 13	Fire Extinguisher Cabinets	08-18
	DIVISION 21 - FIRE SUPPRESSION	
21 08 00	Commissioning of Fire Suppression System	11-16
21 13 13	Wet-Pipe Sprinkler Systems	06-15
	DIVISION 22 – PLUMBING	
22 05 11	Common Work Results for Plumbing	09-20
22 05 19	Meters and Gages for Plumbing Piping	09-20
22 05 23	General-Duty Valves for Plumbing Piping	09-20
22 07 11	Plumbing Insulation	09-19
22 08 00	Commissioning of Plumbing Systems	11-16
22 11 00	Facility Water Distribution	05-21
22 13 00	Facility Sanitary and Vent Piping	09-20
	DIVISION 23 – HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)	
23 05 11	Common Work Results for HVAC	02-20
23 05 12	General Motor Requirements for HVAC and Steam Generation Equipment	02-20
23 05 93	Testing, Adjusting, and Balancing for HVAC	02-20
23 07 11	HVAC and Boiler Plant Insulation	02-20
23 08 00	Commissioning of HVAC Systems	02-20
23 09 23	Direct-Digital Control System for HVAC	09-11
23 21 13	Hydronic Piping	02-20
23 23 00	Refrigerant Piping	02-20
23 31 00	HVAC Ducts and Casings	02-20
23 37 00	Air Outlets and Inlets	02-20
23 81 00	Decentralized Unitary HVAC Equipment	03-20
23 82 16	Air Coils	03-20
	DIVISION 26 – ELECTRICAL	
26 05 11	Requirements for Electrical Installations	01-16
26 05 19	Low-Voltage Electrical Power Conductors and Cables	01-17
26 05 26	Grounding and Bonding for Electrical Systems	01-17
26 05 33	Raceway and Boxes for Electrical Systems	01-18
26 05 41	Underground Electrical Construction	01-17

SECTION NO.	DIVISION AND SECTION TITLES	DATE
26 08 00	Commissioning of Electrical Systems	11-16
26 24 16	Panelboards	01-18
26 24 16.1	TR Panel Schedules	
26 27 26	Wiring Devices	01-18
26 29 21	Enclosed Switches and Circuit Breakers	01-17
26 33 53	Static Uninterruptible Power Supply	01-17
26 36 23	Automatic Transfer Switches	01-17
26 43 13	Surge Protective Devices	01-17
26 51 00	Interior Lighting	01-18
	DIVISION 27 – COMMUNICATIONS	
27 05 11	Requirements for Communications Installations	09-19
27 05 26	Grounding and Bonding for Communications Systems	06-15
27 05 33	Conduits and Boxes for Communications Systems	10-18
27 05 36	Cable Trays for Communications Systems	12-22
27 05 53	Identification for Communications Systems	12-22
27 08 00	Commissioning of Communications Systems	11-16
27 11 16	Communications Cabinets, Racks, Frames, and Enclosures	12-22
27 11 19	Communications Termination Blocks and Patch Panels	12-22
27 11 26	Communications Rack Mounted Power Protection and Power Strips	12-22
27 13 23	Communications Optical Fiber Backbone Cabling	12-22
27 13 23.13	Communications Optical Fiber Cable Splicing and Terminations	12-22
27 15 10	Data Port	01-22
27 15 10.1	Existing Data Drops	
27 15 10.2	New Data Drops	
27 15 13	Communications Copper Horizontal Cabling	12-22
27 16 19	Communications Patch Cords, Station Cords, and Cross Connect Wire	12-22
27 78 00	Closeout Submittals for Communications	03-23
	DIVISION 28 – ELECTRONIC SAFETY AND SECURITY	
28 05 00	Common Work Results for Electronic Safety and Security	04-18
28 05 13	Conductors and Cables for Electronic Safety and Security	10-18
28 05 26	Grounding and Bonding for Electronic Safety and Security	09-11
28 05 28.33	Conduits and Backboxes for Electronic Safety and Security	09-11
28 08 00	Commissioning of Electronic Safety and Security Systems	11-16
28 13 00	Physical Access Control System	10-11
28 23 00	Security Surveillance Television System (SSTV)	09-11
	DIVISION 31 – EARTHWORK	
31 20 00	Earthwork	07-16

SECTION NO.	DIVISION AND SECTION TITLES	DATE
	DIVISION 32 - EXTERIOR IMPROVEMENTS	
32 05 23	Cement and Concrete for Exterior Improvements	08-16
32 12 16	Asphalt Paving	09-15
32 17 23	Pavement Markings	08-16

- - -END- - -

SECTION 00 01 15
LIST OF DRAWING SHEETS

The drawings listed below accompanying this specification form a part of the contract.

Drawing No.	Title
	VOLUME 1 OF 4
GENERAL	
G-001.1	COVER VOLUME 1
G-002	GENERAL INFORMATION
G-003	CAMPUS MAP
G-004	TYPICAL ICRA CONDITIONS AND DETAILS
G-005	CONTRACTOR WORK PROCEDURES
001.G-101	BUILDING 1, BASEMENT OVERALL PLAN
001.G-111	BUILDING 1, FIRST FLOOR OVERALL PLAN
001.G-121	BUILDING 1, SECOND FLOOR OVERALL PLAN
002.G-111	BUILDING 2, FIRST FLOOR, OVERALL PLAN
002.G-121	BUILDING 2, SECOND FLOOR, OVERALL PLAN
002.G-131	BUILDING 2, THIRD FLOOR, OVERALL PLAN
002.G-141	BUILDING 2, FOURTH FLOOR, OVERALL PLAN
003.G-111	BUILDING 3, FIRST FLOOR OVERALL PLAN
003.G-121	BUILDING 3, SECOND FLOOR OVERALL PLAN
003.G-131	BUILDING 3, THIRD FLOOR OVERALL PLAN
004.G-101	BUILDING 4, BASEMENT OVERALL PLAN
004.G-111	BUILDING 4, FIRST FLOOR OVERALL PLAN
005.G-101	BUILDING 5, BASEMENT FLOOR ELECTRICAL OVERALL PLAN
005.G-111	BUILDING 5, FIRST FLOOR OVERALL PLAN
005.G-121	BUILDING 5, SECOND FLOOR OVERALL PLAN
006.G-101	BUILDING 6, BASEMENT OVERALL PLAN
006.G-111	BUILDING 6, FIRST FLOOR OVERALL PLAN
006.G-121	BUILDING 6, SECOND FLOOR OVERALL PLAN
006.G-131	BUILDING 6, THIRD FLOOR OVERALL PLAN
007.G-100	BUILDING 7, BASEMENT FLOOR, OVERALL PLAN
007.G-110	BUILDING 7, FIRST FLOOR, OVERALL PLAN
007.G-120	BUILDING 7, SECOND FLOOR, OVERALL PLAN
007.G-130	BUILDING 7, THIRD FLOOR, OVERALL PLAN
007.G-140	BUILDING 7, FOURTH FLOOR, OVERALL PLAN

007.G-101	BUILDING 7, BASEMENT, OVERALL PLAN A
007.G-102	BUILDING 7, BASEMENT, OVERALL PLAN B
007.G-103	BUILDING 7, BASEMENT, OVERALL PLAN C
007.G-104	BUILDING 7, BASEMENT, OVERALL PLAN D
007.G-105	BUILDING 7, BASEMENT, OVERALL PLAN E
007.G-106	BUILDING 7, BASEMENT, OVERALL PLAN F
007.G-111	BUILDING 7, FIRST FLOOR, OVERALL PLAN A
007.G-112	BUILDING 7, FIRST FLOOR, OVERALL PLAN B
007.G-113	BUILDING 7, FIRST FLOOR, OVERALL PLAN C
007.G-114	BUILDING 7, FIRST FLOOR, OVERALL PLAN D
007.G-115	BUILDING 7, FIRST FLOOR, OVERALL PLAN E
007.G-116	BUILDING 7, FIRST FLOOR, OVERALL PLAN F
007.G-121	BUILDING 7, SECOND FLOOR, OVERALL PLAN A
007.G-122	BUILDING 7, SECOND FLOOR, OVERALL PLAN B
007.G-123	BUILDING 7, SECOND FLOOR, OVERALL PLAN C
007.G-124	BUILDING 7, SECOND FLOOR, OVERALL PLAN D
007.G-125	BUILDING 7, SECOND FLOOR, OVERALL PLAN E
007.G-126	BUILDING 7, SECOND FLOOR, OVERALL PLAN F
007.G-131	BUILDING 7, THIRD FLOOR, OVERALL PLAN A
007.G-132	BUILDING 7, THIRD FLOOR, OVERALL PLAN B
007.G-133	BUILDING 7, THIRD FLOOR, OVERALL PLAN C
007.G-134	BUILDING 7, THIRD FLOOR, OVERALL PLAN D
007.G-135	BUILDING 7, THIRD FLOOR, OVERALL PLAN E
007.G-136	BUILDING 7, THIRD FLOOR, OVERALL PLAN F
007.G-141	BUILDING 7, FOURTH FLOOR, OVERALL PLAN A
007.G-142	BUILDING 7, FOURTH FLOOR, OVERALL PLAN B
007.G-143	BUILDING 7, FOURTH FLOOR, OVERALL PLAN C
007.G-144	BUILDING 7, FOURTH FLOOR, OVERALL PLAN D
007.G-145	BUILDING 7, FOURTH FLOOR, OVERALL PLAN E
007.G-146	BUILDING 7, FOURTH FLOOR, OVERALL PLAN F
008.G-101	BUILDING 8, FIRST FLOOR OVERALL PLANS
009.G-110	BUILDING 9, FIRST FLOOR ELECTRICAL, OVERALL PLAN
009.G-111	BUILDING 9, FIRST FLOOR OVERALL PLAN A
009.G-112	BUILDING 9, FIRST FLOOR OVERALL PLAN B
009.G-113	BUILDING 9, FIRST FLOOR OVERALL PLAN C
009.G-120	BUILDING 9, SECOND FLOOR OVERALL PLAN
009.G-121	BUILDING 9, SECOND FLOOR OVERALL PLAN A

009.G-122 BUILDING 9, SECOND FLOOR OVERALL PLAN B
009.G-123 BUILDING 9, SECOND FLOOR ELECTRICAL, OVERALL PLAN C
009.G-130 BUILDING 9, THIRD FLOOR OVERALL PLAN
009.G-131 BUILDING 9, THIRD FLOOR OVERALL PLAN A
009.G-132 BUILDING 9, THIRD FLOOR OVERALL PLAN B
009.G-133 BUILDING 9, THIRD FLOOR OVERALL PLAN C
013.G-111 BUILDING 13, FIRST FLOOR OVERALL PLAN
014.G-111 BUILDING 14, FIRST FLOOR, OVERALL PLAN
015.G-111 BUILDING 15, FIRST FLOOR OVERALL PLAN
016.G-111 BUILDING 16, FIRST FLOOR, OVERALL PLAN
045.G-111 BUILDING 45, FIRST FLOOR, OVERALL PLAN
045.G-121 BUILDING 45, SECOND FLOOR, OVERALL PLAN
046.G-111 BUILDING 46, FIRST FLOOR, OVERALL PLAN
046.G-121 BUILDING 46, SECOND FLOOR, OVERALL PLAN
046.G-131 BUILDING 46, THIRD FLOOR, OVERALL PLAN
049.G-111 BUILDING 49, FIRST FLOOR, OVERALL PLAN
136.G-111 BUILDING 136, FIRST FLOOR, OVERALL PLAN
142.G-111 BUILDING 142, FIRST FLOOR, OVERALL PLAN
147.G-111 BUILDING 147, FIRST FLOOR, OVERALL PLAN
171.G-111 BUILDING 171, FIRST FLOOR, OVERALL PLANS

VOLUME 2 OF 4

GENERAL

G-001.2 COVER VOLUME 2

CIVIL

C-001 LEGEND & GENERAL NOTES
C-100 OVERALL SITE PLAN
C-200 OVERALL EXISTING UTILITY SITE PLAN
C-201 PARTIAL SITE PLAN - EXISTING UTILITY LINES
C-202 PARTIAL SITE PLAN - EXISTING UTILITY LINES
C-203 PARTIAL SITE PLAN - EXISTING UTILITY LINES
C-204 PARTIAL SITE PLAN - EXISTING UTILITY LINES
C-300 OVERALL SITE PLAN - NEW EHRM LINES
C-301 PARTIAL SITE PLAN - NEW EHRM LINES
C-302 PARTIAL SITE PLAN - NEW EHRM LINES

C-303	PARTIAL SITE PLAN - NEW EHRM LINES
C-304	PARTIAL SITE PLAN - NEW EHRM LINES
C-400	DUCT BANK PROFILES - NEW EHRM LINES
C-401	DUCT BANK PROFILES - NEW EHRM LINES
C-402	DUCT BANK PROFILES - NEW EHRM LINES
C-500	EHRM MANHOLE, DUCT BANK, & PULL BOX DETAILS
C-501	MISC. SITE DETAILS
C-502	EROSION CONTROL DETAILS

ARCHITECTURAL

A-001	ARCHITECTURAL SYMBOLS, ABBREVIATIONS AND NOTES
A-002	PARTITION TYPES AND DETAILS
A-004	DOOR SCHEDULE
A-005	ROOM FINISH SCHEDULE, GENERAL NOTES AND ABBREVIATIONS
001.A-401	ENLARGED PLANS, BUILDING 1, FIRST FLOOR, TELECOM ROOM 103
001.A-402	ENLARGED PLANS, BUILDING 1, SECOND FLOOR, TELECOM ROOM 202
002.A-401	ENLARGED PLANS, BUILDING 2, FIRST FLOOR, TELECOM ROOM 133
002.A-402	ENLARGED PLANS, BUILDING 2, SECOND FLOOR, TELECOM ROOM 256
002.A-403	ENLARGED PLANS, BUILDING 2, THIRD FLOOR, TELECOM ROOM 359
002.A-404	ENLARGED PLANS, BUILDING 2, FOURTH FLOOR, TELECOM ROOM 424
003.A-401	ENLARGED PLANS, BUILDING 3, FIRST FLOOR, TELECOM ROOM 105
003.A-402	ENLARGED PLANS, BUILDING 3, SECOND FLOOR, TELECOM ROOM 205
003.A-403	ENLARGED PLANS, BUILDING 3, THIRD FLOOR, TELECOM ROOM 305
004.A-401	ENLARGED PLANS, BUILDING 4, FIRST FLOOR, TELECOM ROOM 102E
005.A-400	ENLARGED PLANS, BUILDING 5, GROUND FLOOR, TELECOM ROOM G06A
005.A-401	ENLARGED PLANS, BUILDING 5, FIRST FLOOR, TELECOM ROOM 110A
005.A-402	ENLARGED PLANS, BUILDING 5, SECOND FLOOR, TELECOM ROOM 212C
006.A-400	ENLARGED PLANS, BUILDING 6, BASEMENT, TELECOM ROOM 008
006.A-401	ENLARGED PLANS, BUILDING 6, FIRST FLOOR, TELECOM ROOM 101
006.A-402	ENLARGED PLANS, BUILDING 6, SECOND FLOOR, TELECOM ROOM 201
006.A-403	ENLARGED PLANS, BUILDING 6, THIRD FLOOR, TELECOM ROOM 310
007.A-401	ENLARGED PLANS, BUILDING 7, BASEMENT, COMPUTER ROOM 45B
007.A-402	ENLARGED PLANS, BUILDING 7, BASEMENT, COMPUTER ROOM 45B
007.A-403	ENLARGED PLANS, BUILDING 7, BASEMENT, TELECOM ROOM 17
007.A-404	ENLARGED PLANS, BUILDING 7, FIRST FLOOR, TELECOM ROOM 1A-184A
007.A-405	ENLARGED PLANS, BUILDING 7, FIRST FLOOR, TELECOM ROOM D-33

007.A-406	ENLARGED PLANS, BUILDING 7, FIRST FLOOR, TELECOM ROOM 1A-117
007.A-407	ENLARGED PLANS, BUILDING 7, SECOND FLOOR, TELECOM ROOM 267A
007.A-408	ENLARGED PLANS, BUILDING 7, SECOND FLOOR, TELECOM ROOM 2M4
007.A-409	ENLARGED PLANS, BUILDING 7, THIRD FLOOR, TELECOM ROOM 373D
007.A-410	ENLARGED PLANS, BUILDING 7, THIRD FLOOR, TELECOM ROOM 3M4
007.A-411	ENLARGED PLANS, BUILDING 7, FOURTH FLOOR, TELECOM ROOM 471A
007.A-412	ENLARGED PLANS, BUILDING 7, FOURTH FLOOR, TELECOM ROOM 402
008.A-401	ENLARGED PLANS, BUILDING 8, FIRST FLOOR
009.A-401	ENLARGED PLANS, BUILDING 9, FIRST FLOOR, TELECOM ROOM
009.A-402	ENLARGED PLANS, BUILDING 9, SECOND FLOOR, TELECOM ROOM
009.A-403	ENLARGED PLANS, BUILDING 9, THIRD FLOOR, TELECOM ROOM
013.A-401	ENLARGED PLANS, BUILDING 13, FIRST FLOOR
014.A-401	ENLARGED PLANS, BUILDING 14, FIRST FLOOR
015.A-401	ENLARGED PLANS, BUILDING 15, FIRST FLOOR, TELECOM ROOM
016.A-401	ENLARGED PLANS, BUILDING 16, FIRST FLOOR, TELECOM ROOM 110B
045.A-401	ENLARGED PLANS, BUILDING 45, FIRST FLOOR, TELECOM ROOM 173
045.A-402	ENLARGED PLANS, BUILDING 45, FIRST FLOOR, TELECOM ROOM 170
045.A-403	ENLARGED PLANS, BUILDING 45, SECOND FLOOR, TELECOM ROOM 272
045.A-404	ENLARGED PLANS, BUILDING 45, SECOND FLOOR, TELECOM ROOM 268
046.A-401	ENLARGED PLANS, BUILDING 46, THIRD FLOOR, TELECOM ROOM 302
049.A-401	ENLARGED PLANS, BUILDING 49, FIRST FLOOR, TELECOM ROOM 166
136.A-401	ENLARGED PLANS, BUILDING 136, FIRST FLOOR, TELECOM ROOM 32
142.A-401	ENLARGED PLANS, BUILDING 142, FIRST FLOOR, TELECOM ROOM 13
147.A-401	ENLARGED PLANS, BUILDING 147, FIRST FLOOR, TELECOM ROOM 102
171.A-401	ENLARGED PLANS, BUILDING 171, FIRST FLOOR, TELECOM ROOM 108

VOLUME 3 OF 4

GENERAL

G-001.3	COVER VOLUME 3

MECHANICAL

MP001	MECHANICAL GENERAL INFORMATION
MP002	PLUMBING GENERAL INFORMATION
MP003	FIRE SUPPRESSION GENERAL INFORMATION
001.M-101	BUILDING 1, FIRST FLOOR, OVERALL MECHANICAL PLAN

001.MP401	BUILDING 1, FIRST FLOOR, TELECOM ROOM 103 PLANS
001.MP402	BUILDING 1, SECOND FLOOR, TELECOM ROOM 202 PLANS
002.M-101	BUILDING 2, FOURTH FLOOR, OVERALL MECHANICAL PLAN
002.MP401	BUILDING 2, FIRST FLOOR, TELECOM ROOM 133 PLANS
002.MP402	BUILDING 2, SECOND FLOOR, TELECOM ROOM 256 PLANS
002.MP403	BUILDING 2, THIRD FLOOR, TELECOM ROOM 359 PLANS
002.MP404	BUILDING 2, FOURTH FLOOR, TELECOM ROOM 424 PLANS
003.MP401	BUILDING 3, FIRST FLOOR, TELECOM ROOM 105 PLANS
003.MP402	BUILDING 3, SECOND FLOOR, TELECOM ROOM 205 PLANS
003.MP403	BUILDING 3, THIRD FLOOR, TELECOM ROOM 305 PLANS
004.M-101	BUILDING 4, FIRST FLOOR, OVERALL MECHANICAL PLAN
004.MP401	BUILDING 4, FIRST FLOOR, TELECOM ROOM 102E PLANS
005.MP401	BUILDING 5, BASEMENT FLOOR, TELECOM ROOM G06A PLANS
005.MP402	BUILDING 5, FIRST FLOOR, TELECOM ROOM 110A PLANS
005.MP403	BUILDING 5, SECOND FLOOR, TELECOM ROOM 212C PLANS
006.MP401	BUILDING 6, BASEMENT, TELECOM ROOM 008 PLANS
006.MP402	BUILDING 6, FIRST FLOOR, TELECOM ROOM 101 PLANS
006.MP403	BUILDING 6, SECOND FLOOR, TELECOM ROOM 201 PLANS
006.MP404	BUILDING 6, THIRD FLOOR, TELECOM ROOM 310 PLANS
007.M-101	BASEMENT FLOOR OVERALL MECHANICAL PLAN
007.MP401	BUILDING 07, BASEMENT FLOOR, TELECOM ROOM 17 PLANS
007.MP402	BUILDING 07, BASEMENT FLOOR, TELE./COMPUTER RM 42, COMPUTER RM 45 MECHANICAL PLANS
007.MP403	BUILDING 07, FIRST FLOOR, TELECOM ROOM 184A PLANS
007.MP404	BUILDING 07, FIRST FLOOR, TELECOM ROOM 1A-117 PLANS
007.MP405	BUILDING 07, FIRST FLOOR, TELECOM ROOM D-33 PLANS
007.MP406	BUILDING 07, SECOND FLOOR, TELECOM ROOM 267A PLANS
007.MP407	BUILDING 07, SECOND FLOOR, TELECOM ROOM 2M4 PLANS
007.MP408	BUILDING 07, THIRD FLOOR, TELECOM ROOM 373D PLANS
007.MP409	BUILDING 07, THIRD FLOOR, TELECOM ROOM 3M4 PLANS
007.MP410	BUILDING 07, FOURTH FLOOR, TELECOM ROOM 471A PLANS
007.MP411	BUILDING 07, FOURTH FLOOR, TELECOM ROOM 402 PLANS
008.MP401	BUILDING 8, FIRST FLOOR, TELECOM ROOM 105C PLANS
009.M-101	BUILDING 9, FIRST FLOOR, OVERALL MECHANICAL PLAN
009.MP401	BUILDING 9, FIRST FLOOR, TELECOM ROOM 135 PLANS
009.MP402	BUILDING 9, SECOND FLOOR, TELECOM ROOM 218 PLANS
009.MP403	BUILDING 9, THIRD FLOOR, TELECOM ROOM 315 PLANS

013.MP401	BUILDING 13, FIRST FLOOR, TELECOM ROOM 6 PLANS
014.M-101	BUILDING 14, FIRST FLOOR, OVERALL MECHANICAL PLAN
014.MP401	BUILDING 14, FIRST FLOOR, TELECOM ROOM 1A107 PLANS
015.MP401	BUILDING 15, FIRST FLOOR, TELECOM ROOM 7F PLANS
016.MP401	BUILDING 16, FIRST FLOOR, TELECOM ROOM 110B PLANS
045.M-101	BUILDING 45, FIRST FLOOR, OVERALL MECHANICAL PLAN
045.MP401	BUILDING 45, FIRST FLOOR, TELECOM ROOM 170 PLANS
045.MP402	BUILDING 45, FIRST FLOOR, TELECOM ROOM 173 PLANS
045.MP403	BUILDING 45, SECOND FLOOR, TELECOM ROOM 268 PLANS
045.MP404	BUILDING 45, SECOND FLOOR, TELECOM ROOM 272 PLANS
046.M-101	BUILDING 46, FIRST FLOOR, OVERALL MECHANICAL PLAN
046.MP401	BUILDING 46, THIRD FLOOR, TELECOM ROOM 302 PLANS
049.M-101	BUILDING 49, FIRST FLOOR, OVERALL MECHANICAL PLAN
049.MP401	BUILDING 49, FIRST FLOOR, TELECOM ROOM 166 PLANS
136.MP401	BUILDING 136, FIRST FLOOR, TELECOM ROOM 32 PLANS
142.MP401	BUILDING 142, FIRST FLOOR, TELECOM ROOM 7B PLANS
147.MP401	BUILDING 147, FIRST FLOOR, TELECOM ROOM 1 PLANS
171.MP401	BUILDING 171,FIRST FLOOR, TELECOM ROOM 108 PLANS
MP501	MECHANICAL AND PLUMBING DETAILS
MP502	MECHANICAL AND PLUMBING DETAILS
MP503	MECHANICAL AND PLUMBING DETAILS
MP601	MECHANICAL SCHEDULES

VOLUME 4 OF 4

GENERAL

G-001.4	COVER VOLUME 4

ELECTRICAL

000.ET001	ELECTRICAL GENERAL NOTES, SYMBOL LEGENDS, AND ABBREVIATIONS
000.ET002	TECHNOLOGY GENERAL NOTES, SYMBOL LEGEND, AND ABBREVIATIONS
000.ET501	TYPICAL TELECOM ROOM DETAILS
000.ET502	ELECTRICAL DETAILS
000.ET503	ELECTRICAL DETAILS
000.ET504	TECHNOLOGY DETAILS
000.ET505	CHANNEL RACK DETAILS
000.ET506	SITE TECHNOLOGY DETAILS
000.ES101	OUTDOOR BUILDING FIBER LOOP DIAGRAM
001.ET401	BUILDING 1, FIRST FLOOR, TELECOM ROOM 103 PLANS

001.ET402	BUILDING 1, SECOND FLOOR, TELECOM ROOM 202 PLANS
001.ET601	BUILDING 1, FIBER RISER DIAGRAM
001.ET602	BUILDING 1, SINGLE LINE AND BONDING RISER DIAGRAMS
002.ET401	BUILDING 2, FIRST FLOOR, TELECOM ROOM 133 PLANS
002.ET402	BUILDING 2, SECOND FLOOR, TELECOM ROOM 256 PLANS
002.ET403	BUILDING 2, THIRD FLOOR, TELECOM ROOM 359 PLANS
002.ET404	BUILDING 2, FOURTH FLOOR, TELECOM ROOM 424 PLANS
002.ET601	BUILDING 2, FIBER RISER DIAGRAM
002.ET602	BUILDING 2, SINGLE LINE AND BONDING RISER DIAGRAMS
003.ET401	BUILDING 3, FIRST FLOOR, TELECOM ROOM 105 PLANS
003.ET402	BUILDING 3, SECOND FLOOR, TELECOM ROOM 205 PLANS
003.ET403	BUILDING 3, THIRD FLOOR, TELECOM ROOM 305 PLANS
003.ET601	BUILDING 3, FIBER RISER DIAGRAM
003.ET602	BUILDING 3, SINGLE LINE AND BONDING RISER DIAGRAM
004.ET401	BUILDING 4, FIRST FLOOR, TELECOM ROOM 102E PLANS
004.ET601	BUILDING 4, FIBER RISER DIAGRAM
004.ET602	BUILDING 4, SINGLE LINE AND BONDING RISER DIAGRAMS
005.ET401	BUILDING 5, BASEMENT FLOOR, TELECOM ROOM G06A PLANS
005.ET402	BUILDING 5, FIRST FLOOR, TELECOM ROOM 110A PLANS
005.ET403	BUILDING 5, SECOND FLOOR, TELECOM ROOM 212C PLANS
005.ET601	BUILDING 5, FIBER RISER DIAGRAM
005.ET602	BUILDING 5, SINGLE LINE AND BONDING RISER DIAGRAMS
006.ET401	BUILDING 6, BASEMENT FLOOR, TELECOM ROOM 008 PLANS
006.ET402	BUILDING 6, FIRST FLOOR, TELECOM ROOM 101 PLANS
006.ET403	BUILDING 6, SECOND FLOOR, TELECOM ROOM 201 PLANS
006.ET404	BUILDING 6, THIRD FLOOR, TELECOM ROOM 310 PLANS
006.ET601	BUILDING 6, FIBER RISER DIAGRAM
006.ET602	BUILDING 6, SINGLE LINE AND BONDING RISER DIAGRAMS
007.ET400A	BASEMENT LEVEL, MAIN COMPUTER ROOM 42, POWER AND TECHNOLOGY PLAN
007.ET400B	BASEMENT LEVEL, MAIN COMPUTER ROOM 42, POWER AND DEMO PLAN
007.ET401	BUILDING 7, BASEMENT FLOOR, TELECOM ROOM 17 PLAN
007.ET402	BUILDING 7, FIRST FLOOR, TELECOM ROOM 1A-184A PLANS
007.ET403	BUILDING 7, FIRST FLOOR, TELECOM ROOM 1A-117 PLANS
007.ET404	BUILDING 7, FIRST FLOOR, TELECOM ROOM D-33 PLANS
007.ET405	BUILDING 7, SECOND FLOOR, TELECOM ROOM 267A PLANS
007.ET406	BUILDING 7, SECOND FLOOR, TELECOM ROOM 2M4 PLANS

007.ET407	BUILDING 7, THIRD FLOOR, TELECOM ROOM 373D PLANS
007.ET408	BUILDING 7, THIRD FLOOR, TELECOM ROOM 3M4 PLANS
007.ET409	BUILDING 7, FOURTH FLOOR, TELECOM ROOM 471A PLANS
007.ET410	BUILDING 7, FOURTH FLOOR, TELECOM ROOM 402 PLANS
007.ET601	BUILDING 7, TECHNOLOGY RISER DIAGRAM
007.ET602	BUILDING 7, SINGLE LINE DIAGRAMS
007.ET603	BUILDING 7, SINGLE LINE DIAGRAMS
007.ET604	BUILDING 7 BONDING RISER DIAGRAM
008.ET401	BUILDING 8, FIRST FLOOR, TELECOM ROOM 105C PLANS
008.ET601	BUILDING 8, SINGLE LINE, FIBER RISER, AND BONDING RISER DIAGRAMS
009.ET401	BUILDING 9, FIRST FLOOR, TELECOM ROOM 135 PLANS
009.ET402	BUILDING 9, SECOND FLOOR, TELECOM ROOM 218 PLANS
009.ET403	BUILDING 9, THIRD FLOOR, TELECOM ROOM 315 PLANS
009.ET601	BUILDING 9, FIBER RISER DIAGRAM
009.ET602	BUILDING 9, SINGLE LINE AND BONDING RISER DIAGRAMS
013.ET401	BUILDING 13, TELECOM ENCLOSURE 6 PLANS
013.ET601	BUILDING 13, SINGLE LINE, FIBER RISER, AND BONDING RISER DIAGRAMS
014.ET401	BUILDING 14, FIRST FLOOR, TELECOM ROOM 1A107 PLANS
014.ET601	BUILDING 14, SINGLE LINE, FIBER RISER, AND BONDING RISER DIAGRAMS
015.ET401	BUILDING 15, FIRST FLOOR, TELECOM ROOM 7F PLANS
015.ET601	BUILDING 15, SINGLE LINE, FIBER RISER, AND BONDING RISER DIAGRAMS
016.ET401	BUILDING 16, FIRST FLOOR, TELECOM ENCLOSURE 110B PLANS
016.ET601	BUILDING 16, SINGLE LINE, FIBER RISER, AND BONDING RISER DIAGRAMS
045.ET401	BUILDING 45, FIRST FLOOR, TELECOM ROOM 170
045.ET402	BUILDING 45, FIRST FLOOR, TELECOM ROOM 173
045.ET403	BUILDING 45, SECOND FLOOR, TELECOM ROOM 268
045.ET404	BUILDING 45, SECOND FLOOR, TELECOM ROOM 272
045.ET601	BUILDING 45, SINGLE LINE, FIBER RISER, AND BONDING RISER DIAGRAMS
046.ET401	BUILDING 46, THIRD FLOOR, TELECOM ENCLOSURE 302 PLANS
046.ET601	BUILDING 46, SINGLE LINE, FIBER RISER, AND BONDING RISER DIAGRAMS

049.ET401	BUILDING 49, TELECOM ROOM 166 PLANS
049.ET601	BUILDING 49, FIBER AND BONDING RISER DIAGRAMS
049.ET602	BUILDING 49, SINGLE LINE DIAGRAM
136.ET401	BUILDING 136, FIRST FLOOR, TELECOM ROOM 32 PLANS
136.ET601	BUILDING 136, SINGLE LINE, FIBER RISER, AND BONDING RISER DIAGRAMS
142.ET401	BUILDING 142, FIRST FLOOR, TELECOM ENCLOSURE ROOM 13 PLANS
142.ET601	BUILDING 142, FIBER RISER DIAGRAM
142.ET602	BUILDING 142, SINGLE LINE AND BONDING RISER DIAGRAMS
147.ET401	BUILDING 147, FIRST FLOOR, TELECOM ENCLOSURE 102 PLANS
147.ET601	BUILDING 147, SINGLE LINE, FIBER RISER, AND BONDING RISER DIAGRAMS
171.ET401	BUILDING 171, FIRST FLOOR, TELECOM ENCLOSURE 108 PLANS
171.ET601	BUILDING 171, SINGLE LINE, FIBER RISER, AND BONDING RISER DIAGRAMS

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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 EHRM Infrastructure Upgrades as required by drawings and specifications.

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

C. Offices of Apogee Consulting 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. Before placement and installation of work subject to tests by testing laboratory retained by Department of Veterans Affairs, the Contractor shall notify the COR in sufficient time to enable testing laboratory personnel to be present at the site in time for proper taking and testing of specimens and field inspection. Such prior notice shall be not less than three workdays unless otherwise designated by the COR.

E. 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.

1.3 STATEMENT OF BID ITEM(S)

A. ITEM I, BASE BID – GENERAL CONSTRUCTION: Work includes selective demolition, general construction, and alterations (including necessary removal of existing structures and construction and certain other items). Work includes all labor, material, equipment and supervision to perform the required demolition and construction work on this project including Architectural Modifications, Fire Protection Systems, Plumbing Systems, Mechanical Systems, Electrical Systems, and Telecommunication Systems as described in the Specifications and

indicated on the Construction Documents.

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.

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.
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. 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 toolboxes 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.

D. 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.

E. 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 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 determined by the COR.

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

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.

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:
2. To ensure such executions, Contractor shall furnish the COR with a

schedule of approximate phasing dates on which the Contractor intends to accomplish work in each specific area of site, building or portion thereof. In addition, Contractor shall notify the COR two weeks in advance of the proposed date of starting work in each specific area of site, building or portion thereof. Arrange such phasing dates to ensure accomplishment of this work in successive phases mutually agreeable to COR and Contractor.

3. 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.

J. Construction Fence: Before construction operations begin, Contractor shall provide a chain link construction fence, 2.1m (seven feet) minimum height, around the construction staging area. 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.

K. When a building area 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.

L. 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.

M. 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.

N. 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.

O. 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.

P. Coordination of Construction with Cemetery Director: The burial activities at a National Cemetery shall take precedence over construction activities. The Contractor must cooperate and coordinate with the Cemetery Director, through the COR, in arranging construction schedule to cause the least possible interference with cemetery activities in actual burial areas. Construction noise during the interment services shall not disturb the service. Trucks and workers shall not pass through the service area during this period:

1. The Contractor is required to discontinue his work sufficiently in advance of Easter Sunday, Mother's Day, Father's Day, Memorial Day, Veteran's Day and/or Federal holidays, to permit him to clean up all areas of operation adjacent to existing burial plots before these

dates.

2. Cleaning up shall include the removal of all equipment, tools, materials and debris and leaving the areas in a clean, neat condition.

1.7 TELECOM ROOM PHASING NOTES

A. Work related the remodeling of existing rooms into new telecommunication rooms shall be performed sequentially by floor starting at the lowest floor level. All work, excluding work in the telecommunication rooms, will be completed on the floor and approved by the COR before proceeding to the next floor.

B. Contractor will be allowed to modify or construct four telecommunication rooms at a time. All four rooms must be completed and approved by COR prior to proceeding to work on additional rooms.

C. Work hours and special considerations within the work constraint by area matrix.

D. Any data ports moved from old infrastructure to new shall be operable at the end of each workday. The priority is to not lose data service for more than one shift.

E. Coordinate with COR for all outages that will affect more than 6 rooms at a time. Outage must be approved in writing a minimum of 3 weeks prior.

F. Data cabling replacement for areas served by a newly constructed telecommunications room should be installed in the following manner:

1. Construct closet, install racks and equipment.
2. Run cabling to each room served by the closet down the corridors and coil the cable in each destination room.
3. Terminate all cables at the patch panels within the new closet.
4. Pull out old cables at each room and terminate at new ports specified. A maximum of 6 rooms can be taken out of service at a time.
5. Blank any faceplates no longer used up, and install faceplate covers.
6. Coordinate with the COR to be present during test and certify all cables per specification prior to moving to next rooms.
7. Plug all existing equipment into new ports.

G. Data cabling replacement for areas served by a moved telecommunications room should be installed in the following manner:

1. Inform any space expansion of closet required by documents.
2. Build one new rack at a time if space is constrained. Run cabling to each room served by the closet down the corridors and coil the cable outside each room.
3. Terminate all cables at the patch panels within the new rack.
4. Pull out old cables at each room and terminate at new ports specified. A maximum of 6 rooms can be taken out of service at a time.
5. Blank any faceplates no longer used up, and install faceplate covers.
6. Coordinate with the COR to be present during test and certify all cables per specification prior to moving next rooms. Plug all existing equipment into new ports.
7. Repeat for each rack until all racks in closet are complete.

H. Remove all existing cabling that has been disconnected as part of this project. Remove cabling by floor after completion of new data cabling on that floor.

I. Contractor to provide a draft phasing plan denoting the order in which the telecom improvements will be completed within 30 days of project award. The phasing plan shall address the following requirements:
   1. Simultaneous operation of old and new telecommunication rooms (TRs): during the cutover period, existing connections to old TRs must remain active until full cutover to the new tr is complete. The phasing plan shall explicitly describe how old and new TRs will be kept operational simultaneously throughout the transition.
   2. A-side / B-side distribution cutover sequence: the recommended approach for transitioning from old TRs to new TRs is as follows:
      a. Bring up the new B-side distribution to all new TRs while leaving the old TRs active on the existing distribution.
      b. Once all new TRs are fully operational on the a-side distribution, proceed to move the a-side distribution to the new TRs.
      c. At no point shall both the B-side and B-side distributions be in transition simultaneously. This ensures continuous network connectivity throughout the cutover process.
   3. National OIT swing switch limitation: national OIT limits the number of swing switches to 10 per site at any given time. Since no new

switches are provided under this contract and existing equipment is being relocated, the phasing plan shall account for this constraint. The number of TRs being cut over simultaneously shall not exceed the available swing switch allotment.

4. National OIT advance notification: national OIT requires a minimum of 4 weeks advance notice prior to any proposed tr cutover activity so that switches can be reconfigured. The contractor shall incorporate this lead time into the phasing plan and submit cutover notifications to national OIT in accordance with this requirement. The COR shall be copied on all such notifications.

J. Contractor should keep a rolling 3 week look ahead denoting schedule for cabling work in each area.

K. Contractor to schedule walk through of each department at least 90 days prior to starting work to discuss sequencing and discuss requirements of each department.

L. Contractor will be responsible to setup all project meetings using the Microsoft teams or an equivalent application.

1.8 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 areas of buildings in which alterations occur and areas which are anticipated routes of access, and furnish a report, signed by both, 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 buildings.
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

, 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.

1.9 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 Transformers and Capacitors: The Contractor shall be responsible for disposal of the Polychlorinated Biphenyl (PCB) transformers and 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

1.10 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.

1.11 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).

1.12 PHYSICAL DATA - SOIL CONDITIONS - NOT USED

1.13 PROFESSIONAL SURVEYING SERVICES

A. A registered professional land surveyor or registered civil engineer whose services are retained and paid for by the Contractor shall perform services specified herein and in other specification sections. The Contractor shall certify that the land surveyor or civil engineer is not one who is a regular employee of the Contractor, and that the land surveyor or civil engineer has no financial interest in this contract.

1.14 LAYOUT OF WORK

A. The Contractor shall lay out the work from Government established base lines and benchmarks, 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 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. During progress of work, and particularly as work progresses from floor to floor, Contractor shall have line grades and plumbness of all major form work checked and certified by a registered land surveyor or registered civil engineer as meeting requirements of contract drawings. Furnish such certification to the COR before any major items of concrete work are placed. In addition, Contractor shall furnish to the COR certificates from a registered land surveyor or registered civil engineer that the following work is complete in every respect as required by contract drawings.
   1. Lines of each building and/or addition.
   2. Elevations of bottoms of footings and tops of floors of each building and/or addition.
   3. Lines and elevations of sewers and of all outside distribution systems.
   4. Lines of elevations of all swales and interment areas.
   5. Lines and elevations of roads, streets and parking lots.

E. 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.

F. Upon completion of the work, the Contractor shall furnish the COR one electronic copy and reproducible drawings at the scale of the contract drawings, showing the finished grade on the grid developed for constructing the work, including burial monuments and fifty foot stationing along new road centerlines. These drawings shall bear the seal of the registered land surveyor or registered civil engineer.

G. 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".

1.15 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.

1.16 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 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:

E. 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.

1. 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.
2. 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.
3. Third Priority Code 3. All other work to be initiated within 3 workdays and work continuously to completion or relief.
4. The "Construction Warranty Service Priority List" is as follows:
   a) <u>Code 1-Life Safety Systems</u>
      1) Fire suppression systems.
      2) Fire alarm system(s).
   b) <u>Code 1-Air Conditioning Systems</u>
      1) Air conditioning leak in part of the building, if causing damage.
      2) Air conditioning system not cooling properly.
   c) <u>Code 1 Doors</u>
      1) Overhead doors not operational, causing a security, fire or safety problem.
      1) Interior, exterior personnel doors or hardware, not functioning properly, causing security, fire or safety

problem.

d) Code 3-Doors
   1) Overhead doors not operational.
   2) Interior/exterior personnel doors or hardware not functioning properly.

e) Code 1-Electrical
   1) Power failure (entire area or any building operational after 1600 hours).
   2) Security lights.
   3) Smoke detectors.

f) Code 2-Electrical
   1) Power failure (no power to a room or part of building). Receptacle and lights not operational (in a room or part of building).

g) Code 3-Electrical
   1) Exterior lights not operational.

h) Code 1-Gas
   1) Leaks and pipeline breaks.

i) Code 1-Heat
   1) Power failure affecting heat.

j) Code 1-Plumbing
   1) Hot water heater failure.
   2) Leaking water supply pipes

k) Code 2-Plumbing
   1) Flush valves not operating properly.
   2) Fixture drain, supply line or any water pipe leaking.
   3) Toilet leaking at base.

l) Code 3- Plumbing
   1) Leaky faucets.

m) Code 3-Interior
   1) Floors damaged.
   2) Paint chipping or peeling.
   3) Casework damaged.

n) Code 1-Roof Leaks
   1) Damage to property is occurring.

o) Code 2-Water (Exterior)
   1) No water to facility.

p) Code 2-Water (Hot)

1) No hot water in portion of building listed.

q) Code 3

1) All work not listed above.

F. 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	

1.17 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.

1.18 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, (2014 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.

1.19 TEMPORARY USE OF EXISTING ELEVATORS

A. Contractor will not be allowed the use of existing elevators. Outside type hoist shall be used by Contractor for transporting materials and equipment.

B. 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. 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 contractor’s 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 contractor’s 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 contractor’s 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.

1.20 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. *Contractor may have for use of Contractor's workers; such toilet accommodations as may be assigned to Contractor by Medical Center. Contractor shall keep such places clean and be responsible for any damage done thereto by Contractor's workers. Failure to maintain satisfactory condition in toilets will deprive Contractor of the privilege to use such toilets.

1.21 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.

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 and any electrical heating devices providing temporary heat. Electricity for all other uses is available at no cost to the Contractor.

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.

G. Fuel: Natural and LP gas and burner fuel oil required for boiler cleaning, normal initial boiler-burner setup and adjusting, and for performing the specified boiler tests will be furnished by the Government. Fuel required for prolonged boiler-burner setup, adjustments, or modifications due to improper design or operation of boiler, burner, or control devices shall be furnished and paid by the Contractor at Contractor's expense.

1.22 TESTS

A. 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.

B. 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.

C. 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.

D. 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.

E. 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.

F. 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.

1.23 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.

1.24 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.

   1. Storage space for equipment will be provided by the Government and the Contractor shall be prepared to unload and store such equipment therein upon its receipt at the Medical Center.

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.

1.25 RELOCATED ITEMS

A. Contractor shall disconnect, dismantle as necessary, remove and reinstall in new location, all existing equipment and items indicated by symbol "R" 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.

1.26 CONSTRUCTION SIGN

A. Provide a Construction Sign where directed by the COR. All wood members shall be of framing lumber. Cover sign frame with 0.7 mm (24 gage) galvanized sheet steel nailed securely around edges and on all bearings. Provide three 100 by 100 mm (4 inch by 4 inch) posts (or equivalent round posts) set 1200 mm (four feet) into ground. Set bottom of sign level at 900 mm (three feet) above ground and secure to posts with through bolts. Make posts full height of sign. Brace posts with 50 x 100 mm (two by four inch) material as directed.

B. Paint all surfaces of sign and posts two coats of white gloss paint. Border and letters shall be of black gloss paint, except project title which shall be blue gloss paint.

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

1.27 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 made a part of this specification.

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

Number of Photos	
Estimated Cost	No. of Photos
Up to $250,000	50 to 100
Up to $500,000	100 to 150
Up to $1,000,000	150 to 200
Up to $2,000,000	200 to 250
Up to $5,000,000	250 to 300
Up to $10,000,000	300 to 400
More than $10,000,000	400 to 500

1.28 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 photopath.

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.

1.29 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.

- - - E N D - - -

SECTION 01 32 16.15
PROJECT SCHEDULES (SMALL PROJECTS – DESIGN/BID/BUILD)

PART 1 - GENERAL

1.1 DESCRIPTION

A. The Contractor will develop a fully Resource loaded (cost) Network Analysis System (NAS) plan/diagram and computer generated schedule demonstrating fulfillment of the entire contract requirements, will keep the plan and computer generated schedule up-to-date in accordance with the specification requirements of this section and will 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 Schedule Updates and Progress Payment Submission of the work under this contract.

1.2 PROJECT SCHEDULER

A. Designate a qualified 3rd-party scheduling consultant who will develop and maintain the project schedule.

B. The scheduling consultant must have five (5) years of experience as a lead project scheduler or previous scheduling experience on at least three (3) projects of similar size and scope.

C. The scheduling consultant must be prepared to discuss, in detail, the proposed sequence of work and methods of operation, and how that information will be communicated through the progress schedule at the preconstruction meeting.

D. The scheduling consultant is required to attend a monthly schedule meeting and make site visits to prepare, develop, and maintain the progress schedules.

1.3 SUBMITTALS

A. Initial Schedule:

1. Submit an initial schedule within 7 calendar days after Notice to Proceed (NTP).
   a. Include full schedule details for the first 60 calendar days of work starting on the NTP date and show the schedule ending on or before the Contract Completion Date (CCD).
   b. Provide a summary bar chart schedule (acceptable formats include, but are not limited to, Microsoft Excel, Microsoft Project, Oracle Primavera P6, and Gantt Chart).

c. Show the proposed sequence, durations, early and late start dates for major work activities.
d. Show the proposed calendar dates for starting and finishing initial contract activities including, but not limited to, set up of construction site, site layouts, travel routes, waste, and staffing areas.

2. Conduct a schedule review meeting with the Government within 14 calendar days after NTP. At this meeting, plan to discuss the proposed schedule for the entire project, including both the detailed first 60-day period covered by the initial schedule as well as the following summary schedule. If deviations to the staging, phasing, or sequencing required by the contract documents are proposed, be prepared to discuss these deviations.
3. The Government will respond by approving the initial schedule, rejecting the schedule and identifying the reason for rejection, or by asking the contractor for additional information clarifying the proposed schedule activities and timelines.
4. The Government will use the approved initial schedule to monitor progress until the baseline schedule is approved.
5. The Government may withhold progress payments until the initial schedule is approved.

B. Schedule of Costs.

1. No more than 30 calendar days after receipt of the Notice to Proceed, prepare and submit a schedule of costs to the Government for review, in accordance with the technical and schedule submittal requirements listed in this is specification.
2. The approved Schedule of Costs will serve as a tool in addition to the required monthly schedule update to determine progress payments to the Contractor for work completed.
3. The costs shown on the Schedule of Costs must represent true costs and the work activities/events match the project schedule work activities/events. The VA Contracting Officers Representative (VA COR) may require the Contractor to submit its original estimate sheets or other supporting documentation to substantiate the detailed makeup of the cost schedule.

4. The total costs of all work activities/events listed on the Schedule of Costs must equal the total contract price. The breakdown must include all line items specified in the contract and work activities shown on the schedule.
5. The Contractor is responsible for regularly updating the Schedule of Costs to reflect any approved changes to the contract scope or cost structure. Updates must be submitted for approval to the Contracting Officer to ensure continued accuracy and compliance with contract requirements.
6. Failure to submit or maintain an accurate and approved Schedule of Costs may result in delayed progress payments and potential penalties as outlined in the contract agreement.
7. All documentation related to the Schedule of Costs, including original estimate sheets and cost substantiation documents, must be maintained and made available for review upon request by the Contracting Officer or VA COR.

C. Baseline Schedule.

1. No more than 30 calendar days after approval of the initial schedule, prepare and submit a baseline schedule to the Government for review, in accordance with the technical and schedule submittal requirements listed in this specification.
2. The Government will respond by accepting the baseline schedule, rejecting the schedule and identifying the reason for rejection, or by asking for more information.
3. Address the reasons for rejection or provide the information requested and resubmit the revised baseline schedule no more than
   10 calendar days after the Government’s response.
4. The Government may withhold progress payments until the baseline schedule is approved.
5. No stored material work activities will be shown or approved be on the baseline schedule.
6. The Baseline Schedule Critical Path of the project shall be limited to:
   a. 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.

b. Multiple Critical paths will not be allowed.

7. The Baseline Schedule shall contain sufficient detail such that no more than 5% of work activities have durations exceeding 20 work days, in accordance with DCMA 14-point Schedule Assessment Guidelines.

D. Monthly Schedule Update.

1. Prepare and submit a monthly schedule update to the Government that depicts the status of the project as of the end of the month, in accordance with the technical and schedule submittal requirements listed in this specification.
2. The update must reflect a new data date, work performed up to, but not including, the new data date, and the plan for completing the project.
3. Submit the schedule update by the first Monday of the following month.
4. The Government may withhold progress payments until the monthly schedule update is approved.
5. Each monthly schedule update must be submitted with the associated schedule log.

E. Revised Schedule.

1. The Government has the right to request a revised schedule.
2. Circumstances leading to such a request include, but are not limited to:
   a. A projected or forecasted delay to scheduled interim or project completion dates.
   b. A significant difference between the actual sequence or duration of work and that depicted in the schedule.
3. Prepare and submit the revised schedule no more than 10 calendar days after the Government’s request in accordance with the technical and schedule submittal requirements listed in this specification.
4. The Government will respond by accepting the revised schedule, rejecting the schedule and identifying the reasons for rejection, or by requesting more information. Address the

reasons for rejection or submit the information requested no more than 10 calendar days after the Government's request.

5. The Government may withhold progress payments until the revised schedule is approved.

F. Final Schedule.

1. Within 30 calendar days of final acceptance of the project, submit a final schedule with actual start and finish dates for each activity.
2. Include with the submission a certification signed by a principal of the firm stating: "To the best of my knowledge, the enclosed final schedule reflects the actual start and finish dates of the activities contained herein."

G. The Government's approval of any schedule, whether initial, baseline, update, or revised, does not modify the contract or constitute endorsement or validation by the Government of the Contractor's logic, activity durations, or assumptions in creating the schedule. By approving the schedule, the Government does not guarantee that the project can be performed or completed as scheduled. If the Contractor or the Government discover errors after the schedule has been approved, correct the error(s) in the next schedule submission.

1.4 BASELINE COMPARISON REPORTING

A. The Contractor shall prepare and submit a graphical Baseline Comparison Report on a monthly basis. This report shall provide an analysis of variances between the approved baseline schedule and the current project schedule. The Baseline Comparison Report shall supplement the required monthly schedule updates and shall comply with the requirements of this section, without superseding or modifying the Contractor's obligations under other schedule-related provisions of this Specification Section.

B. The Baseline Comparison Report shall be submitted as part of the Contractor's monthly schedule update package and shall include the following:

1. A graphical Gantt chart illustrating:
   a. Original baseline schedule dates for all major work activities/milestones.

b. Current actual/forecasted dates for all major work activities/milestones.
c. Clear visual indication of variances between baseline and current dates.
d. Critical path activities highlighted.
e. Major project phases and key milestones.

2. A narrative analysis including:
   a. An analysis of concurrent delays, where applicable.
3. The Contractor shall maintain a delay cause log that:
   a. Chronicles the evolution of each delay
   b. References supporting documentation.
   c. Tracks the resolution status of each delay.
   d. Links delays to specific schedule activities and work packages.
   e. Identifies potential knock-on effects to subsequent activities.

C. The baseline comparison report shall be reviewed during monthly schedule update meetings. Refer to Section 1.9 (Payment and Progress Reporting) for meeting procedures and performance review requirements. Schedule of values based on the cost estimate should coincide with billing.

1.5 WORK ACTIVITY/EVENT COST DATA

A. The Contractor shall cost load all work activities/events except procurement activities. The cumulative amount of all cost-loaded work activities/events (including alternates) shall equal the total contract price. Distribute overhead, profit, and general conditions proportionally across all work activities/events along the project's length (critical path). 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 and 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. 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 Article, FAR 52.232 – 5 (PAYMENT UNDER FIXED PRICE CONSTRUCTION CONTRACTS) and VAAR 852.232 – Article 70 Without NAS-CPM or Article 71 Including NAS-CPM for (PAYMENTS UNDER FIXED PRICE CONSTRUCTION).

C. In accordance with FAR 52.236 – 1 (PERFORMANCE OF WORK BY THE CONTRACTOR), 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.

D. The Contractor shall cost load work activities/events for all Bid Items. The sum of each Bid Item work shall equal the value of the bid item in the Contractors' bid.

E. With prior written approval from the Contracting Officer, the Contractor may request payment for suitably stored and maintained materials/equipment that conform to specifications and are ready for installation, in accordance with the provisions in VAAR 852.232 –
Article 70 Without NAS-CPM or Article 71 Including NAS-CPM for (PAYMENTS UNDER FIXED PRICE CONSTRUCTION). Requests must include comprehensive documentation, such as invoices, proof of payment, and evidence of secure storage with appropriate insurance. Upon approval, payment for materials will be made in accordance with contract provisions, and title to the materials shall vest in the Owner. The contractor is responsible for replacement of non-confirming or damaged materials at no additional cost to the owner. Payment for stored materials will be reflected on the schedule by cost-loading the delivery activity to represent payment upon material receipt at the site, while the installation activity will be separately cost-loaded to represent payment under completion of installation. These schedule will clearly delineate submittal, procurement, delivery (cost-loaded for stored material payment), and installation (cost-loaded for installed material payment) as distinct activities.

1.6 PROJECT SCHEDULE REQUIREMENTS

A. Show on the project schedule the sequence of work activities/events required for complete performance of all items of work. The Contractor shall:

1. Show activities/events as:
   a. Contractor's time required for submittal of shop drawings, templates, fabrication, delivery and similar pre-construction work.
   b. Contracting Officer's and Architect Engineer's review and approval of shop drawings, equipment schedules, samples, template, or similar items.
   c. Interruption of VA Facilities utilities, delivery of Government furnished equipment, and rough-in drawings, project phasing and any other specification requirements.
   d. Test, balance and adjust various systems and pieces of equipment, maintenance and operation manuals, instructions and preventive maintenance tasks.
   e. 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.
2. 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.
3. Break up the work into activities/events of a duration no longer than 20 work days each or one reporting period, 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 VA COR may approve the showing of a longer duration. The duration for VA approval of any required submittal, shop drawing, or other submittals will follow review requirements as specified in Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
4. Describe work activities/events clearly, so the work is readily identifiable 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.

5. The schedule shall be generally numbered in such a way to reflect either discipline, phase or location of the work.

B. The Contractor shall submit the following supporting data in addition to the project schedule:
   1. The appropriate project calendar including working days and holidays.
   2. The planned number of shifts per day.
   3. The number of hours per shift.

C. Failure of the Contractor to include this data shall delay the review of the submittal until the Contracting Officer is in receipt of the missing data.

D. To the extent that the Project Schedule or any revised Project Schedule shows anything not jointly agreed upon, it shall not be deemed to have been approved by the VA COR. 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 VA COR's approval of the Project Schedule.

E. Separate Cost-Loaded Activities for Adjusting and Testing Systems:
   1. The CPM shall include separate cost-loaded activities for the adjustment and testing of systems in accordance with the provisions in VAAR 852.232 – Article 70 Without NAS-CPM or Article 71 Including NAS-CPM for (PAYMENTS UNDER FIXED PRICE CONSTRUCTION). The percentages provided shall be used to determine the cost of adjust and test work activities/ events, identifying the value of the work for payment purposes.

1.7 TECHNICAL REQUIREMENTS

A. Software Compatibility Requirements.
   1. The Government uses Oracle Primavera P6 Professional and Microsoft Project Professional to schedule and monitor its construction projects.
   2. Prepare and maintain the schedule using one of the following software options:
      a. Oracle Primavera P6 Professional (Version 22 or higher unless pre-approved)
      b. Microsoft Project Professional (Version 2021 or Higher)

B. Schedule Requirements.

1. Calculate the schedule using the Retained Logic scheduling option unless written authorization is obtained from the Government to use the Progress Override scheduling option.
2. At least 90% of all schedule activities shall be assigned to Finish-to-Start (FS) relationships.
3. Do not use the following types of logic relationships:
   a. Negative lags
   b. Lead and lag time activities
   c. Start-to-finish or finish-to-finish relationships
      Open ends. Only the first activity will have no predecessor, and only the last activity will have no successor.
   d. Constraints (a limited number of constraints may be used only with the Government’s written authorization).
   e. Manually modified dates (manually modify dates may be used only with the Government’s written authorization).
4. For any logic relationships that do not meet the criteria above in 1.6.B.2, the contractor must provide justification for the noncompliance to obtain the Government’s authorization to proceed. If the Government does not provide written authorization, the contractor must resubmit the schedule submission.
5. Include the following work activities, as applicable:
   a. Work to be performed by the contractor, subcontractors, and suppliers.
   b. Work to be performed by the Government, other contractors, and third parties such as permitting authorities or other entities required for completion of the project.
   c. The project start date, scheduled completion date, and other contractually mandated milestones, start and finish dates for phases, and site access or availability dates.
   d. Submittals and Government review and approval of submittals (Reference specification section 01 33 23 for submission requirements).
   e. Fabrication, delivery, installation, testing, and similar activities for materials, equipment, and related items.
   f. Sampling and testing periods.

g. Settlement or surcharge periods.
h. Cure periods.
i. Utility notifications, shutdowns, relocations, and similar activities.
j. Installation, erection and removal, and similar activities related to temporary systems or structures such as temporary electrical systems or shoring.
k. Punch list, substantial completion, final cleanup, and similar activities.
l. Required acceptance testing, inspections, or similar activities.
m. Durations for receipt of permits or acquisition of rights of way.

6. Define the following attributes for each activity in the schedule:
   a. A unique alphanumeric Activity ID.
   b. A unique descriptive name, using such clear, concise attributes as work type, location so each activity is easily understood. Avoid name abbreviations or overly long activity names to ensure each activity can be objectively measured and clearly understood by all stakeholders.
   c. A duration stated in workdays of no more than 20 workdays unless a longer duration is requested by the contractor and approved by the Government.
   d. Uses codes for responsibility, phasing, and staging.

1.8 SCHEDULE SUBMISSION REQUIREMENTS

A. Preparing Schedule on Owner’s Database. If the schedule is prepared using My Primavera in the owner’s database, then for each schedule submission, submit the following items:
   1. A transmittal letter to the owner identifying which schedule in the database is being submitted for review.
   2. A narrative report.

B. Preparing Schedule on Separate Database. If the schedule is prepared using Primavera Version 6.0, Primavera for Contractors, or another software compatible with Primavera Version 6.0, then, for each schedule submission, submit the following items:
   1. A transmittal letter
   2. A narrative report

3. A Primavera Version 6.0 compatible electronic file of the schedule.
4. The critical path in bar chart format (Longest Path sort)
5. Work paths with total float values within 20 workdays of the critical path's total float value in bar chart format. For example, if the critical path has a total float value of zero, then show all the work paths with total float values of 20 or less.
6. An activity network diagram plotted in color, on E-size paper, with each sheet of the plot including a title, match data for diagram correlation, a page number, and a legend. The activity network diagram should only be submitted with schedules with revised relationships or activity durations.
7. An updated schedule log associated with each Monthly Schedule Update.
8. A project S-Curve in both graphical and tabular format, displaying both schedule and cost data.
9. A Predecessor/Successor report with the following items for each activity:
10. Activity ID and description
11. Original duration
12. Remaining duration
13. Calendar ID
14. Predecessors and Successors
15. Early start date
16. Early finish date
17. Late start date
18. Late finish date
19. Total float
20. Relationship type
21. Lags
22. Constraints

C. Preparing Schedule on using Microsoft Project Professional, submit the following items:
1. A transmittal letter
2. A narrative report

3. A Microsoft Project Professional .mpp electronic file of the schedule.
   a. The critical path in bar chart format (Longest Path sort)
   b. Work paths with total float values within 20 workdays of the critical path's total float value in bar chart format. For example, if the critical path has a total float value of zero, then show all the work paths with total float values of 20 or less.
   c. An activity network diagram plotted in color, on E-size paper, with each sheet of the plot including a title, match data for diagram correlation, a page number, and a legend. The activity network diagram should only be submitted with schedules with revised relationships or activity durations.
   d. A project S-Curve in both graphical and tabular format, displaying both schedule and cost data.
   e. A Predecessor/Successor report with the following items for each activity:
      1) WBS and Task Name
      2) Baseline duration
      3) Remaining duration
      4) Predecessors and Successors
      5) 5)Early start date
      6) Early finish date
      7) Late start date
      8) Late finish date
      9) Total slack
      10) Constraints
   f. A Lag report displaying all lags within the project schedule.

D. Narrative Reports for the Initial and Baseline Schedule. For each submission of the initial and baseline schedule provide a narrative report that includes the following information:
   1. Explanation of the overall plan to complete the project, including where the work will begin and how the work and crews will flow through the project
   2. Use and application of the workdays per week, number of shifts per day, number of hours per shift, holidays observed, and how

the schedule accommodates adverse weather days for each month of activity

3. If the project is a multi-year project, then identify the work to be completed in each construction season
4. A statement explaining why the scheduled completion date is forecast to occur before or after the contract completion date.
5. An explanation stating why any of the contract milestone dates are forecast to occur late.
6. A description of problems or issues anticipated
7. A description of anticipated delays, including:
   a. Identification of the delayed activity by activity ID and description
   b. Type of delay
   c. Cause of the delay
   d. Effect of the delay on other activities, milestones, and completion dates
   e. Identification of the actions needed to avoid or mitigate the delay
   f. A description of the critical path
   g. A description of work paths with total float values within 20 workdays of the critical path's total float value. For example, if the critical path has a total float value of zero, then describe all the work paths with total float values of 20 or less.
   h. A statement identifying constraints and an explanation of the reason for and purpose of each constraint.
   i. A statement describing the status of required permits.
   j. The statement describing the reason for the use of each lag.

E. Narrative Reports for the Monthly Schedule Update and Revised Schedule. For each submission of the monthly schedule update and revised schedule provide a narrative report that includes the following information:

1. A description of the status of the scheduled completion date (and any contract milestone date(s)) since the last schedule submitted

2. A statement explaining why the scheduled completion date is forecast to occur before or after the contract completion date. An explanation stating why any of the contract milestone dates are forecasted to occur late
3. A description of the work performed since the last schedule update
4. A description of unusual labor, shift, equipment, or material conditions or restrictions encountered or anticipated
5. A description of the problems encountered or anticipated since the last schedule submission
6. A statement that identifies and describes any current and anticipated delays. A discussion of delays in the narrative report does not constitute notice and does not replace the need for the contractor to provide notice as required by the contract. Include the following:
   a. Identification of the delayed activity by activity ID and description
   b. Type of delay
   c. Cause of the delay
   d. Effect of the delay on other activities, milestones, and completion dates
   e. Identification of the actions needed to avoid or mitigate the delay
   f. A description of the critical path
   g. A description of changes in the critical path and schedule completion date (for the project or its milestones) from the last schedule submission
   h. Descriptions of the status of work paths that have total float values within 20 workdays of the critical path identified in the previous schedule submission
   i. Descriptions of work paths with total float values within 20 workdays of the critical path’s total float value. For example, if the critical path has a total float value of negative 25, then show all the near-critical paths with total float values of negative 5 or less.
   j. A statement or Schedule Comparison Report that identifies the changes made between the previous schedule submission

and the current proposed schedule, including, but not limited to:

1) Data date
2) Completion date
3) Activity code assignments
4) Scheduling options
5) Activity descriptions
6) Added activities
7) Deleted activities
8) Added activity relationships
9) Deleted activity relationships
10) Activity original durations
11) Activity remaining durations
12) Activity actual start and finishes
13) Percent complete
14) Constraints
15) Activity resources
16) Activity costs
17) Activity coding

k. A statement providing the status of pending items, including, but not limited to:

1) Permits
2) Change orders
3) Time extension requests
4) Noncompliance or similar notices are indicating deficiencies in the contractor’s performance.

7. 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, will arrange a separate meeting with the Contracting Officer and/or the VA COR to discuss the requirements of this specification in detail. The Contractor and the Contractor’s scheduling consultant, will acknowledge, in writing, their understanding and compliance with the requirement 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 will not relieve the contractor from compliance with requirements of this specification section and the remaining contract documents.

1.9 QUALITY ASSURANCE

A. Quality assurance of the schedule must conform to the following standards
   1. DCMA 14-point Schedule Assessment Guidelines
B. GAO's Schedule assessment guide - Best Practices for Project Schedules Appendix II.

1.10 PAYMENT TO THE CONTRACTOR

A. Monthly, the contractor shall submit an application and certificate for payment using VA Form 10-6001a or 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, PAYMENT AND PROGRESS REPORTING, as the basis upon which progress payments will be made pursuant to Article, FAR
   52.232 – 5 (PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS) and VAAR 852.232 – Article 70 Without NAS-CPM or Article 71 Including NAS-CPM for (PAYMENTS UNDER FIXED PRICE CONSTRUCTION). The Contractor shall be entitled to a monthly progress payment upon approval of estimates as determined from the currently approved updated project schedule. Monthly payment requests shall include: a listing of all agreed upon project schedule changes and associated data; and electronic files of the resulting monthly updated schedule, provided in both PDF and native scheduling software formats.

B. Approval of the Contractor's monthly Application for Payment shall be contingent, among other factors, on the submittal of a satisfactory monthly update of the project schedule.

C. CPayment for adjust and test activities will be made only after the Contractor has demonstrated that each of the systems is substantially complete and operates as required by the contract. The Contractor must adequately document

1.11 PAYMENT AND PROGRESS REPORTING

A. Monthly schedule update meetings will be held on dates mutually agreed to by the VA COR and the Contractor. Contractor and their scheduling consultant shall attend all monthly schedule update meetings. The Contractor shall accurately update the Project Schedule and all other data required and provide this information to the VA COR three work days in advance of the schedule update meeting. Job progress will be reviewed to verify:

1. Actual start and/or finish dates for updated/completed activities/events.
2. Remaining duration for each activity/event started, or scheduled to start, but not completed.
3. Logic, time and cost data for change orders, and supplemental agreements that are to be incorporated into the Project Schedule.
4. Changes in activity/event sequence and/or duration which have been made, pursuant to the provisions of following Article, ADJUSTMENT OF CONTRACT COMPLETION.
5. Completion percentage for all completed and partially completed activities/events.
6. Logic and duration revisions required by this section of the specifications.
7. Activity/event duration and percent complete shall be updated independently.

B. After completion of the joint review, the contractor shall generate an updated computer-produced calendar-dated schedule and supply the VA COR with reports in accordance with the Article, PROJECT SCHEDULE REQUIREMENTS, specified.

C. After completing the monthly schedule update, the contractor's representative or scheduling consultant shall rerun all current

period contract change(s) against the prior approved monthly project schedule. The analysis shall only include original workday durations and schedule logic agreed upon by the contractor and COR for the contract change(s). When there is a disagreement on logic and/or durations, the Contractor shall use the schedule logic and/or durations provided and approved by the COR. After each rerun update, the resulting electronic project schedule data file shall be appropriately identified and submitted to the VA in accordance to the requirements listed in articles 1.3 and 1.7. This electronic submission is separate from the regular monthly project schedule update requirements and shall be submitted to the COR within fourteen
(14) calendar days of completing the regular schedule update. Before inserting the contract changes durations, care must be taken to ensure that only the original durations will be used for the analysis, not the reported durations after 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.

D. Following approval of the Baseline Schedule, the VA, the General Contractor, its approved CPM Consultant, VA COR, and all subcontractors needed, as determined by the SRE, shall meet to discuss the monthly updated schedule. The main emphasis shall be to address work activities to avoid slippage of project schedule and to identify any necessary actions required to maintain project schedule during the reporting period. The Government 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. This schedule coordination meeting will occur after each monthly project schedule update meeting utilizing the resulting schedule reports from that schedule update. If the project is behind schedule, discussions should include ways to prevent further slippage as well as ways to improve the project schedule status, when appropriate.

1.12 RESPONSIBILITY FOR COMPLETION

A. If it becomes apparent from the current revised monthly progress schedule that phasing or contract completion dates will not be met, the Contractor shall execute some or all 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.

B. Prior to proceeding with any of the above actions, the Contractor shall notify and obtain approval from the VA Contracting Officer for the proposed schedule changes. If such actions are approved, the representative schedule revisions shall be incorporated by the Contractor into the Project Schedule before the next update, at no additional cost to the Government.

1.13 ADJUSTMENT OF CONTRACT COMPLETION

A. The contract completion time will be adjusted only for causes specified in this contract. Request for an extension of the contract completion date by the Contractor shall be supported with a clearly explained narrative justification, CPM data and supporting evidence as the VA COR may deem necessary for determination as to whether or not the Contractor is entitled to an extension of time under the provisions of the contract. Submission of proof based on 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 extended and predicted 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.

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 FAR 52.243 – 4 (Changes). The Contractor shall include, as a part of each change order proposal, a sketch showing all CPM logic revisions, duration (in work days) changes, and cost changes, for work in question and its relationship to other activities on the approved network diagram.

D. All delays due to non-work activities/events such as RFI’s, WEATHER, STRIKES, and similar non-work activities/events shall be analyzed on a month-by-month basis.

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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. Submittals must be delivered in a logical sequence relative to the critical path of the contract and must be delivered with consideration for lead times associated with equipment. Materials and equipment with powered connections, structural supports or other coordinated devices must be delivered on a similar timeline so that interdependent submittals can be reviewed concurrently to ensure alignment.

B. Detailed submittal requirements are found in the technical sections of the contract specifications. The COR 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.

B. Shop Drawings: Drawings, diagrams, schedules, and other data specifically prepared by the Contractor to illustrate details of a portion of the work. The purpose of shop drawings is to demonstrate the Contractor's understanding of the design intent, ensure proper coordination with adjoining construction and other trades, and provide sufficient information for fabrication and installation. Shop drawings must include sufficiently detailed and accurate to enable fabrication

and installation of the work without further clarification or interpretation. The shop drawings shall be reviewed and approved by the Contractor prior to submission to the Architect/Engineer for review. Shop drawings shall include, but not be limited to:

1. Clearly defined layouts and orientations
2. Identification of critical dimensions and installation locations
3. Coordination with adjoining construction and interface with other trades and disciplines
4. Indication of required roof, wall, and floor openings
5. Demonstration of relationships to adjacent work
6. Incorporation of coordination with other trades such as structural, mechanical, electrical, fire protection, etc. that is required for full integration of the work

C. 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.

D. 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.

E. Design Data: Calculations, mix designs, analyses, or other data pertaining to a part of work.

F. 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.

G. 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.

H. 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.

I. 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.

J. 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.

K. 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.

L. Confirmation Letter from Manufacturer: document issued by a manufacturer or General Contractor (GC) during the preconstruction phase, providing assurance that specified products or services will meet the project's requirements. The purpose of this letter is to demonstrate the manufacturer's or GC's commitment to comply with the stated specifications and standards, facilitate the Architect-Engineer's (AE) approval process, allocate risk appropriately, and ensure accountability for product performance and compliance post-installation. The Confirmation Letter shall include, but not be limited to:

1. A clear statement of the manufacturer's or GC's commitment to comply with the project's specifications and standards
2. Identification of the specific products or services covered by the letter
3. Acknowledgment of the manufacturer's or GC's responsibility to ensure the products or services meet the project's requirements
4. A statement that the manufacturer or GC will provide all necessary documentation, test reports, and compliance evidence upon request.

1.3 SUBMITTAL REGISTER

A. The submittal register will list items of equipment and materials for which the contract documents but which have been omitted from the submittal register.

B. The submittal register will serve as a scheduling document for submittals and will be used to control submittal actions throughout the contract period.

C. 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.

D. 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 COR.

E. 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.

1.4 SUBMITTAL SCHEDULING

A. The Contractor shall schedule, submit, review, and obtain approval for submittals prior to the acquisition of the material or equipment to ensure compliance with project requirements and to avoid delays in the work.

B. The Contractor shall furnish a complete submittal register as per the project specifications and a submittal schedule showing all submittals required for the project and when each item will be submitted for approval. Schedule to be submitted to VA and AE within 14 calendar days from NTP. The submittal schedule shall be coordinated with the planned construction sequence and lead times to ensure timely delivery of materials and equipment and to avoid delays in the work. The submittal schedule shall clearly identify the following:

1. Lead times for each submittal, including time for preparation, review, revision, and approval
2. Critical path submittals that directly impact the project schedule
3. Alignment of submittal dates with the corresponding construction schedule activities)

C. The Contractor shall coordinate scheduling, sequencing, preparing, and processing of submittals with performance of work to ensure that the work progresses according to the project schedule and is not delayed by submittal processing. The Contractor shall allow sufficient time for review and approval of submittals, taking into account the complexity of the submittal and the potential for revisions and resubmittals.

D. For submittals or RFIs reopened by the VA COR, Contractor, or Architect/Engineer for any reason, including but not limited to requests for clarification, new information, or reconsideration, the Contractor shall compile all new information into the original form, referencing the original number. The Contractor shall resubmit to the Architect/Engineer as a new revision (e.g., Rev 1) and shall clearly identify all changes. This revision shall supersede all previous versions and shall be assigned a new due date. The Architect/Engineer shall respond only to clearly identified new or outstanding items within the updated timeframe. The Architect/Engineer's review shall not imply approval or coordination beyond the immediate scope of the revised RFI.

E. The Contractor shall be responsible for ensuring that all submittals are complete, accurate, and submitted in a timely manner to avoid delays in the work. No delay costs or time extensions will be allowed for time lost due to incomplete or late submittals. The Contractor shall proactively track and manage open review comments to ensure timely resolution and approval of submittals. The Contractor shall regularly update and maintain the submittal schedule to reflect the current status of each submittal and its impact on the overall project schedule.)

1.5 SUBMITTAL PREPARATION

A. Each submittal package shall be complete with all required sub-components as stated in the submittal requirements for the given spec section compiled into a single, cohesive submittal for each material, product, unit of work, or system. Submittals shall contain sufficient detail to allow ready determination of compliance with contract requirements. The Contractor shall ensure that each submittal package is comprehensive and self-contained, enabling efficient review and approval without the need for cross-referencing or additional information.

B. The Contractor shall collect required data for each specific material, product, unit of work, or system into a single submittal package. The Contractor shall coordinate with manufacturers and subcontractors in advance per requirements in individual specification sections to determine all data required for approval. The Contractor shall be responsible for ensuring that all required data is obtained and included in the submittal package, and shall delineate choices, options, and portions applicable to the project.) Partial submittals will not be accepted for expedition of construction effort. Incomplete submittals will be returned without review.

C. It is the Contractor's responsibility to pre-coordinate all submittals before submissions to the VA COR to streamline reviews and minimize rejections. The Contractor shall establish a process for internal review and coordination of submittals prior to submission to ensure completeness, accuracy, and compliance with project requirements.)

D. The Contractor shall remove all irrelevant or unnecessary data from the submittal to facilitate accuracy and timely processing. Submittals that contain an excessive amount of irrelevant or unnecessary data will be returned without review. The Contractor shall be responsible for ensuring that each submittal is concise, well-organized, and focused on the specific material, product, unit of work, or system being submitted for approval.

E. Submittals must be timed so that interdependent submittals are delivered on a similar timeline.

F. By specification section, submittals must be provided as complete single packages, including all relevant data, product information, licenses, certificates, and test results. The Contractor shall ensure that all sub-parts of a submittal under a single specification section are compiled and submitted together as a comprehensive package. Piecemeal submittal components, with the exception of post-construction submittals, will be returned without review.

G. The contractor shall make every effort to compile a comprehensive submittal package that includes all required components such as product data, samples, test reports, certificates, and other items as specified in the contract documents. If the contractor is unable to provide a complete package, GC must clearly communicate any missing components to the AE and the VA within the submittal package. At a minimum, a

complete submittal package should consist of the following:

01 - PRECON SUBMITTALS

02 - SHOP DRAWINGS

03 - PRODUCT DATA

04 - SAMPLES

05 - DESIGN DATA

06 - TEST REPORTS

07 - CERTIFICATES

08 - MANUFACTURER'S INSTALLATION INSTRUCTIONS

09 - WARRANTY INFORMATION

10 - MAINTENANCE INSTRUCTIONS

11 - INSTALLATION INSTRUCTIONS

H. 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. When a resubmission, add alphabetic suffix on submittal description. For example, submittal 18 would become 18R1, to indicate resubmission.
7. Product identification and location in project.

I. 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.

J. Stamp, sign, and date each submittal transmittal form indicating action taken. Submittals received without Contractor signature and action will be returned without review.

K. 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: __________________________________________________________________|
|                                                                           |
|___________________________________________________________________________|
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1.6 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 COR.

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. Scanned documents will be returned without review.

D. The Contractor shall provide an online construction document management platform for use by all parties at the Contractor's expense. The

purpose of this platform is to facilitate efficient communication, collaboration, and document sharing among project stakeholders throughout the construction process. The platform shall meet the following performance requirements:

1. Accessibility: The platform shall be accessible from the VA computer network and support files of any size. Email shall not be used as the primary method for submitting files but may be used for notification purposes.
2. Functionality: The platform shall have features typical of construction platforms, including version control, access permissions, file organization, full-text search capabilities, and user activity logs. These features shall enable users to easily navigate, locate, and manage project documents while maintaining data security and integrity.
3. Usability: The Contractor shall be responsible for setting up, providing, training, and maintaining the document management platform for the duration of the construction contract. The platform shall be user-friendly and intuitive, requiring minimal training for project stakeholders to effectively utilize its features.
4. Reliability: The document management platform shall be a professionally developed and supported commercial software product designed specifically for organizing, managing, and sharing construction project information. Generic consumer file sharing platforms shall not be permitted. The platform shall demonstrate a proven track record of reliability and performance in the construction industry.
5. Security: The platform shall incorporate robust security measures to protect sensitive project data, including secure data storage, encryption, and user access controls. The Contractor shall ensure that the platform complies with all relevant data protection regulations and VA security requirements.
6. Scalability: The platform shall be capable of accommodating the anticipated volume of project documents and users throughout the construction process. It shall maintain consistent performance and responsiveness as the project progresses and the number of documents and users increases.

Prior to selection and implementation, the Contractor shall submit the proposed platform to the COR and Architect-Engineer for approval. The submission shall include documentation demonstrating how the proposed platform meets the specified performance requirements. Alternative platforms will be considered provided they meet the criteria described herein regarding access, capabilities, security, support, and intended use for construction projects.

E. Provide hard copies of submittals when requested by the COR. Up to 3 additional hard copies of any submittal may be requested at the discretion of the COR, at no additional cost to the VA.

1.7 SAMPLES

A. Submit two sets of physical samples showing a 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. The Contractor shall clearly identify and label the specified selections, as per the contract documents, for each color, finish, pattern, or texture required for the project. If the Contractor submits a range of options without specifying the recommended selections, the VA reserves the right to request clarification or make the final selection from the submitted options.

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 may be requested back for use in the project after reviewed and approved.

1.8 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 COR may withhold from progress payments 50

percent of the price of the item with which such O&M Data are applicable.

1.9 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.

1.10 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. The VA's approval of submittals is for product specifications, not performance. The actual performance of materials and products is dependent on proper installation, maintenance, and other factors beyond the scope of the VA's submittal review.

B. Conditional approval is granted when a submittal is satisfactory at the time of review, but final approval is contingent upon submission and acceptance of related submittals that impact overall system functionality and compliance. The contractor may proceed with work related to the conditionally approved submittal but acknowledges that modifications may be required based on review of future related submittals to ensure interdependent components collectively meet system design criteria. Full acceptance is pending final review of associated submittals and verification of cross-compatibility of all interconnected elements.

C. Period of review for submittals begins when the VA COR receives submittal from the Contractor.

D. Period of review for each resubmittal is the same as for initial submittal.

E. VA review period is 15 business days for submittals.

F. VA review period is 10 business days for RFIs.

G. The AE(architect/engineer)will return submittals to the Contractor with the following notations:

1. "FURNISH AS CORRECTED": authorizes the contractor to proceed with the Work covered provided the contractor incorporates the noted comments And makes the noted corrections.

2. "FURNISHED AS SUBMITTED": authorizes the contractor to proceed with the work covered as submitted.
3. "NO ACTION TAKEN": indicates the submittal was received but no action was taken by the AE at this time.
4. "NO EXCEPTIONS TAKEN": indicates the AE has reviewed the submittal and takes no exceptions to the work proposed. Contractor may proceed with work as submitted.
5. "PARTIAL RESUBMITTAL REQUIRED": contractor shall proceed with parts of work not affected by portions of submittal noted as requiring revision and resubmission.
6. “REJECTED”: submittal does not conform to contract requirements. Contractor shall not proceed with work submitted. Revise submittal per AE and/or VA comments and corrections and resubmit. No work shall proceed for this item until resubmittal is approved.
7. “REVIEWED”: submittal has been reviewed by AE. No further AE action required at this time. The AE defers judgement of compliance to the VA.
8. "REVISE AND RESUBMIT": submittal does not comply with contract requirements or is incomplete. Resubmit appropriate changes and corrections for further AE review prior to proceeding with work. No work shall proceed for this item until resubmittal is approved.
9. "CONDITIONALLY APPROVED": submittal is satisfactory at this time but final approval is contingent upon submission and acceptance of related submittals that impact overall system functionality and compliance. Contractor may proceed with work related to this submittal but acknowledges that modifications may be required based on review of future related submittals to ensure interdependent components collectively meet system design criteria. Full acceptance is pending final review of associated submittals and verification of cross-compatibility of all interconnected elements.
10. "FOR INFORMATION/ RECORD ONLY": indicates that the submittal is for documentation purposes only and does not require AE review or approval. This notation is typically used for informational submittals that do not impact the work but are required to be on file for record-keeping purposes.

H. The AE and 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.

I. 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.

J. 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.

K. Retain a copy of all approved submittals at project site, including approved samples.

1.11 RFIS

A. RFI Requirements and Cost Impact Disclosure

1. Each RFI submission shall include:

   a. Clear identification of the specific detail, drawing, or specification being questioned

   b. The Contractor's proposed recommendation, solution or interpretation

   c. Mandatory selection of one of the following cost impact declarations:

      1) YES - Response will result in cost impact regardless of direction provided

      2) NO - No cost impact regardless of direction provided

      3) TBD - Cost impact depends on specific direction provided. If TBD is selected

   d. Supporting documentation including photos, sketches, or other relevant information.

2. RFIs submitted without the above information will be returned without review and marked "Additional Information Needed" with a requirement to provide complete information.

B. For RFIs reopened by the VA COR, Contractor, or Architect/Engineer for any reason, including but not limited to requests for clarification, new information, or reconsideration, the Contractor shall compile all new information into the original form, referencing the original

number. This revision shall supersede all previous versions and shall be assigned a new due date. The Architect/Engineer shall respond only to clearly identified new or outstanding items within the updated timeframe.

1.12 WITHHOLDING OF PAYMENT

A. Payment for materials incorporated in the work will not be made if required approvals have not been obtained.

---END---

SECTION 01 35 26
SAFETY REQUIREMENTS

PART 1 - GENERAL

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 Engineers (ASSE):

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

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

99-2018.....Health Care Facilities Code

241-2019.....Standard for Safeguarding Construction, Alteration, and Demolition Operations

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 1910 .....Safety and Health Regulations for General Industry

29 CFR 1926 .....Safety and Health Regulations for Construction Industry

I. VHA Directive 2005-007

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. "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.

D. High Visibility Accident. Any mishap which may generate publicity or high visibility.

E. Accident/Incident Criticality Categories:

1. No impact – near miss incidents that should be investigated but are not required to be reported to the VA;
2. Minor incident/impact – incidents that require first aid or result in minor equipment damage (less than $5000). These incidents must be investigated but are not required to be reported to the VA;
3. Moderate incident/impact – Any work-related injury or illness that results in:
   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;

4. 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,

5. ny incident that leads to major equipment damage (greater than $5000).

F. These incidents must be investigated and are required to be reported to the VA;

1 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.

G. 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 a physician or registered personnel.

1.3 REGULATORY REQUIREMENTS:

A. In addition to the detailed requirements included in the provisions of this contract, comply with 29 CFR 1926, comply with 29 CFR 1910 as incorporated by reference within 29 CFR 1926, comply with ASSE 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.

1.4 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 accident 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 (model language can be found in ASSE A10.33). Specifically articulating the safety requirements found within these VA contract safety specifications.
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) Plan preparer (Qualified Person such as corporate safety staff person or contracted Certified Safety Professional with construction safety experience);
      2) Plan approver (company/corporate officers authorized to obligate the company);
      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.

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 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 training is required for all workers on site and the OSHA 30-hour training 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. ACCIDENT/INCIDENT INVESTIGATION & REPORTING. The Contractor shall conduct mishap investigations of all Moderate and Major as well as all High Visibility Incidents. The APP shall include accident/incident investigation procedure and identify person(s) responsible to provide the following to the Contracting Officer Representative or Government Designated Authority:

1) Exposure data (man-hours worked);
2) Accident investigationreports;
3) Project site injury and illness logs.

i. PLANS (PROGRAMS, PROCEDURES) REQUIRED. Based on a risk assessment of contracted activities and on mandatory OSHA 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 be limited to procedures for addressing the risks associates 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 (Machine 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) PreCast Concrete;
28) Public (Mandatory compliance with ANSI/ASSE A10.34-2012).

C. Submit the APP to the Contracting Officer Representative or Government Designated Authority 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 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 Contracting Officer Representative. 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 Contracting Officer within 24 hours of discovery. Eliminate/remove the hazard. In the interim, take all necessary action to restore and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public and the environment.

1.5 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 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 and/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 Contracting Officer Representative or 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 monthly) 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.

1.6 PRECONSTRUCTION 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 preconstruction 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.

C. Deficiencies in the submitted APP will be brought to the attention of the Contractor within 14 days of submittal, and the Contractor shall revise the plan to correct deficiencies and re-submit it for acceptance. Do not begin work until there is an accepted APP.

1.7 "SITE SAFETY AND HEALTH OFFICER" (SSHO) AND "COMPETENT PERSON" (CP):

A. The Prime Contractor shall designate a minimum of one SSHO at each project site that will be identified as the SSHO to administer the Contractor's safety program and government-accepted Accident Prevention Plan. 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).

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).

1.8 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. As a minimum the SSHO must have completed the OSHA 30-hour Construction Safety class and have five (5) years of construction industry safety experience or three (3) years if he/she possesses a Certified Safety Professional (CSP) or certified Construction Safety and Health Technician (CSHT) certification or have a safety and health degree from an accredited university or college.

B. All designated CPs shall have completed the OSHA 30-hour Construction Safety course within the past 5 years.

C. In addition to the OSHA 30 Hour Construction Safety Course, 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 & control associated with those high hazard work operations. Documented "repeat" deficiencies in the execution of safety requirements will require retaking the requisite formal course.

D. All other construction workers shall have the OSHA 10-hour Construction Safety Outreach course and any necessary safety training to be able to identify hazards within their work environment.

E. 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 conference for acceptance.

F. 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 Resident Engineer that individuals have undergone contractor's safety briefing.

G. Ongoing safety training will be accomplished in the form of weekly documented safety meeting.

1.9 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 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 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 can be a corporate safety professional or independently contracted. 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 Contracting Officer Representative within one week of the onsite inspection.

1.10 ACCIDENTS, OSHA 300 LOGS, AND MAN-HOURS:

A. The prime contractor shall establish and maintain an accident 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 Contracting Officer Representative as soon as practical, but no more than four hours after any accident meeting the definition of a Moderate or Major incidents, High Visibility Incidents, , or any weight handling and hoisting equipment accident. Within notification include contractor name; contract title; type of contract; name of activity, installation or location where accident 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 accident (to include type of construction equipment used, PPE used, etc.). Preserve the conditions and evidence on the accident site until the Contracting Officer Representative determine whether a government investigation will be conducted.

B. Conduct an accident investigation for all Minor, Moderate and Major incidents as defined in paragraph DEFINITIONS, and property damage accidents resulting in at least $20,000 in damages, to establish the root cause(s) of the accident. Complete the VA Form 2162 (or equivalent) and provide the report to the Contracting Officer Representative or Government Designated Authority within 5 calendar days of the accident. The Contracting Officer Representative will provide copies of any required or special forms.

C. A summation of all man-hours worked by the contractor and associated sub-contractors for each month will be reported to the Contracting Officer Representative monthly.

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 as requested.

1.11 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. Mandatory PPE includes:

1. Hard Hats – unless written authorization is given by 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 regulations.
2. Safety glasses - unless written authorization is given by 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 the 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.

1.12 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)). The ICRA procedure found on the American Society for Healthcare Engineering (ASHE) website will be utilized. Risk classifications of Class II or lower will require approval by the Contracting Officer Representative or Government Designated Authority 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 COR. 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 IV**, 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 Contracting Officer Representative.
      2) Execute work by methods to minimize raising dust from construction operations.
      3) 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 Contracting Officer Representative.
2. Class II requirements:
   a. During Construction Work:
      1) Notify 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 Contracting Officer Representative.

3. Class III requirements:
   a. During Construction Work:
      1) Obtain permit from the 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, 0.01 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 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 Contracting Officer Representative.
4. Class IV requirements:
   a. During Construction Work:
      1) Obtain permit from the 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, 0.01 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 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 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 - Drywall barrier erected with joints covered or sealed to prevent dust and debris from escaping.
      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 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: Hospital-approved disinfectant or equivalent product
8. 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 the COR 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 the 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.

1.13 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.

1.14 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. 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).

D. 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 treated plywood (flame spread rating of 25 or less in accordance with ASTM E84) on both sides of fire retardant treated wood 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.

E. Temporary Heating and Electrical: Install, use and maintain installations in accordance with 29 CFR 1926, NFPA 241 and NFPA 70.

F. Means of Egress: Do not block exiting for occupied buildings, including paths from exits to roads. Minimize disruptions and coordinate with Contracting Officer Representative.

G. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to Contracting Officer Representative.

H. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.

I. 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 Resident Engineer.

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 COR at least 5 working days 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.

1.15 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 where 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. The 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).

1.16 FALL PROTECTION

A. The fall protection (FP) threshold height requirement is 6 ft (1.8 m) for ALL WORK, unless specified differently or the OSHA 29 CFR 1926 requirements are more stringent, to include steel erection activities, systems-engineered activities (prefabricated) metal buildings, residential (wood) construction and scaffolding work.

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 OSHA requirements.

1.17 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 6 ft (1.8 m) 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.

1.18 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 COR 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 COR. The permit shall be maintained onsite and the first section of the permit shall include the following:

1. Estimated start time & stop time2. Specific location and nature of the work.
2. 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.
3. Indication of whether soil or concrete removal to an offsite location is necessary.
4. Indication of whether soil samples are required to determined soil contamination.
5. Indication of coordination with local authority (i.e. "One Call") or contractor's effort to determine utility location with search and survey equipment.
6. Indication of review of site drawings for proximity of utilities to digging/drilling.

C. The second section of the permit for excavations greater than five feet in depth shall include the following:

1. 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 penetronmeter 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).
2. 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.

3. 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.
4. 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.

D 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

E. 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.

F. Excavations greater than 20 feet in depth require a Professional Engineer designed excavation protective system.

1.19 CRANES

A. All crane work shall comply with 29 CFR 1926 Subpart CC.

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 COR 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.

D. Crane operators shall not carry loads
   1. over the general public or VAMC personnel
   2. over any occupied building unless
      a. the top two floors are vacated
      b. or overhead protection with a design live load of 300 psf is provided

1.20 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.

1.21 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 COR.

1.22 WELDING AND CUTTING

As specified in section 1.14, Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with the COR. Obtain permits from COR at least 12 hours in advance. Designate contractor's responsible project-site fire prevention program manager to permit hot work.

1.23 LADDERS

A. All Ladder use shall comply with 29 CFR 1926 Subpart X.
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.

1.24 FLOOR & WALL OPENINGS

A. All floor and wall openings shall comply with 29 CFR 1926 Subpart M.
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 toeboards 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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SECTION 01 42 19
REFERENCE STANDARDS

PART 1 - GENERAL

1.1 DESCRIPTION

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)

The specifications and standards cited in this solicitation can be examined at the following location:

DEPARMENT 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)

The specifications cited in this solicitation may be obtained from the associations or organizations listed below.

AA Aluminum Association Inc.
http://www.aluminum.org

AABC Associated Air Balance Council
https://www.aabc.com

AAMA American Architectural Manufacturer's Association
http://www.aamanet.org

AASHTO American Association of State Highway and Transportation Officials
http://www.aashto.org

AATCC American Association of Textile Chemists and Colorists
http://www.aatcc.org

ACGIH American Conference of Governmental Industrial Hygienists
http://www.acgih.org

ACI American Concrete Institute
http://www.aci-int.net

ACPA American Concrete Pipe Association
http://www.concrete-pipe.org

ACPPA American Concrete Pressure Pipe Association
http://www.acppa.org

ADC Air Diffusion Council
http://flexibleduct.org

AGA American Gas Association
http://www.aga.org

AGC Associated General Contractors of America
http://www.agc.org

AGMA American Gear Manufacturers Association, Inc.
http://www.agma.org

AH American Hort
https://www.americanhort.org

AHAM Association of Home Appliance Manufacturers
http://www.aham.org

AIA American Institute of Architects

http://www.aia.org

AISC American Institute of Steel Construction
http://www.aisc.org

AISI American Iron and Steel Institute
http://www.steel.org

AITC American Institute of Timber Construction
https://aitc-glulam.org

AMCA Air Movement and Control Association, Inc.
http://www.amca.org

ANSI American National Standards Institute, Inc.
http://www.ansi.org

APA The Engineered Wood Association
http://www.apawood.org

ARI Air-Conditioning and Refrigeration Institute
http://www.ari.org

ARPM Association for Rubber Product Manufacturers
https://arpm.com

ASABE American Society of Agricultural and Biological Engineers
https://www.asabe.org

ASCE American Society of Civil Engineers
http://www.asce.org

ASHRAE American Society of Heating, Refrigerating, and Air-Conditioning Engineers
http://www.ashrae.org

ASME American Society of Mechanical Engineers
http://www.asme.org

ASSE American Society of Sanitary Engineering International
http://www.asse-plumbing.org

ASTM American Society for Testing and Materials International
http://www.astm.org

AWI Architectural Woodwork Institute
https://www.awinet.org

AWS American Welding Society
https://www.aws.org

AWWA American Water Works Association
https://www.awwa.org

BHMA Builders Hardware Manufacturers Association

https://www.buildershardware.com

BIA The Brick Industry Association
http://www.gobrick.com

CAGI Compressed Air and Gas Institute
https://www.cagi.org

CGA Compressed Gas Association, Inc.
https://www.cganet.com

CI The Chlorine Institute, Inc.
https://www.chlorineinstitute.org

CISCA Ceilings and Interior Systems Construction Association
https://www.cisca.org

CISPI Cast Iron Soil Pipe Institute
https://www.cispi.org

CLFMI Chain Link Fence Manufacturers Institute
https://www.chainlinkinfo.org

CPA Composite Panel Association
https://www.compositepanel.org

CPMB Concrete Plant Manufacturers Bureau
https://www.cpmb.org

CRA California Redwood Association
http://www.calredwood.org

CRSI Concrete Reinforcing Steel Institute
https://www.crsi.org

CTI Cooling Technology Institute
https://www.cti.org

DHA Decorative Hardwoods Association
https://www.decorativehardwoods.org

DHI Door and Hardware Institute
https://www.dhi.org

EGSA Electrical Generating Systems Association
http://www.egsa.org

EEI Edison Electric Institute
https://www.eei.org

EPA United States Environmental Protection Agency
https://www.epa.gov

ETL ETL Testing Services
http://www.intertek.com

FAA	Federal Aviation Administration https://www.faa.gov
FCC	Federal Communications Commission https://www.fcc.gov
FPS	Forest Products Society http://www.forestprod.org
GANA	Glass Association of North America http://www.glasswebsite.com
FM	Factory Mutual Global Insurance https://www.fmglobal.com
GA	Gypsum Association https://gypsum.org
GSA	General Services Administration https://www.gsa.gov
HI	Hydraulic Institute http://www.pumps.org
ICC	International Code Council https://shop.iccsafe.org
ICEA	Insulated Cable Engineers Association https://www.icea.net
ICAC	Institute of Clean Air Companies http://www.icac.com
IEEE	Institute of Electrical and Electronics Engineers https://www.ieee.org\
IGMA	Insulating Glass Manufacturers Alliance https://www.igmaonline.org
IMSA	International Municipal Signal Association http://www.imsasafety.org
MBMA	Metal Building Manufacturers Association https://www.mbma.com
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry http://msshq.org
NAAMM	National Association of Architectural Metal Manufacturers https://www.naamm.org
PHCC	Plumbing-Heating-Cooling Contractors Association https://www.phccweb.org

NBS	National Bureau of Standards See - NIST
NBBI	The National Board of Boiler and Pressure Vessel Inspectors https://www.nationalboard.org
NEC	National Electric Code See - NFPA National Fire Protection Association
NEMA	National Electrical Manufacturers Association https://www.nema.org
NFPA	National Fire Protection Association https://www.nfpa.org
NHLA	National Hardwood Lumber Association https://www.nhla.com
NIH	National Institute of Health https://www.nih.gov
NIST	National Institute of Standards and Technology https://www.nist.gov
NELMA	Northeastern Lumber Manufacturers Association, Inc. http://www.nelma.org
NPA	National Particleboard Association (See CPA, Composite Panel Association)
NSF	National Sanitation Foundation http://www.nsf.org
OSHA	Occupational Safety and Health Administration Department of Labor https://www.osha.gov
PCA	Portland Cement Association https://www.cement.org
PCI	Precast Prestressed Concrete Institute https://www.pci.org
PPI	Plastics Pipe Institute https://www.plasticpipe.org
PEI	Porcelain Enamel Institute http://www.porcelainenamel.com
PTI	Post-Tensioning Institute http://www.post-tensioning.org
RFCI	Resilient Floor Covering Institute https://www.rfci.com

RIS	Redwood Inspection Service (See Western Wood Products Association) https://www.wwpa.org
SCMA	Southern Cypress Manufacturers Association http://www.cypressinfo.org
SDI	Steel Door Institute http://www.steeldoor.org
SJI	Steel Joist Institute https://www.steeljoist.org
SMACNA	Sheet Metal & Air-Conditioning Contractors' National Association https://www.smacna.org
SSPC	The Society for Protective Coatings https://www.sspc.org
STI	Steel Tank Institute https://www.steeltank.com
SWI	Steel Window Institute https://www.steelwindows.com
TCNA	Tile Council of North America https://www.tcnatile.com
TEMA	Tubular Exchanger Manufacturers Association http://www.tema.org
TPI	Truss Plate Institute https://www.tpinst.org
UBC	The Uniform Building Code (See ICC)
UL	Underwriters' Laboratories Incorporated https://www.ul.com
ULC	Underwriters' Laboratories of Canada https://www.ulc.ca
WCLB	West Coast Lumber Inspection Bureau http://www.wclib.org
WDMA	Window and Door Manufacturers Association https://www.wdma.com
WRCLA	Western Red Cedar Lumber Association https://www.realcedar.com
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

This section specifies requirements for Contractor Quality Control (CQC) for Design-Bid-Build (DBB) or Design-Build (DB) construction projects. This section can be used for both project types.

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

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
   c. Additional Requirements for Design Quality Control (DQC) Plan
2. Design Data
   a. Discipline-Specific Checklists
   b. Design Quality Control
3. Test Reports
   a. Verification Statement

PART 2 PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

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 no later than 15 days 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 120 days to match timeline established immediately above 15 business 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 be issued by the CQC System Manager. Furnish copies of these letters to the Contracting Officer or Authorized designee.
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. Additional Requirements for Design Quality Control (DQC) Plan: The following additional requirements apply to the DQC Plan for DB projects only and not DBB projects:

1. Submit and maintain a DQC Plan as an effective QC program which assures that all services required by this contract are performed and provided in a manner that meets professional architectural and engineering quality standards. As a minimum, all documents must be technically reviewed by competent, independent reviewers identified in the DQC Plan. The same element that produced the product may not perform the independent technical review (ITR). Correct errors and deficiencies in the design documents prior to submitting them to the Government.
2. Include the design schedule in the master project schedule, showing the sequence of events involved in carrying out the project design tasks within the specific Contract period. This should be at a detailed level of scheduling sufficient to identify all major design tasks, including those that control the flow of work. Include review and correction periods associated with each item. This should be a forward planning as well as a project monitoring tool. The schedule reflects calendar days and not dates for each activity. If the schedule is changed, submit a revised schedule reflecting the change within 7 calendar days. Include in the DQC Plan the discipline-specific checklists to be used during the design and quality control of each submittal. Submit at each design phase as part of the project documentation these completed discipline-specific checklists.

3. Implement the DQC Plan by a DQC Manager who has the responsibility of being cognizant of and assuring that all documents on the project have been coordinated. This individual must be a person who has verifiable engineering or architectural design experience and is a Professional Engineer or Registered Architect within the state of Construction location. Notify the Contracting Officer or Authorized designee, in writing, of the name of the individual, and the name of an alternate person assigned to the position.

D. 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.

E. 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:

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 2 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. 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 5 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. The CQC System Manger is assigned as CQC System Manager but has duties as project superintendent in addition to quality control. 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, Commissioning Agent/LEED specialist, 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 are employees of the prime or subcontractor; be 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.

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.
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.

Area	Qualifications
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 technicaion of the firm certified by the NEBB.
Design Quality Control Manager	Registered Architect or Professional Engineer

D. 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.

E. 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:** 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.

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 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.

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 Resident Engineer 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.
10. Provide documentation of design quality control activities. For independent design reviews, provide, as a minimum, identification of the Independent Technical Reviewer (ITR) team, the ITR review comments, responses, and the record of resolution of the comments.

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

Templates of various quality control reports can be found on the Whole Building Design Guide website at https://www.wbdg.org/FFC/NAVGRAPH/01%2045%2000.00%2020_quality_control_reports.pdf

3.11 **NOTIFICATION OF NONCOMPLIANCE:** 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.

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SECTION 01 45 29
TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 DESCRIPTION:

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.

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):

A325-10.....Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

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

A490-12.....Standard Specification for Heat Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength

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/ft3 (2,700 KNm/m3))

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

E. American Welding Society (AWS):

D1.D1.1M-10.....Structural Welding Code-Steel

1.3 REQUIREMENTS:

A. Accreditation Requirements: Construction materials testing laboratories shall be accredited by a laboratory accreditation authority and shall be required to submit a copy of the Certificate of Accreditation and Scope of Accreditation. The laboratory’s scope of accreditation shall 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 COR regarding suitability or unsuitability of areas where proof-rolling was observed. Where unsuitable results are observed, witness excavation of unsuitable material and recommend to COR 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.
2. Make field density tests in accordance with the primary testing method following ASTM D6938 wherever possible. Field density tests utilizing ASTM D1556 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. If the testing laboratory propose these alternative methods, they shall 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 shall be placed. Subsequent verification and approval of each footing subgrade shall 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.

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.

3.4 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.

3.5 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. Minimum compaction is for base and subgrade shall be 95% SPD.

3.6 SITE WORK CONCRETE:

Test site work concrete including materials for concrete as required in Article CONCRETE of this section.

3.7 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 COR 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 shall be removed from the site at the Contractor’s expense. Any rejected concrete that is placed shall 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 shall 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. 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.

3.8 REINFORCEMENT:

A. Review mill test reports furnished by Contractor.

A. 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).

B. Make one tensile and one bend test in accordance with ASTM A370 from each pair of samples obtained.

C. Written report shall include, in addition to test results, heat number, manufacturer, type and grade of steel, and bar size.

D. Perform tension tests of mechanical and welded splices in accordance with ASTM A370.

3.9 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.

3.10 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 A325 or A490 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 A325 or A490 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 A325 or A490 Bolts. Inspect all bolts in connection when one or more are rejected.
d. Bolts installed by turn-of-nut tightening shall 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. 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.

3.11 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.

3.12 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.

3.13 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 shall 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.

3.14 TYPE OF TEST:

Approximate Number of Tests Required

A. Earthwork:

Laboratory Compaction Test, Soils(ASTM D1557) _____

Field Density, Soils (AASHTO T191, T205, or T310) _____

Penetration Test, Soils _____

B. Landscaping:

Topsoil Test _____

C. Aggregate Base:

Laboratory Compaction, (ASTM D1557) _____

Field Density,(ASTM D1556) _____

Aggregate, Base Course Gradation (AASHTO T27) _____

Wear (AASHTO T96) _____

Soundness (AASHTO T104) _____

D. Asphalt Concrete:

Field Density, ASTM D1188 _____

Aggregate, Asphalt Concrete Gradation (AASHTO T27) _____

Wear (AASHTO T96) _____

Soundness (AASHTO T104) _____

E. Concrete:

Making and Curing Concrete Test Cylinders (ASTM C31) _____

Compressive Strength, Test Cylinders (ASTM C39) _____

Concrete Slump Test (ASTM C143) _____

Concrete Air Content Test (ASTM C173) _____

Unit Weight, Lightweight Concrete (ASTM C567) _____

Aggregate, Normal Weight: Gradation (ASTM C33) _____

Deleterious Substances (ASTM C33) _____

Soundness (ASTM C33) _____

Abrasion (ASTM C33) _____

Aggregate, Lightweight Gradation (ASTM C330) _____

Deleterious Substances (ASTM C330) _____

Unit Weight (ASTM C330) _____

Flatness and Levelness Readings (ASTM E1155) (number of days) _____

F. Reinforcing Steel:

Tensile Test (ASTM A370) _____

Bend Test (ASTM A370) _____

Mechanical Splice (ASTM A370) _____

Welded Splice Test (ASTM A370) _____

G. Shotcrete:

Taking and Curing Test Cores (ACI 506) _____

Compressive Strength, Test Cores (ACI 506) _____

H. Prestressed Concrete:

Testing Strands (ASTM A416) _____

I. Masonry:

Making and Curing Test Cubes (ASTM C109) _____

Compressive Strength, Test Cubes (ASTM C109) _____

Sampling and Testing Mortar, Comp. Strength (ASTM C780) _____

Sampling and Testing Grout, Comp. Strength (ASTM C1019) _____

Masonry Unit, Compressive Strength (ASTM C140) _____

Prism Tests (ASTM C1314) _____

J. Structural Steel:

Ultrasonic Testing of Welds (ASTM E164) _____

Magnetic Particle Testing of Welds (ASTM E709) _____

Radiographic Testing of Welds (ASTM E94) _____

K. Sprayed-On Fireproofing:

Thickness and Density Tests (ASTM E605) _____

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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 - (2010; Errata 2011; Supp 2 2013) Minimum Design Loads for Buildings and Other Structures

C. International Code Council (ICC)

2. ICC IBC - (2015) 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.

B. Structural observations will be performed by the Government. The contractor must provide notification to the Contracting Officer 14 days prior to the following points of construction that structural observations need to occur.

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 00.00 10 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 tie.
      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 Temp

SECTION 01 45 35
Statement of SI Tem

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.

M. Submittals: Government approval is required for all submittals. CQC Special Inspection reports shall be submitted under this Specification section and follow the [Special Inspection]: [Applicable Specification section or description] naming 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;

N. 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); Underwriters Laboratories (UL). Qualifications should be in accordance with the following minimums:

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	

Area	Special Inspector	Associated Special Inspector	SIOR
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 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	ACI Concrete Construction Special Inspector in Training, 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	

Area	Special Inspector	Associated Special Inspector	SIOR
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-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	
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	

Area	Special Inspector	Associated Special Inspector	SIOR
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.	
Exterior Insulation and Finish Systems (EIFS)	AWCI EIFS Inspector Certificate, or Exterior Design Institute Certificate, 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.	

Area	Special Inspector	Associated Special Inspector	SIOR
Smoke Control	AABC Technician Certification with one year of related experience, or Registered Professional Engineer with related experience	Engineer-In-Training with one year of 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 RESPONSIBILIES MATRIX

Inspector	Responsibility	Condition
SIOR	a. Supervise all Special Inspectors required by the contract documents and the IBC. b. Submit a SIOR Letter of Acceptance to the Contracting Officer attesting to acceptance of the duties of SIOR, signed and sealed by the SIOR. c. Verify the qualifications of all of the Special Inspectors. d. Verify the qualifications of fabricators.	Applicable when SIOR is required
	e. Submit Special Inspections agency's written practices for the monitoring and control of the agency's operations to include the following: 1. 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. 2. The agency's inspection procedures, including general inspection, material controls, and visual welding inspection. f. 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 required and when the structural design is required to follow AISC341 for seismic design of steel structures
	g. Prepare a Special Inspections Project Manual, which will cover the following: 1. Roles and responsibilities of the following individuals during Special Inspections: SIOR, SI, General Contractor, Subcontractors, QC Manager, and DOR. 2. Organizational chart and/or communication plan, indicating lines of communication 3. 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. 4. Indicate the government reporting procedures. 5. Propose forms or templates to be used by SI and SIOR to document inspections.	Applicable when SIOR is required

Inspector	Responsibility	Condition
	6. Indicate procedures for tracking nonconforming work and verification that corrective work is complete. 7. Indicate how the SIOR and/or SI will participate in weekly QC meetings. 8. Indicate how Special Inspections of shop fabricated items will be handled when the fabricator's shop is not certified per paragraph FABRICATOR SPECIAL INSPECTIONS. 9. 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. h. 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. i. 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. j. Submit a copy of the Special Inspector's daily reports to the QC Manager. k. 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. l. 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: 1. A brief summary of the work performed during the reporting time frame.	

Inspector	Responsibility	Condition
	2. 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. 3. Discrepancies which were resolved or corrected. 4. A list of nonconforming items requiring resolution. 5. All applicable test results including nondestructive testing reports.	
QC Manager	a. 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
	b. Maintain a rework items list that includes discrepancies noted on the Special Inspectors daily report.	n/a
Special Inspectors	a. Inspect all elements of the project for which the special inspector is qualified to inspect and are identified in the Schedule of Special Inspections. b. Attend preparatory phase meetings related to the Definable Feature of Work (DFOW) for which the special inspector is qualified to inspect.	
	c. Submit Special Inspections agency's written practices for the monitoring and control of the agency's operations to include the following: 1. 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. 2. The agency's inspection procedures, including general inspection, material controls, and visual welding inspection. d. Submit qualification records for nondestructive testing (NDT) technicians designated for the project. e. 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

Inspector	Responsibility	Condition
	f. Submit a copy of the daily reports to the QC Manager. g. 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. h. 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: 1. A brief summary of the work performed during the reporting time frame 2. 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. 3. Discrepancies which were resolved or corrected. 4. A list of nonconforming items requiring resolution. 5. All applicable test result including nondestructive testing reports. j. 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.	Applicable when SIOR is not required
	k. Submit daily reports to the SIOR	Applicable when SIOR is required

3.2 DEFECTIVE WORK

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.

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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. Drawings showing locations of any proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials. Include as part of an Erosion Control Plan approved by the District Office of the U.S. Soil Conservation Service and the Department of Veterans Affairs.
j. Environmental Monitoring Plans for the job site including land, water, air, and noise.
k. 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.
l. 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.

1.5 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, land forms, 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 100 (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 00, EARTH MOVING.

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 Government property to minimize erosion and to prevent sediment from entering nearby water courses or lakes.

7. Manage and control spoil areas on 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 State 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 8:00a.m. and 6:00p.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
SCAPERS	80	PILE DRIVERS	95
GRADERS	75	JACK HAMMERS	75
TRUCKS	75	ROCK DRILLS	80
PAVERS, STATIONARY	80	PNEUMATIC TOOLS	80
PUMPS	75	BLASTING	95
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. Fabricate from 50 Kg (110 pound) mat finish white paper.

B. Cut to 100 mm (4-inch) wide by 300 mm (12 inch) long size tag.

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. Reinforce hole on both sides with gummed cloth washer or other suitable material capable of preventing tie pulling through paper edge.

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. Install temporary signs attached to room door frame or room door knob, lever, or pull for doors on corridor openings.

B. Mark on signs with felt tip marker having approximately 3 mm (1/8-inch) wide stroke for clearly legible numbers or letters.

C. Identify room with numbers as designated on floor plans.

3.2 LOCATION

A. Install on doors that have room, corridor, and space numbers shown.

B. Doors that do not require signs are as follows:

1. Corridor barrier doors (cross-corridor) in corridor with same number.
2. Folding doors or partitions.
3. Toilet or bathroom doors within and between rooms.
4. Communicating doors in partitions between rooms with corridor entrance doors.
5. Closet doors within rooms.

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:

J. Soil.

K. Inerts (eg, concrete, masonry and asphalt).

L. Clean dimensional wood and palette wood.

M. Green waste (biodegradable landscaping materials).

N. Engineered wood products (plywood, particle board and I-joists, etc).

O. Metal products (eg, steel, wire, beverage containers, copper, etc).

P. Sheathings

Q. Cardboard, paper and packaging.

R. Bitumen roofing materials.

S. Plastics (eg, ABS, PVC).

T. Carpet and/or pad.

U. Gypsum board.

V. Insulation.

W. Paint.

X. 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 and 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. Green Building Initiative (GBI): Green Globes for New Construction 2019

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 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 the, Division 21, Division 22, Division 23, Division 26, 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 limitedDivision 21, Division 22, Division 23 and Division 26series 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. 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 contracts with a Contractor to provide construction services. The contracts are administered by the VA Contracting Officer and the Resident Engineer as the designated representative of the Contracting Officer. On this project, the authority to modify the contract in any way is strictly limited to the authority of the Contracting Officer.

B. In this project, only two contract parties are recognized and communications on contractual issues are strictly limited to VA Resident Engineer 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 Resident Engineer 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 Resident Engineer.

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 Resident Engineer. 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 Resident Engineer 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 Resident Engineer to require either an official interpretation of the construction documents or require a modification of the contract documents, the Contracting Officer or Resident Engineer will issue an official directive to this effect.
4. All parties to the Commissioning Process shall be individually responsible for alerting the Resident Engineer 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 Resident Engineer, 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 21 08 00 COMMISSIONING OF FIRE PROTECTION SYSTEMS.
E. Section 22 08 00 COMMISSIONING OF PLUMBING SYSTEMS.
F. Section 23 08 00 COMMISSIONING OF HVAC SYSTEMS.
G. Section 26 08 00 COMMISSIONING OF ELECTRICAL 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.

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

List of Acronyms	
Acronym	Meaning
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
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
USGBC	United States Green Building Council

1.6 DEFINITIONS

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.

Accuracy: The capability of an instrument to indicate the true value of a measured quantity.

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

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.

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.

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.

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.

CCTV: Closed circuit Television. Normally used for security surveillance and alarm detections as part of a special electrical security system.

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)

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

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.

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.

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.

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).

Commissioning Manager (CxM): A qualified individual appointed by the Contractor to manage the commissioning process on behalf of the Contractor.

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)

Commissioning Plan: A document that outlines the commissioning process, commissioning scope and defines responsibilities, processes, schedules, and the documentation requirements of the Commissioning Process.

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.

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.

Commissioning Representative (CxR): An individual appointed by a sub-contractor to manage the commissioning process on behalf of the sub-contractor.

Commissioning Specifications: The contract documents that detail the objective, scope and implementation of the commissioning process as developed in the Commissioning Plan.

Commissioning Team: Individual team members whose coordinated actions are responsible for implementing the Commissioning Process.

Construction Phase Commissioning: All commissioning efforts executed during the construction process after the design phase and prior to the Acceptance Phase Commissioning.

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.

Construction Phase Commissioning (CPC): All commissioning efforts executed during the construction process after the design phase and prior to the Acceptance Phase Commissioning.

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.

Data Logging: The monitoring and recording of temperature, flow, current, status, pressure, etc. of equipment using stand-alone data recorders.

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.

Deficiency: See "Commissioning Issue".

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.

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.

Design Narrative: A written description of the proposed design solutions that satisfy the requirements of the OPR.

Design Phase Commissioning (DPC): All commissioning tasks executed during the design phase of the project.

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.

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.

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.

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.

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.

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.

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.

Lessons Learned Workshop: A workshop conducted to discuss and document project successes and identify opportunities for improvements for future projects.

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.

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').

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.

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.

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.

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

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.

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.

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.

Range: The upper and lower limits of an instrument's ability to measure the value of a quantity for which the instrument is calibrated.

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.

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.

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.

Special System Inspections: Inspections required by a local code authority prior to occupancy and are not normally a part of the commissioning process.

Static Tests: Tests or inspections that validate a specified static condition such as pressure testing. Static tests may be specification or code initiated.

Start Up Tests: Tests that validate the component or system is ready for automatic operation in accordance with the manufactures requirements.

Systems Manual: A system-focused composite document that includes all information required for the owners operators to operate the systems.

Test Procedure: A written protocol that defines methods, personnel, and expectations for tests conducted on components, equipment, assemblies, systems, and interfaces among systems.

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.

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.

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.

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.

Trending: Monitoring over a period of time with the building automation system.

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.

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.

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.

Warranty Visit: A commissioning meeting and site review where all outstanding warranty issues and deferred testing is reviewed and discussed.

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**
HVAC Drainage System	Condensatpumps, drains, and associated hydronic piping, pumps, and valves.
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
Unitary Heat Pump Systems	Computer Room Air Conditioning (CRAC) unit , controls, interface with facility DDC
Electrical	

Systems To Be Commissioned	
System	**Description**

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 CxA will be provided by A/E firm; the CxA will not be a part of the design team.
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. Appoint an individual, company or firm to act as the Commissioning Agent. The CxA will be provided by A/E firm; the CxA will not be a part of the design team.

B. 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.

C. 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. The Contractor shall assign a Commissioning Manager to manage commissioning activities of the Contractor, and subcontractors.

B. 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.

C. 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 a 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. 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 Resident Engineer 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 °C (1.0 °F) and a resolution of + or - 0.1 °C (0.2 °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 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	

Construction Phase		CxA = Commissioning Agent RE = Resident Engineer 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
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	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	Status Reports	L	A	R	R	O	

Construction Phase		CxA = Commissioning Agent RE = Resident Engineer 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
Logs	Maintain Commissioning Issues Log	L	A	R	R	O	

B. The following table outlines the roles and responsibilities for the Commissioning Team members during the Acceptance Phase:

Acceptance Phase		CxA = Commissioning Agent RE = Resident Engineer 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	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	

Acceptance Phase		CxA = Commissioning Agent					L = Lead
Commissioning Roles & Responsibilities		RE = Resident Engineer					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
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	
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	

Acceptance Phase		CxA = Commissioning Agent RE = Resident Engineer 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
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	

C. The following table outlines the roles and responsibilities for the Commissioning Team members during the Warranty Phase:

Warranty Phase		CxA = Commissioning Agent RE = Resident Engineer 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	Post-Occupancy User Review Meeting	L	A	O	P	P	

Warranty Phase		CxA = Commissioning Agent					L = Lead
Commissioning Roles & Responsibilities		RE = Resident Engineer					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
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 22, Division 23, and Division 26and 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 Resident Engineer 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 Resident Engineer. Any pre-test trend analysis comments generated by the Commissioning Team should be addressed and resolved by the Contractor, as directed by the Resident Engineer, 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.

CRAC Units 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

CRAC Units Trending and Alarms							
Point	**Type**	**Trend Interval**	**Operational Trend Duration**	**Testing Trend Duration**	**Alarm Type**	**Alarm Range**	**Alarm Delay**
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
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		

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 Resident Engineer 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

4. 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. The following table is a sample that can be used as a template for submission.

AIR HANDLING UNIT AHU-1				
Control Reference	Proportional Constant	Integral Constant	Derivative Constant	Interval
Heating Valve Output	1000	20	10	2 sec.

3.6 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 Resident Engineer, 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:

1. 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.

2. Instructor Qualifications: A factory authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

3. 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. 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:

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 00, EARTHWORK.

B. Safety Requirements: Section 01 35 26 Safety Requirements Article, ACCIDENT PREVENTION PLAN (APP).

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 to highest remaining floor. Keep stairway free of obstructions and debris until that level of structure has been removed.
   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 buildings and 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 Resident Engineer. 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:

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.

- - - E N D - - -

ASBESTOS 3-YEAR REINSPECTION REPORT

for the

DEPARTMENT OF VETERANS AFFAIRS

ALEXANDRIA VAMC
PINEVILLE, LA

RFQ #:
VA256-17-Q-0029

INSPECTION DATES:
JANUARY 23-26, 2017

PRIME CONTRACTOR:
USFIN DEVELOPMENT, LLC. 5808 NEATHAMMER LN. EDWARDSVILLE, IL 62025 419-382-9574 USFin

TABLE OF CONTENTS

1.0 ASBESTOS INSPECTION SUMMARY

2.0 APPENDICES

Appendix A – Asbestos Cost Estimates by Building

Appendix B – Asbestos Homogeneous Areas by Building

Appendix C – Asbestos Material Assessments Areas by Building

Appendix D – Asbestos Location Drawings

Appendix E - Inspector Certifications & Training

List of Acronyms

ACBM	Asbestos Containing Building Material
ACM	Asbestos Containing Material
AHERA	Asbestos Hazard Emergency Response Act
AIHA	American Industrial Hygiene Association
CAA	Clean Air Act
CFR	Code of Federal Regulations
EPA	United States Environmental Protection Agency
HazCom	Hazard Communication
HEPA	High Efficiency Particulate Air Filter
HVAC	Heating, Ventilation, and Air Conditioning
IDEM	Louisiana Department of Environmental Management
MISC	Miscellaneous Asbestos Containing Material
NESHAP	National Emission Standards for Hazardous Air Pollutants
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards and Technology
NOB	Non-friable Organically Bound
NVLAP	National Voluntary Laboratory Accreditation Program
OSHA	Occupational Safety and Health Administration
PAT	AIHA Proficiency Analytical Testing Program
PCM	Phase Contrast Microscopy
PEL	Permissible Exposure Limit
PLM	Polarized Light Microscopy
TEM	Transmission Electron Microscopy
TSCA	Toxic Substances Control Act
TSI	Thermal Systems Insulation
USFin	USFin Development, LLC
VA	United States Department of Veterans Affairs
VAMC	VA Medical Center
XRD	X-Ray Diffraction

1.0 ASBESTOS INSPECTION SUMMARY

EXECUTIVE SUMMARY

From January 23-26, 2017, USFin Development, LLC performed a 3-year AHERA asbestos reinspection at the Alexandria VAMC located in Pineville, LA in accordance with RFQ VA256-17-Q-0029. The purpose of the inspection was to update existing survey information from the previous asbestos reinspection conducted in 2013 by Altec Environmental Consultants. All accessible functional areas in the facilities were surveyed. All previous asbestos survey information and sampling conducted at the facilities were evaluated and incorporated into this survey. All confirmed asbestos-containing materials were verified. This report can be incorporated into the facility's management plan for asbestos-containing materials.

The inspection was conducted by Brett Brumbaugh and Sam Ansara (USFin) and Jeremiah Garms of PSI/Intertek. The project manager was Mr. Brumbaugh who has been conducting asbestos surveys, sampling, and asbestos management planning work since 1987.

Previous sampling results and inventory spreadsheets from the previous survey and additional asbestos information provided by the current staff of the VAMC were used in this report. No additional samples of newly identified suspect materials were collected during this inspection. Certain areas such as inaccessible pipe chases, areas above fixed permanent ceilings, and flooring materials located beneath carpeting were not inspected or tested.

2.0 ASBESTOS BACKGROUND

The term asbestos describes six naturally occurring fibrous minerals found in certain types of rock formations. The minerals chrysotile, amosite, and crocidolite have been most commonly used in building products such as floor tile, pipe insulation, boiler insulation, asbestos cement materials, roofing materials, and plasters. The minerals anthophyllite, actinolite, and tremolite are not frequently found in ACBM.

Intact and undisturbed ACBM do not pose a health risk. They may, however, become a health hazard if they are damaged, disturbed, or deteriorate over time and release fibers into the air. If released into the air, asbestos fibers may be inhaled. After prolonged or intense exposure, inhaled asbestos fibers may cause various types of lung disease. The health risks associated with asbestos exposure are greater for those who smoke.

3.0 REGULATORY BACKGROUND

3.1 Federal Regulations

The United States Environmental Protection Agency (EPA), the Occupational Safety and Health Administration (OSHA), and delegated states are responsible for regulating environmental exposure and protecting workers from asbestos exposure. OSHA is responsible for the health and safety of workers who may be exposed to asbestos in connection with their jobs (Occupational Exposure to Asbestos; Title 29, Code of Federal Regulations (CFR) Parts 1910.1001 and 1926.1101). The EPA and state regulators are responsible for developing and enforcing

regulations necessary to protect the general public from exposure to airborne contaminants that are known to be hazardous to human health.

In 1979, EPA began an asbestos technical assistance program for building owners, environmental groups, contractors, and industry. In May 1982, EPA issued the first regulation intended to control asbestos in schools under the authority of the Toxic Substances Control Act (TSCA); this regulation is known as the Asbestos-in-Schools Rule.

Two EPA regulations govern asbestos: the Asbestos Hazard Emergency Response Act (AHERA) and the National Emission Standards for Hazardous Air Pollutants (NESHAP).

AHERA

In 1986, Congress enacted AHERA (Title 40, CFR Part 763) which mandated a regulatory program to address the asbestos hazards in schools. A part of AHERA deals with the mandatory training and accreditation of persons who perform certain types of asbestos-related work in schools. Subsequently, in 1990 Congress amended AHERA to extend some of the training and accreditation requirements to persons performing such work in public and commercial buildings.

AHERA requires inspections of school buildings to determine the conditions of ACBM and preparation of management plans which recommend the best way to reduce the asbestos hazards. The United States Veterans Administration (VA) has adopted many of the requirements of AHERA for surveys performed at VA facilities. The methods may include removal, encapsulation, enclosure, repair, and operations and maintenance to protect human health and the environment from ACBM.

NESHAP

The Clean Air Act (CAA) of 1970 required EPA to develop and enforce regulations to protect the general public from exposure to airborne contaminants that are known to be hazardous to human health; therefore, EPA promulgated NESHAP (Title 40, CFR Part 61) on April 6, 1973.

NESHAP is intended to minimize the release of asbestos fibers during certain activities (i.e., renovations, demolition, and installations). It specifies work practices to be followed during renovations of buildings (except apartment buildings that have no more than four dwelling units) which contain a specific amount of friable asbestos. NESHAP requires that buildings be inspected for ACBM prior to renovation/demolition projects.

NESHAP also requires owners and operators subject to the asbestos rules to notify delegated state and local agencies and/or the regional EPA offices before demolition or renovation activities begin. In addition, NESHAP requires the removal of all friable ACBM prior to demolition.

OSHA

OSHA began regulating workplace asbestos exposure in 1970, adopting a permissible exposure limit (PEL) to regulate worker exposure. The original asbestos standard has been revised several times to better protect workers. On August 10, 1994, OSHA issued a revised final standard regulating asbestos exposure in all industries. The newly revised standard for the construction

industry lowers the PEL. The revised standard also establishes a new classification system for asbestos construction work, which clearly spells out mandatory work practices to follow to reduce worker exposures (see Occupational Exposure to Asbestos, Title 29, CFR 1926.1101).

3.2 State and Local Regulations

Louisiana state regulations are similar to the Federal regulations. In many instances state and local asbestos regulations are more stringent, therefore, it is recommended that the applicable state asbestos regulation(s) be reviewed before the start of any renovation/demolition projects.

State asbestos regulations include requirements for licensing and certification of personnel who will perform asbestos-related work activities. All personnel who engage in asbestos-related activities must comply with the state licensing/certification requirements as well as with all Federal requirements.

4.0 ANALYTICAL METHODS AND LIMITATIONS

4.1 Bulk Sampling Protocol

EPA and OSHA define an ACBM as any material which contains greater than 1percent asbestos (some state regulations may be more stringent). The ACBM inspection and bulk sampling were performed in accordance with the methods outlined in the EPA guidance document titled *Guidance for Controlling Asbestos-Containing Materials in Buildings* (Document No. 560/5-85/024). In addition, bulk sampling of asbestos was performed in accordance with 40 CFR Part 763, AHERA requirements for number of samples and types of ACBM to be sampled. According to these requirements, materials are classified as either surfacing (e.g., decorative plaster, spray-applied fireproofing), thermal system insulation (e.g., pipe insulation, pipe fitting insulation, boiler insulation), or miscellaneous materials (e.g., floor tile, ceiling tile, plaster, wallboard, mastics).

The number of samples collected from each material varies based on the classification of the material and increases as the potential for a non-uniform mixture of asbestos in the material increases. Typically, regulations require a minimum number of samples to be collected from the different classifications of suspect ACBM, as follows:

- Surfacing Material
  - a) Three samples from homogeneous areas up to 1,000 square feet
  - b) Five samples from homogeneous areas between 1,000 and 5,000 square feet
  - c) Seven samples from homogeneous areas over 5,000 square feet
- Thermal System Insulation
  - a) Minimum of three samples per homogeneous area
- Miscellaneous Material
  - a) Minimum of two samples per homogeneous area, but must be sufficient to determine asbestos content

5.0 SUMMARY OF FINDINGS

5.1 Survey Access Limitations

All accessible areas within the facilities were inspected for ACBM, including access panels to chases, areas above suspended ceilings, and crawl spaces. Any areas not inspected included non-accessible pipe chases, areas above plaster ceilings, areas above patient-care operations, secured areas, and areas occupied by patients where access could not be gained.

The areas not inspected, or where access could not be obtained, must be assumed to contain asbestos and be inspected prior to any renovation or demolition activities.

6.0 CONCLUSION/RECOMMENDATIONS

An operations and maintenance (O&M) program has been developed by the VAMC specifically for the positively identified ACBM in the facilities. Any renovation/demolition work which may impact these positive materials should be conducted in accordance with the O&M program and all applicable Federal, state, and local regulations by appropriately trained and VA-approved personnel and contractors. Since demolition was not performed as part of the inspection work at the facilities, certain areas such as pipe chases and areas above fixed permanent ceilings, fire-door interiors, and vault/safe wall and door linings were not inspected or tested. Prior to renovation and alteration work which could impact these areas, USFin recommends that exploratory demolition be performed and a qualified inspector be utilized to examine the areas and collect samples as needed. USFin recommends sampling of roofing materials, duct mastics, laboratory equipment and electrical components (not specifically examined as part of this survey) if renovation activities are planned which may disturb these materials.

Respectfully Submitted:

Brett L. Brumbaugh – Project Manager

ASBESTOS 3-YEAR REINSPECTION REPORT
DEPARTMENT OF VETERANS AFFAIRS
ALEXANDRIA VAMC – PINEVILLE, LA
JANUARY 2017

LISTING OF BUILDINGS INSPECTED

BLDG. #	BUILDING NAME	YEAR BUILT	# OF FLOORS	SQUARE FOOTAGE
1	Administration Building	1929	4	29,600
2	C&P	1929	4	62,500
3	Women' s Clinic	1929	3	27,500
4	Food and Nutrition	1929	3	24,000
5	Engineering	1929	3	38,500
6	HR	1929	3	40,500
7	Hospital	1950	7	260,500
8	Canteen Service	1940	3	22,500
13	Metal Shop	1929	1l	6,800
15	Fire Station	1931	2	7,500
18	Quarters	1929	3	2,748
19	Quarters	1929	3	5,090
20	Quarters	1929	3	5,090
21	Quarters	1929	3	5,090
22	Quarters	1929	3	4,285
38	Generator Building		1	440
39	Generator Building		1	440
42	Pump House		1	150
117	Paint Shop	1946	1	1,050
120	Paint Shop	1946	1	1,050
TOTAL SQUARE FOOTAGE				545,333

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APPENDIX B

Asbestos Homogeneous Areas by Building

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Building 1				
Floor	**Miscellaneous Materials**	**Ceiling Materials**	**TSI Materials**	**Flooring Materials**
Basement	NO ACM	NO ACM	HMA-1-B-TSI Steam Pipes	HMA-1-B-FT&M Various Floor Tile and Mastic
First	NO ACM	NO ACM	HMA-1-1-TSI HVAC Pipes	HMA-1-1-FT&M Various Floor Tile and Mastic
Second	NO ACM	NO ACM	NO ACM	HMA-1-2-FT&M Various Floor Tile and Mastic
Attic	NO ACM	NO ACM	NO ACM	NO ACM

Building 2				
Floor	**Miscellaneous Materials**	**Ceiling Materials**	**TSI Materials**	**Flooring Materials**
Basement	NO ACM	NO ACM	NO ACM	NO ACM
First	HMA-01 Fire Doors	NO ACM	HMA-2-1-TSI Pipe Insulation (3) Vertical pipes	HMA-2-1-FT&M Various Floor Tile and Mastic
Second	HMA-01 Fire Doors	NO ACM	HMA-2-2-TSI Pipe Insulation (1) Vertical Pipe	HMA-2-2-FT&M Various Floor Tile and Mastic
Third	HMA-01 Fire Doors	NO ACM	HMA-2-3-TSI Pipe Insulation - (1) Vertical Pipes	HMA-2-3-FT&M Various Floor Tile and Mastic
Fourth	HMA-01 Fire Doors	NO ACM	HMA-2-4-TSI Air Handlers Ductwork Pipe Insulation & Fittings - (3) Vertical	HMA-2-4-FT&M Various Floor Tile and Mastic
Attic	HMA-2-A-M Black Mastic on Ductwork	NO ACM	HMA-2-A-TSI Insulation on Air Handler and Ducts Insulated Elbows Exhaust Blower Pipe Insulation & Fittings - (7) Vertical Vibration Isolators	NO ACM

Building 3				
Floor	**Miscellaneous Materials**	**Ceiling Materials**	**TSI Materials**	**Flooring Materials**
Basement	NO ACM	NO ACM	NO ACM	NO ACM
First	HMA-01 Fire Doors	NO ACM	NO ACM	HMA-3-1-FT&M Various Floor Tile and Mastic
Second	HMA-01 Fire Doors	HMA-3-2-CT Black Glue Dots Under 12"X12"	NO ACM	HMA-3-2-FT&M Various Floor Tile and Mastic
Third	HMA-01 Fire Doors	HMA-3-3-CT Black Glue Dots Under 12"X12" Ceiling Tile	NO ACM	HMA-3-3-FT&M Various Floor Tile and Mastic
Attic	NO ACM	NO ACM	NO ACM	NO ACM

Building 4				
Floor	**Miscellaneous Materials**	**Ceiling Materials**	**TSI Materials**	**Flooring Materials**
Basement	HMA-01 Fire Doors	NO ACM	NO ACM	HMA-4-B-FT&M Various Floor Tile and Mastic
First	HMA-01 Fire Doors	NO ACM	NO ACM	HMA-4-1-FT&M Various Floor Tile and Mastic
Building 5				
Floor	**Miscellaneous Materials**	**Ceiling Materials**	**TSI Materials**	**Flooring Materials**
Ground	HMA-01 Fire Doors	NO ACM	HMA-5-G-TSI Steam Pipes, Water Pipes, Tank Insulation	HMA-5-G-FT&M Various Floor Tile and Mastic
First	HMA-01 Fire Doors	NO ACM	NO ACM	HMA-5-1-FT&M Various Floor Tile and Mastic
Second	HMA-01 Fire Doors	NO ACM	NO ACM	HMA-5-2-FT&M Various Floor Tile and Mastic
Building 6				
Floor	**Miscellaneous Materials**	**Ceiling Materials**	**TSI Materials**	**Flooring Materials**
Basement	HMA-01 Fire Doors	NO ACM	HMA-6-B-TSI TSI Piping	HMA-6-B-FT&M Various Floor Tile and Mastic
First	HMA-01 Fire Doors	NO ACM	HMA-6-1-TSI TSI Piping	HMA-6-1-FT&M Various Floor Tile and Mastic
Second	HMA-01 Fire Doors	NO ACM	HMA-6-2-TSI TSI Piping	HMA-6-2-FT&M Various Floor Tile and Mastic
Third	HMA-01 Fire Doors	NO ACM	HMA-6-3-TSI TSI Piping	HMA-6-3-FT&M Various Floor Tile and Mastic
Building 7				
Floor	**Miscellaneous Materials**	**Ceiling Materials**	**TSI Materials**	**Flooring Materials**
Basement	Ductwork HMA-01 Fire Doors	NO ACM	HMA-7-B-TSI HVAC Pipes	HMA-7-B-FT&M Various Floor Tile and Mastic
First	HMA-7-1-M Roofing Materials HMA-01 Fire Doors	NO ACM	NO ACM	HMA-7-1-FT&M Various Floor Tile and Mastic
Second	HMA-01 Fire Doors HMA-03 Transite	NO ACM	NO ACM	HMA-7-2-FT&M Various Floor Tile and Mastic
Third	HMA-01 Fire Doors	NO ACM	NO ACM	HMA-7-3-FT&M Various Floor Tile and Mastic
Fourth	HMA-01 Fire Doors	NO ACM	NO ACM	HMA-7-4-FT&M Various Floor Tile and Mastic
Roof	HMA-01 Fire Doors HMA-7-R-M Roofing Tar	NO ACM	NO ACM	NO ACM

Building 8				
Floor	**Miscellaneous Materials**	**Ceiling Materials**	**TSI Materials**	**Flooring Materials**
Basement	NO ACM	NO ACM	HMA-8-B-TSI Pipe Chases ACM Debris and TSI	NO ACM
First	HMA-01 Fire Doors	NO ACM	NO ACM	HMA-8-1-FT&M Various Floor Tile and Mastic
Second	NO ACM	NO ACM	NO ACM	HMA-8-2-FT&M Various Floor Tile and Mastic
Third	HMA-01 Fire Doors	NO ACM	NO ACM	HMA-8-3-FT&M Various Floor Tile and Mastic
Building 13				
Floor	**Miscellaneous Materials**	**Ceiling Materials**	**TSI Materials**	**Flooring Materials**
Basement	NO ACM	NO ACM	HMA-13-B-TSI Water Pipes HVAC Pipes Pipe Insulation and Contaminated Soil	NO ACM
First	HMA-01 Fire Doors	NO ACM	HMA-13-1-TSI Steam Pipes Water Pipes Vertical Pipes HVAC Pipes	HMA-13-1-FT&M Various Floor Tile and Mastic
Building 14				
Floor	**Miscellaneous Materials**	**Ceiling Materials**	**TSI Materials**	**Flooring Materials**
First Floor Mezzanine	HMA-14-1-MISC Black Table Tops	NO ACM	HMA-14-1-TSI Internal Boiler Insulation & Gaskets	HMA-14-FT-M Various Floor Tile and Mastic
Building 15				
Floor	**Miscellaneous Materials**	**Ceiling Materials**	**TSI Materials**	**Flooring Materials**
First	NO ACM	NO ACM	HMA-15-1-TSI Steam Pipes	HMA-15-1-FT&M Various Floor Tile and Mastic
Building 18				
Floor	**Miscellaneous Materials**	**Ceiling Materials**	**TSI Materials**	**Flooring Materials**
Basement	NO ACM	NO ACM	HMA-18-B-TSI Steam Pipes Water Pipes HMA-18-2-TSI Black Mastic Wrap	NO ACM
First	NO ACM	NO ACM	NO ACM	NO ACM
Second	NO ACM	NO ACM	NO ACM	NO ACM
Attic	NO ACM	NO ACM	NO ACM	NO ACM
Building 19				
Floor	**Miscellaneous Materials**	**Ceiling Materials**	**TSI Materials**	**Flooring Materials**
Basement	NO ACM	NO ACM	HMA-19-B-TSI Steam Pipes Water Pipes	NO ACM
First	NO ACM	NO ACM	NO ACM	NO ACM
Second	NO ACM	NO ACM	NO ACM	NO ACM
Attic	NO ACM	NO ACM	NO ACM	NO ACM

Building 20				
Floor	**Miscellaneous Materials**	**Ceiling Materials**	**TSI Materials**	**Flooring Materials**
Basement	NO ACM	NO ACM	HMA-20-B-TSI All Thermal System Insluation	NO ACM
First	NO ACM	NO ACM	NO ACM	NO ACM
Second	NO ACM	NO ACM	NO ACM	NO ACM
Attic	NO ACM	NO ACM	NO ACM	NO ACM
Building 21				
Floor	**Miscellaneous Materials**	**Ceiling Materials**	**TSI Materials**	**Flooring Materials**
Basement	NO ACM	NO ACM	HMA-21-B-TSI All Thermal Insulation	NO ACM
First	NO ACM	NO ACM	NO ACM	NO ACM
Second	NO ACM	NO ACM	NO ACM	NO ACM
Attic	NO ACM	NO ACM	NO ACM	NO ACM
Building 22				
Floor	**Miscellaneous Materials**	**Ceiling Materials**	**TSI Materials**	**Flooring Materials**
Basement	HMA-22-B-M Thermal System Insulation Debris	NO ACM	HMA-22-B-TSI White Block Insulation	NO ACM
First	NO ACM	NO ACM	NO ACM	NO ACM
Second	HMA-22-2-M Paper Backing in Lighting Fixtures	NO ACM	NO ACM	NO ACM
Attic	NO ACM	NO ACM	NO ACM	NO ACM
Building 38				
Floor	**Miscellaneous Materials**	**Ceiling Materials**	**TSI Materials**	**Flooring Materials**
First	HMA-01 Fire Doors	NO ACM	NO ACM	NO ACM
Building 39				
Floor	**Miscellaneous Materials**	**Ceiling Materials**	**TSI Materials**	**Flooring Materials**
First	HMA-01 Fire Doors	NO ACM	NO ACM	NO ACM
Building 42				
Floor	**Miscellaneous Materials**	**Ceiling Materials**	**TSI Materials**	**Flooring Materials**
First	HMA-01 Fire Doors	NO ACM	HMA-42-1-TSI Non-Block White Insulation	NO ACM

Building 136				
Floor	**Miscellaneous Materials**	**Ceiling Materials**	**TSI Materials**	**Flooring Materials**
First	HMA-01 Fire Doors	NO ACM	HMA-136-B-TSI Piping and Insulation	NO ACM
Buildings T-117 & T-120				
Floor	**Miscellaneous Materials**	**Ceiling Materials**	**TSI Materials**	**Flooring Materials**
First	NO ACM	NO ACM	HMA-117-1-TSI HMA-120-1-TSI Thermal System Insulation	NO ACM
Manhole A - TSI				
HMA-MANHOLE-A-TSI White Wrap Fiberglass Insulation (1) Fitting				
Manhole C - TSI				
HMA-MANHOLE-C-TSI White Wrap Fiberglass Insulation (1) Fitting				
Steam Tunnels - TSI				
HMA-TUNNELS-TSI Mag Block Steam Pipe Insulation				

APPENDIX C

Asbestos Material Assessments Areas by Building

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Homogeneous Area No.	Bldg	Floor	Material Description	Friable	Condition at Last Inspection	Condition Change	Accessibility Restricted	Potential for Disturbance (H, M, L)	Condition	Damage Type	Damage Severity	AHERA Damage Group	Hazard Rank	Removal Priority	Current Condition		Potential for Disturbance	
															Rating	Based On	Rating	Based On
BUILDING 1																		
HMA-1-B-TSI	1	Basement	TSI	YES	G	NO	YES	L	G	N	N	ND	2	6	8	Visual	2	Access
COMMENTS: TSI damage found in pipe chase between rooms 6 and 7.																		
HMA-1-B-FT&M	1	Basement	Various Floor Tile & Mastic	NO	G	NO	YES	L	G	N	N	ND	1	7	6	Visual	3	Floor Maintenance
COMMENTS: None																		
HMA-1-1-FT&M	1	First	Various Floor Tile & Mastic	NO	G	NO	YES	L	G	N	N	ND	1	7	8	Visual	1	Floor Maintenance
COMMENTS: Carpet installed over floor tile in south wing																		
HMA-1-1-TSI	1	First	TSI	YES	G	NO	YES	L	G	N	N	ND	2	6	8	Visual	2	Access
COMMENTS: Room 110 contains 2 vertical 2" lines.																		
HMA-1-2-FT&M	1	Second	Various Floor Tile & Mastic	NO	G	NO	YES	L	G	N	N	ND	1	7	8	Visual	1	Floor Maintenance
COMMENTS: The majority of the rooms have added carpert over floor tile.																		

Homogeneous Area No.	Bldg	Floor	Material Description	Friable	Condition at Last Inspection	Condition Change	Accessibility Restricted	Potential for Disturbance (H, M, L)	Condition	Damage Type	Damage Severity	AHERA Damage Group	Hazard Rank	Removal Priority	Current Condition		Potential for Disturbance	
															Rating	Based On	Rating	Based On
BUILDING 2																		
HMA-2-1-TSI	2	First	TSI	YES	G	NO	YES	L	G	N	N	ND	2	6	8	Visual	2	Access
COMMENTS: No changes																		
HMA-2-1-FT&M	2	First	Various Floor Tile & Mastic	NO	G	NO	YES	L	G	N	N	ND	1	7	8	Visual	2	Floor Maintenance
COMMENTS:																		
HMA-2-2-M	2	Second	Miscellaneous Materials	**Abated**														
COMMENTS:Abated																		
HMA-2-2-TSI	2	Second	TSI	YES	G	NO	YES	L	G	N	N	ND	2	6	8	Visual	2	Access
COMMENTS: No Changes Made																		
HMA-2-2-FT&M	2	Second	Various Floor Tile & Mastic	NO	G	NO	YES	L	G	N	N	ND	1	7	8	Visual	1	Floor Maintenance
COMMENTS: No Changes Made																		
HMA-2-3-TSI	2	Third	TSI	YES	G	NO	YES	L	G	N	N	ND	2	6	3	Visual	3	Access
COMMENTS: No Changes Made																		
HMA-2-3-FT&M	2	Third	Various Floor Tile & Mastic	NO	G	NO	YES	L	G	N	N	ND	1	7	8	Visual	1	Floor Mainenance
COMMENTS: No Changes Made																		
HMA-2-4-TSI	2	Fourth	TSI	YES	G	NO	YES	L	G	N	N	ND	2	6	9	Visual	1	Access
COMMENTS: No Changes Made																		
HMA-2-4-FT&M	2	Fourth	Various Floor Tile & Mastic	NO	G	NO	YES	L	G	N	N	ND	1	7	9	Visual	1	Floor Mainenance
COMMENTS: No Changes Made																		
HMA-2-A-M	2	Attic	Miscellaneous	YES	G	NO	RESTRICTED	L	G	N	N	ND	2	6	8	Visual	3	Vibration
COMMENTS: No Changes Made																		
HMA-2-A-TSI	2	Attic	TSI	YES	G	NO	RESTRICTED	L	G	N	N	ND	2	6	8	Visual	2	Access
COMMENTS: No Changes Made																		

Homogeneous Area No.	Bldg	Floor	Material Description	Friable	Condition at Last Inspection	Condition Change	Accessibility Restricted	Potential for Disturbance (H, M, L)	Condition	Damage Type	Damage Severity	AHERA Damage Group	Hazard Rank	Removal Priority	Current Condition		Potential for Disturbance	
															Rating	Based On	Rating	Based On
BUILDING 3																		
HMA-3-1-FT&M	3	First	Various Floor Tile & Mastic	NO	G	NO	YES	L	G	N	N	ND	1	7	8	Visual	1	Floor Maintenance
COMMENTS: No Changes Made																		
HMA-01	3	First	Fire Doors (3)	YES	-	-	YES	L	-	-	-	-	-	-	10	Visual	1	Access
COMMENTS: No Changes Made																		
HMA-3-2-CT	3	Second	12"x12" Ceiling Glue Dots	NO	G	NO	NO	L	G	N	N	ND	1	7	10	Visual	1	No Access
COMMENTS: No Changes Made																		
HMA-01	3	Second	Fire Door (1)	YES	-	-	YES	L	-	-	-	-	-	-	10	Visual	1	Access
COMMENTS: No Changes Made																		
HMA-3-2-FT&M	3	Second	Various Floor Tile & Mastic	NO	G	NO	YES	L	G	N	N	ND	1	7	8	Visual	2	Floor Maintenance
COMMENTS: No Changes Made																		
HMA-3-3-CT	3	Third	12"x12" Ceiling Glue Dots	NO	G	NO	NO	L	G	N	N	ND	1	7	10	Visual	1	No Access
COMMENTS: No Changes Made																		
HMA-3-3-FT&M	3	Third	Various Floor Tile & Mastic	NO	G	NO	YES	L	G	N	N	ND	1	7	8	Visual	2	Floor Maintenance
COMMENTS: No Changes Made																		
HMA-01	3	Third	Fire Doors (7)	YES	-	-	YES	L	-	-	-	-	-	-	10	Visual	1	Access
COMMENTS: No Changes Made																		

Homogeneous Area No.	Bldg	Floor	Material Description	Friable	Condition at Last Inspection	Condition Change	Accessibility Restricted	Potential for Disturbance (H, M, L)	Condition	Damage Type	Damage Severity	AHERA Damage Group	Hazard Rank	Removal Priority	Current Condition		Potential for Disturbance	
															Rating	Based On	Rating	Based On
BUILDING 4																		
HMA-4-B-TSI	4	Basement	TSI	YES	G	NO	YES	L	G	N	N	ND	2	6	8	Visual	1	Access
COMMENTS: All TSI has been removed from the basement in 2016 per Owner																		
HMA-4-B-FT&M	4	Basement	Various Floor Tile & Mastic	NO	G	NO	YES	L	G	N	N	ND	1	7	8	Visual	1	Floor Maintenance
COMMENTS: Entire floor has been abated, except for stairs, Room 118, 119, and 120 as per owner - Renovation was completed.																		
HMA-01	4	Basement	Fire Doors (6)	YES	-	-	YES	L	-	-	-	-	-	-	10	Visual	1	Access
COMMENTS: No Changes Made																		
HMA-4-1-FT&M	4	First	Various Floor Tile & Mastic	NO	G	NO	YES	L	G	N	N	ND	1	7	8	Visual	1	Floor Maintenance
COMMENTS: Flooring has been abated, except for rooms 103 and 121, which are stairways as per owner.																		
HMA-01	4	First	Fire Doors (5)	YES	-	-	YES	L	-	-	-	-	-	-	10	Visual	1	Access
COMMENTS: No Changes Made																		

Homogeneous Area No.	Bldg	Floor	Material Description	Friable	Condition at Last Inspection	Condition Change	Accessibility Restricted	Potential for Disturbance (H, M, L)	Condition	Damage Type	Damage Severity	AHERA Damage Group	Hazard Rank	Removal Priority	Current Condition		Potential for Disturbance	
															Rating	Based On	Rating	Based On
BUILDING 5																		
HMA-5-G-TSI	5	Ground	TSI (Piping)	YES	G	NO	YES	L	G	N	N	ND	2	6	7	Visual	3	Access
HMA-5-G-TSI	5	Ground	TSI (Tank)	YES	G	NO	YES	L	G	N	N	ND	2	6	7	Visual	3	Access
COMMENTS: Minor damage to seams in walkway to Building 4.																		
HMA-5-G-FT&M	5	Ground	Various Floor Tile & Mastic	NO	G	NO	YES	L	G	N	N	ND	1	7	8	Visual	1	Floor Maintenance
COMMENTS: No Changes Made																		
HMA-01	5	Ground	Fire Doors (4)	YES	-	-	YES	L	-	-	-	-	-	-	10	Visual	1	Access
COMMENTS: No Changes Made																		
HMA-5-1-FT&M	5	First	Various Floor Tile & Mastic	NO	G	NO	YES	L	G	N	N	ND	1	7	9	Visual	1	Floor Maintenance
COMMENTS: No Changes Made																		
HMA-01	5	First	Fire Doors (2)	YES	-	-	YES	L	-	-	-	-	-	-	10	Visual	1	Access
COMMENTS: No Changes Made																		
HMA-5-2-FT&M	5	Second	Various Floor Tile & Mastic	NO	G	NO	YES	L	G	N	N	ND	1	7	9	Visual	1	Floor Maintenance
COMMENTS: No Changes Made																		
HMA-01	5	Second	Fire Doors (2)	YES	-	-	YES	L	-	-	-	-	-	-	10	Visual	1	Access
COMMENTS: No Changes Made																		

Homogeneous Area No.	Bldg	Floor	Material Description	Friable	Condition at Last Inspection	Condition Change	Accessibility Restricted	Potential for Disturbance (H, M, L)	Condition	Damage Type	Damage Severity	AHERA Damage Group	Hazard Rank	Removal Priority	Current Condition		Potential for Disturbance	
															Rating	Based On	Rating	Based On
BUILDING 6																		
HMA-6-B-TSI	6	Basement	TSI	YES	D	NO	YES	M	R	M	O	D	4	4	6	Some Damage	6	Access
COMMENTS: No Changes Made																		
HMA-6-B-FT&M	6	Basement	Various Floor Tile & Mastic	NO	G	NO	YES	L	G	N	N	ND	1	7	10	Floor Mainten ance	1	Access
COMMENTS: No Changes Made																		
HMA-6-1-TSI	6	First	TSI	YES	G	NO	YES	L	G	N	N	ND	2	6	10	Visual	1	Access
COMMENTS: No Changes Made																		
HMA-6-1-FT&M	6	First	Various Floor Tile & Mastic	NO	G	NO	YES	L	G	N	N	ND	1	7	10	Visual	1	Access
COMMENTS: No Changes Made																		
HMA-6-2-TSI	6	Second	TSI	YES	G	NO	YES	L	G	N	N	ND	2	6	10	Visual	1	Access
COMMENTS: No Changes Made																		
HMA-6-2-FT&M	6	Second	Various Floor Tile & Mastic	NO	G	NO	YES	L	G	N	N	ND	1	7	10	Visual	1	Access
COMMENTS: Carpet was installed over floor tile in 236 and 237																		
HMA-6-3-FT&M	6	Third	Various Floor Tile & Mastic	NO	G	NO	YES	L	G	N	N	ND	1	7	10	Visual	1	Access
COMMENTS: No Changes Made																		

Homogeneous Area No.	Bldg	Floor	Material Description	Friable	Condition at Last Inspection	Condition Change	Accessibility Restricted	Potential for Disturbance (H, M, L)	Condition	Damage Type	Damage Severity	AHERA Damage Group	Hazard Rank	Removal Priority	Current Condition		Potential for Disturbance	
															Rating	Based On	Rating	Based On
BUILDING 7																		
HMA-7-B-M	7	Basement	Miscellaneous Materials	YES	R	YES	YES	M	G	P	P	D	3	5	5	Visual	5	Access
COMMENTS: The north side of the east wing was undergoing renovatioin & abatement at the time of the inspection. Updates to be made during next reinspection																		
HMA-7-B-TSI	7	Basement	TSI	YES	G	NO	YES	L	G	N	N	ND	2	6	8	Visual	1	Floor Maintenance
COMMENTS: The north side of the east wing was undergoing renovatioin & abatement at the time of the inspection. Updates to be made during next reinspection																		
HMA-7-B-FT&M	7	Basement	Various Floor Tile & Mastic	NO	G	NO	YES	L	G	N	N	ND	1	7	8	Visual	1	Floor Maintenance
COMMENTS: The north side of the east wing was undergoing renovatioin & abatement at the time of the inspection. Updates to be made during next reinspection																		
HMA-01	7	Basement	Fire Doors (9)	YES	-	-	YES	L	-	-	-	-	-	-	10	Visual	1	Access
COMMENTS: No Changes Made																		
HMA-7-1-FT&M	7	First	Various Floor Tile & Mastic	NO	G	NO	YES	L	G	N	N	ND	1	7	8	Visual	1	Floor Maintenance
COMMENTS: No Changes Made																		
HMA-7-1-M	7	First	Roofing Material	NO	G	NO	RESTRICTED	L	G	N	N	ND	1	7	8	Visual	1	Access
COMMENTS: No Changes Made																		
HMA-01	7	First	Fire Doors (17)	YES	-	-	YES	L	-	-	-	-	-	-	10	Visual	1	Access
COMMENTS: No Changes Made																		
HMA-7-2-FT&M	7	Second	Various Floor Tile & Mastic	NO	G	NO	YES	L	G	N	N	ND	1	7	10	Visual	1	Floor Maintenance
COMMENTS: No Changes Made																		
HMA-03	7	Second	Transite	NO	-	-	NO	3	-	-	-	-	-	-	10	Visual	1	Visual
COMMENTS: No Changes Made																		
HMA-01	7	Second	Fire Doors (8)	YES	-	-	YES	L	-	-	-	-	-	-	10	Visual	1	Access
COMMENTS: No Changes Made																		
HMA-7-3-FT&M	7	Third	Various Floor Tile & Mastic	NO	G	NO	YES	L	G	N	N	ND	1	7	8	Visual	2	Floor Maintenance
COMMENTS: No Changes Made																		
HMA-01	7	Third	Fire Doors (8)	YES	-	-	YES	L	-	-	-	-	-	-	10	Visual	1	Access
COMMENTS: No Changes Made																		
HMA-7-4-FT&M	7	Fourth	Various Floor Tile & Mastic	NO	G	NO	YES	L	G	N	N	ND	1	7	8	Visual	1	Floor Maintenance
COMMENTS: Carpeting has been installed over the floor tile in Rooms 478-480, 483-485, and 487-491.																		
HMA-01	7	Fourth	Fire Doors (8)	YES	-	-	YES	L	-	-	-	-	-	-	10	Visual	1	Access
COMMENTS: No Changes Made																		
HMA-7-R-M	7	Roof	Miscellaneous Materials	NO	G	NO	RESTRICTED	L	G	N	N	ND	1	7	8	Visual	1	Access
COMMENTS: No Changes Made																		

Homogeneous Area No.	Bldg	Floor	Material Description	Friable	Condition at Last Inspection	Condition Change	Accessibility Restricted	Potential for Disturbance (H, M, L)	Condition	Damage Type	Damage Severity	AHERA Damage Group	Hazard Rank	Removal Priority	Current Condition		Potential for Disturbance	
															Rating	Based On	Rating	Based On
BUILDING 8																		
HMA-8-B-TSI	8	Basement	TSI	YES	SD	NO	RESTRICTED	H	SD	P	X	SD	6	4	6	Some Damage	8	Access
COMMENTS: No Changes Made																		
HMA-8-1-FT&M	8	First	Various Floor Tile & Mastic	NO	G	NO	YES	L	G	N	N	ND	1	7	10	Visual	1	Access
COMMENTS: 9" tile was identified in Room 104 and 121.																		
HMA-01	8	First	Fire Doors (3)	YES	-	-	YES	L	-	-	-	-	-	-	10	Visual	1	Access
COMMENTS: No Changes Made																		
HMA-8-2-FT&M	8	Second	Various Floor Tile & Mastic	NO	G	NO	YES	L	G	N	N	ND	1	7	10	Visual	1	Access
COMMENTS: 9"tile was identified in Room 202																		
HMA-01	8	Second	Fire Doors (1)	YES	-	-	YES	L	-	-	-	-	-	-	10	Visual	1	Access
COMMENTS: No Changes Made																		
HMA-8-3-FT&M	8	Third	Various Floor Tile & Mastic	NO	G	NO	YES	L	G	N	N	ND	1	7	10	Visual	1	Access
COMMENTS: No Changes Made																		

Homogeneous Area No.	Bldg	Floor	Material Description	Friable	Condition at Last Inspection	Condition Change	Accessibility Restricted	Potential for Disturbance (H, M, L)	Condition	Damage Type	Damage Severity	AHERA Damage Group	Hazard Rank	Removal Priority	Current Condition		Potential for Disturbance	
															Rating	Based On	Rating	Based On
BUILDING 13																		
HMA-13-B-TSI	13	Basement	TSI	YES	D	NO	YES	L	D	P	M	D	2	6	3	Visual	2	Limited to No Access
COMMENTS: No Changes Made																		
HMA-13-1-TSI	13	First	TSI	YES	D	NO	YES	L	D	P	M	D	2	6	7	Visual	3	Access
COMMENTS: No Changes Made																		
HMA-13-1-FT&M	13	First	Various Floor Tile & Mastic	NO	G	NO	YES	L	G	N	N	ND	1	7	9	Visual	1	Floor Maintenance
COMMENTS: No Changes Made																		
HMA-01	13	First	Fire Door (1)	YES	-	-	YES	L	-	-	-	-	-	-	10	Visual	1	Access
COMMENTS: No Changes Made																		

Homogeneous Area No.	Bldg	Floor	Material Description	Friable	Condition at Last Inspection	Condition Change	Accessibility Restricted	Potential for Disturbance (H, M, L)	Condition	Damage Type	Damage Severity	AHERA Damage Group	Hazard Rank	Removal Priority	Current Condition		Potential for Disturbance	
															Rating	Based On	Rating	Based On
BUILDING 14																		
HMA-14-1-FT&M	14	First	Floor Tile and Mastic	No	-	-	YES	-	-	-	-	-	-	-	8	Visual	1	Floor Maintenance
COMMENTS: No Changes Made																		
HMA-14-1-TSI	14	First	TSI	YES	D	NO	YES	L	G	-	-	ND	1	-	10	Visual	1	Access
COMMENTS: Added internal boiler insulation and gaskets on the 3 boilers. Destructive techniques must be used to identify all assumed ACM inside the boilers prior to demolition.																		
HMA-14-1-MISC	14	First	MISC	NO	-	-	YES	L	G	-	-	ND	1	-	10	Visual	1	Access
COMMENTS: Added Black table top at the west wall of the boiler area. Good condition.																		
Homogeneous Area No.	Bldg	Floor	Material Description	Friable	Condition at Last Inspection	Condition Change	Accessibility Restricted	Potential for Disturbance (H, M, L)	Condition	Damage Type	Damage Severity	AHERA Damage Group	Hazard Rank	Removal Priority	Current Condition		Potential for Disturbance	
															Rating	Based On	Rating	Based On
BUILDING 15																		
HMA-15-1-TSI	15	First	TSI	YES	G	NO	YES	L	G	N	N	ND	2	6	8	Visual	3	Access
COMMENTS: No changes																		
HMA-15-1-FT&M	15	First	Various Floor Tile & Mastic	NO	G	NO	YES	L	G	N	N	ND	1	7	8	Visual	1	Floor Maintenance
COMMENTS: No Changes Made																		
Homogeneous Area No.	Bldg	Floor	Material Description	Friable	Condition at Last Inspection	Condition Change	Accessibility Restricted	Potential for Disturbance (H, M, L)	Condition	Damage Type	Damage Severity	AHERA Damage Group	Hazard Rank	Removal Priority	Current Condition		Potential for Disturbance	
															Rating	Based On	Rating	Based On
BUILDING 18																		
HMA-18-B-TSI	18	Basement	TSI	YES	D	NO	YES	L	R	P	M	ND	3	5	6	Some Damage Visual	1	Access
COMMENTS: No Changes Made																		
HMA-18-2-TSI	18	Second	Black Mastic Wrap	NO	-	-	YES	L	-	-	-	-	-	-	10	Visual	1	Access
COMMENTS:																		
Homogeneous Area No.	Bldg	Floor	Material Description	Friable	Condition at Last Inspection	Condition Change	Accessibility Restricted	Potential for Disturbance (H, M, L)	Condition	Damage Type	Damage Severity	AHERA Damage Group	Hazard Rank	Removal Priority	Current Condition		Potential for Disturbance	
															Rating	Based On	Rating	Based On
BUILDING 19																		
HMA-19-B-TSI	19	Basement	TSI	YES	D	NO	YES	L	R	P	M	ND	3	5	6	Some Damage	3	Access
COMMENTS: No Changes Made																		
Homogeneous Area No.	Bldg	Floor	Material Description	Friable	Condition at Last Inspection	Condition Change	Accessibility Restricted	Potential for Disturbance (H, M, L)	Condition	Damage Type	Damage Severity	AHERA Damage Group	Hazard Rank	Removal Priority	Current Condition		Potential for Disturbance	
															Rating	Based On	Rating	Based On
BUILDING 20																		
HMA-20-B-TSI	20	Basement	TSI	YES	G	NO	YES	L	G	N	N	ND	2	6	8	Visual	3	Access
COMMENTS: No Changes Made																		
Homogeneous Area No.	Bldg	Floor	Material Description	Friable	Condition at Last Inspection	Condition Change	Accessibility Restricted	Potential for Disturbance (H, M, L)	Condition	Damage Type	Damage Severity	AHERA Damage Group	Hazard Rank	Removal Priority	Current Condition		Potential for Disturbance	
															Rating	Based On	Rating	Based On
BUILDING 21																		
HMA-21-B-TSI	21	Basement	TSI	YES	G	NO	YES	L	G	N	N	ND	2	6	8	Visual	3	Access
COMMENTS: No Changes Made																		
Homogeneous Area No.	Bldg	Floor	Material Description	Friable	Condition at Last Inspection	Condition Change	Accessibility Restricted	Potential for Disturbance (H, M, L)	Condition	Damage Type	Damage Severity	AHERA Damage Group	Hazard Rank	Removal Priority	Current Condition		Potential for Disturbance	
															Rating	Based On	Rating	Based On
BUILDING 22																		
HMA-22-B-M	22	Basement	Miscellaneous Materials	YES	G	NO	YES	M	G	N	N	ND	2	6	8	Visual	2	Access
COMMENTS: No Changes Made																		
HMA-22-B-TSI	22	Basement	TSI	YES	G	NO	YES	L	G	N	N	ND	2	6	6	Visual	3	Access
COMMENTS: No Changes Made																		
HMA-22-2-M	22	Second	Miscellaneous Materials	YES	G	NO	RESTRICTED	L	G	N	N	ND	1	7	8	Visual	1	Limited Access
COMMENTS: No Changes Made																		

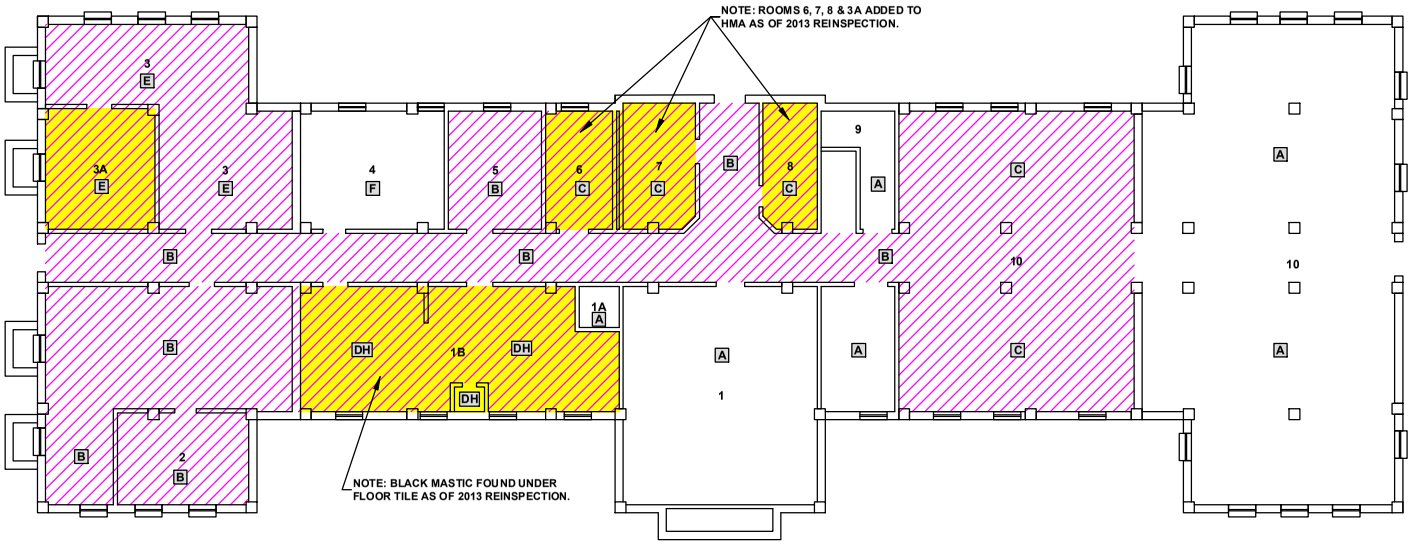
Homogeneous Area No.	Bldg	Floor	Material Description	Friable	Condition at Last Inspection	Condition Change	Accessibility Restricted	Potential for Disturbance (H, M, L)	Condition	Damage Type	Damage Severity	AHERA Damage Group	Hazard Rank	Removal Priority	Current Condition		Potential for Disturbance	
															Rating	Based On	Rating	Based On
BUILDING 38																		
HMA-01	38	First	Fire Door (1)	YES	-	-	YES	L	-	-	-	-	-	-	10	Visual	1	Access
COMMENTS: No Changes Made																		
Homogeneous Area No.	Bldg	Floor	Material Description	Friable	Condition at Last Inspection	Condition Change	Accessibility Restricted	Potential for Disturbance (H, M, L)	Condition	Damage Type	Damage Severity	AHERA Damage Group	Hazard Rank	Removal Priority	Current Condition		Potential for Disturbance	
															Rating	Based On	Rating	Based On
BUILDING 39																		
HMA-01	39	First	Fire Door (1)	YES	-	-	YES	L	-	-	-	-	-	-	10	Visual	1	Access
COMMENTS: No Changes Made																		
Homogeneous Area No.	Bldg	Floor	Material Description	Friable	Condition at Last Inspection	Condition Change	Accessibility Restricted	Potential for Disturbance (H, M, L)	Condition	Damage Type	Damage Severity	AHERA Damage Group	Hazard Rank	Removal Priority	Current Condition		Potential for Disturbance	
															Rating	Based On	Rating	Based On
BUILDING 42																		
HMA-42-1-TSI	42	First	TSI	YES	G	NO	YES	L	G	N	N	ND	2	6	8	Visual	2	Vibration and Access
COMMENTS: No Changes Made																		
HMA-01	42	First	Fire Door (1)	YES	-	-	YES	L	-	-	-	-	-	-	10	Visual	1	Access
COMMENTS: No Changes Made																		
Homogeneous Area No.	Bldg	Floor	Material Description	Friable	Condition at Last Inspection	Condition Change	Accessibility Restricted	Potential for Disturbance (H, M, L)	Condition	Damage Type	Damage Severity	AHERA Damage Group	Hazard Rank	Removal Priority	Current Condition		Potential for Disturbance	
															Rating	Based On	Rating	Based On
BUILDING 136																		
HMA-136-B-TSI	136	Basement	Piping and Insulation	YES	-	-	YES	5	-	-	-	-	-	-	5	Visual	5	Access
COMMENTS: No Changes Made																		
HMA-01	136	First	Fire Doors (4)	YES	-	-	YES	L	-	-	-	-	-	-	10	Visual	1	Access
COMMENTS: No Changes Made																		
Homogeneous Area No.	Bldg	Floor	Material Description	Friable	Condition at Last Inspection	Condition Change	Accessibility Restricted	Potential for Disturbance (H, M, L)	Condition	Damage Type	Damage Severity	AHERA Damage Group	Hazard Rank	Removal Priority	Current Condition		Potential for Disturbance	
															Rating	Based On	Rating	Based On
BUILDINGS T-117 & T-120																		
HMA-117-1-TSI HMA-	T-117	Firs	TSI	YES	G	NO	YES	L	G	N	N	ND	2	6	7	Visual	3	Access
COMMENTS: All damaged TSI has been repaired																		
Homogeneous Area No.	Bldg	Floor	Material Description	Friable	Condition at Last Inspection	Condition Change	Accessibility Restricted	Potential for Disturbance (H, M, L)	Condition	Damage Type	Damage Severity	AHERA Damage Group	Hazard Rank	Removal Priority	Current Condition		Potential for Disturbance	
															Rating	Based On	Rating	Based On
MANHOLE A																		
HMA-MANHOLE- A-			TSI	YES	G	NO	RESTRICTED	L	G	N	N	ND	2	6	8	Visual	1	Access
COMMENTS: No Changes Made																		
Homogeneous Area No.	Bldg	Floor	Material Description	Friable	Condition at Last Inspection	Condition Change	Accessibility Restricted	Potential for Disturbance (H, M, L)	Condition	Damage Type	Damage Severity	AHERA Damage Group	Hazard Rank	Removal Priority	Current Condition		Potential for Disturbance	
															Rating	Based On	Rating	Based On
MANHOLE C																		
HMA-MANHOLE- C-			TSI	YES	G	NO	RESTRICTED	L	G	N	N	ND	2	6	8	Visual	1	Access
COMMENTS: No Changes Made																		
Homogeneous Area No.	Bldg	Floor	Material Description	Friable	Condition at Last Inspection	Condition Change	Accessibility Restricted	Potential for Disturbance (H, M, L)	Condition	Damage Type	Damage Severity	AHERA Damage Group	Hazard Rank	Removal Priority	Current Condition		Potential for Disturbance	
															Rating	Based On	Rating	Based On
STEAM TUNNELS																		
HMA-TUNNELS-TSI	Tunnels	Tunnel	TSI	YES	G	NO	RESTRICTED	L	G	N	N	ND	2	6	8	Visual	1	Access
COMMENTS: Newly added HA during 2017 reinspection																		

APPENDIX D

Asbestos Location Drawings

USFin

Building 1



TITLE

BUILDING 1 - BASEMENT
FLOORING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

HMA-1-B-FT & M FLOOR TILE AND/OR MASTIC - 4,060 SQ FT

AREA UPDATED AS OF 2013 REINSPECTION

FLOORING LEGEND

- A CONCRETE
- B GRAYISH FLOOR MATERIAL
- C RED / WHITE & BLACK / WHITE 9" X 9"
- D GRAY W/ GREEN / WHITE SPECKS 12" X 12"
- E BLACK MASTIC ON CONCRETE
- F BROWN CARPET OVER CONCRETE
- G CERAMIC
- H BLACK MASTIC

USFin

PROJECT NO.	SCALE
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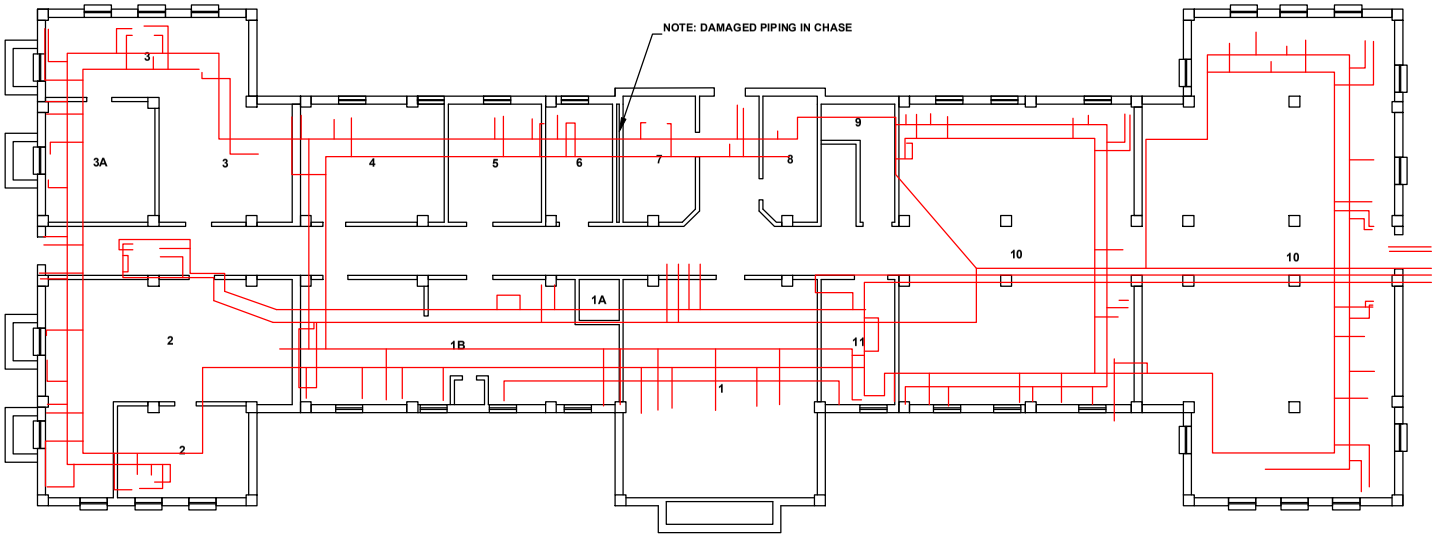
PAGE	**DRAWN BY**
1	BLB
SHEET	**DATE**
B - 11 X 17	2/12/17

Floor.dwg



TITLE

BUILDING 1 - BASEMENT
PIPING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

HMA-1-B-TSI STEAM PIPES
1,830 LIN FT

USFin

PROJECT NO.	SCALE
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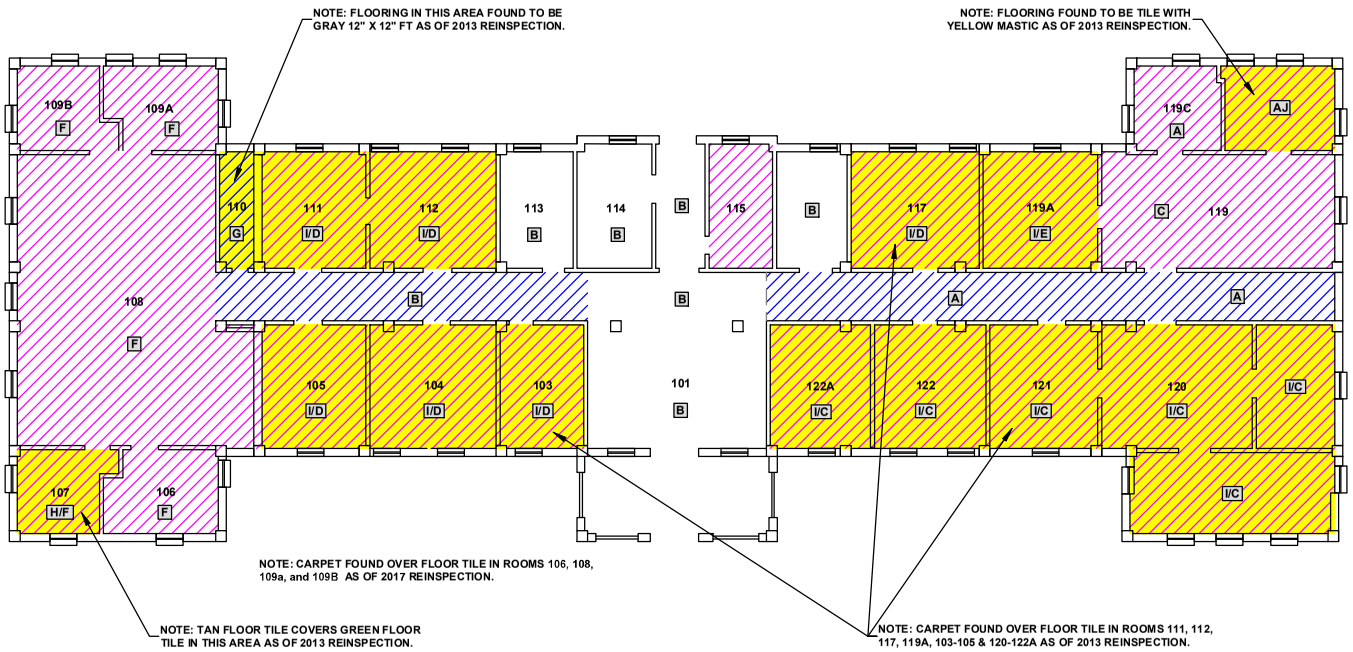
SHEET	**DATE**
B - 11 X 17	2-12-17



TITLE

BUILDING 1 - FIRST FLOOR
FLOORING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

- HMA-1-1-FT & M FLOOR TILE AND/OR MASTIC - 5,410 SQ FT
- ABATED AREAS DATE & COMPANY UNKNOWN
- AREA UPDATED AS OF 2013 REINSPECTION

FLOORING LEGEND

- A CREAM W/ LIGHT BROWN SPECKS 12" X 12"
- B CERAMIC
- C AQUA / WHITE 12" X 12"
- D WHITE / GREEN 9" X 9"
- E GRAY W/ BROWN/WHITE SPECKS 12" X 12"
- F GREEN 12" X 12" UNDER CARPET
- G GRAY 12" X 12" FT
- H TAN 18" X 18" PEEL & STICK FT
- I CARPET
- J YELLOW MASTIC

USFin

PROJECT NO.	SCALE
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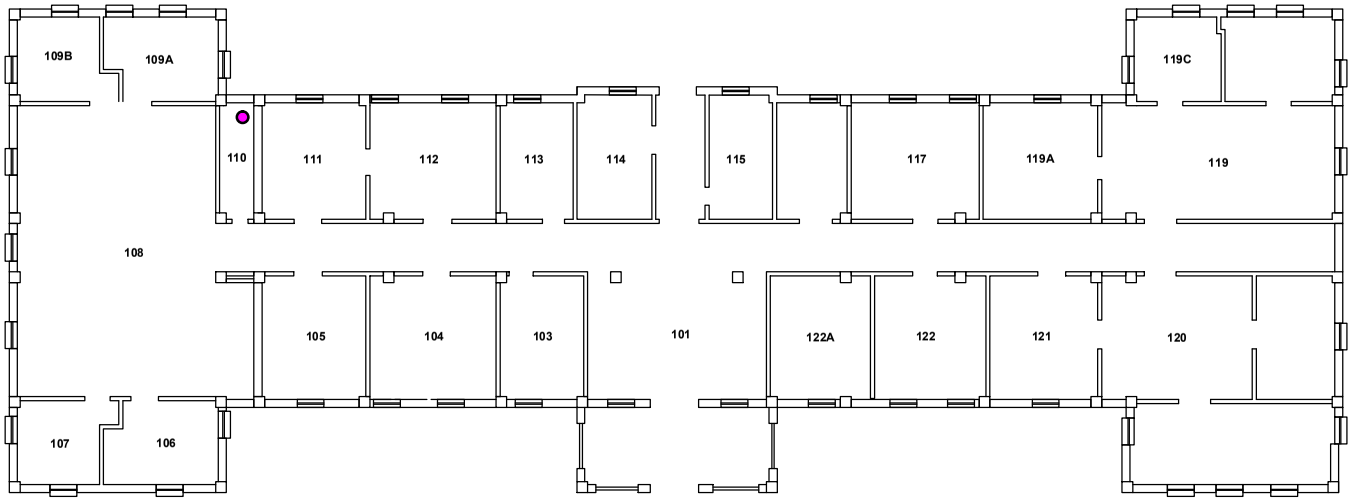
PAGE	**DRAWN BY**
1	BLB
SHEET	**DATE**
B - 11 X 17	2-12-17



TITLE

BUILDING 1 - FIRST FLOOR
PIPING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

HMA-1-1-TSI HVAC PIPES
(1) VERTICAL

USFin

PROJECT NO.	SCALE
17001	1" = 15'
PAGE	**DRAWN BY**
1	BLB
SHEET	**DATE**
B - 11 X 17	2-12-17

TITLE

BUILDING 1 - SECOND FLOOR
FLOORING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

HMA-1-2-FT & M FLOOR TILE AND/OR MASTIC - 6,455 SQ FT

AREA UPDATED AS OF 2013 REINSPECTION

FLOORING LEGEND

- A GRAY 12" X 12"
- B AQUA 12" X 12"
- C DARK AQUA 12" X 12"
- D CERAMIC
- E DARK GREEN 12" X 12"
- F CARPET OVER 9" X 9" FLOOR TILE
- G CARPET

USFin

PROJECT NO.	SCALE
17001	1" = 15'
PAGE	**DRAWN BY**
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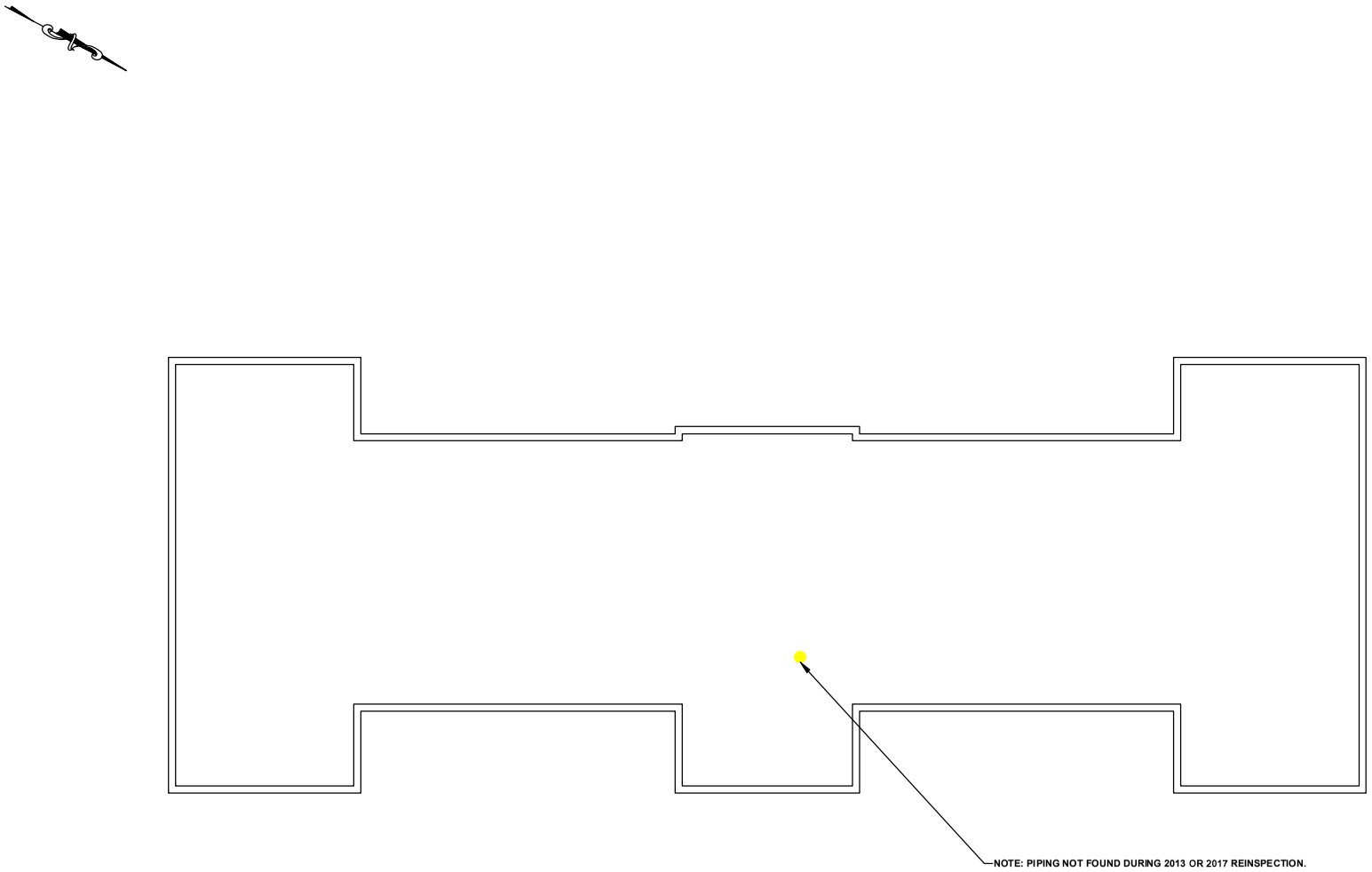
SHEET	**DATE**
B - 11 X 17	2-12-17



TITLE

BUILDING 1 - ATTIC
PIPING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

AREA UPDATED AS OF
2013 REINSPECTION

USFin

PROJECT NO.	SCALE
17001	1" = 15'
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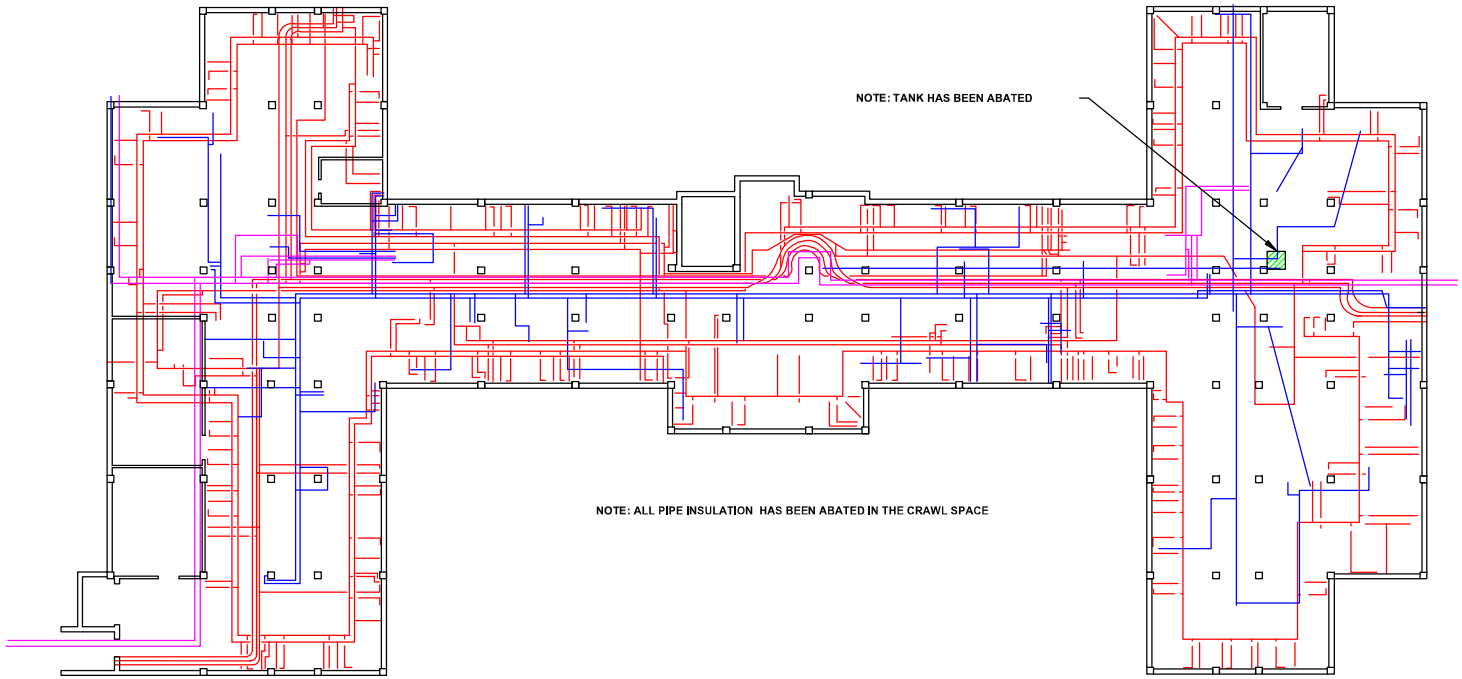
B - 11 X 17	2-12-17

Building 2



TITLE

BUILDING 2 - BASEMENT
PIPING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

- HMA-2-B-TSI TANK INSULATION 8,200 LIN FT
- STEAM PIPES
- HVAC PIPES
- WATER PIPES

NOTES:

ALL PIPE INSULATION IN THE CRAWL SPACE HAS BEEN REMOVED. NO ACM REMAINS IN THE CRAWL SPACE AS OF THE 2017 REINSPECTION

USFin

PROJECT NO.	SCALE
17001	1" = 25'
PAGE	**DRAWN BY**
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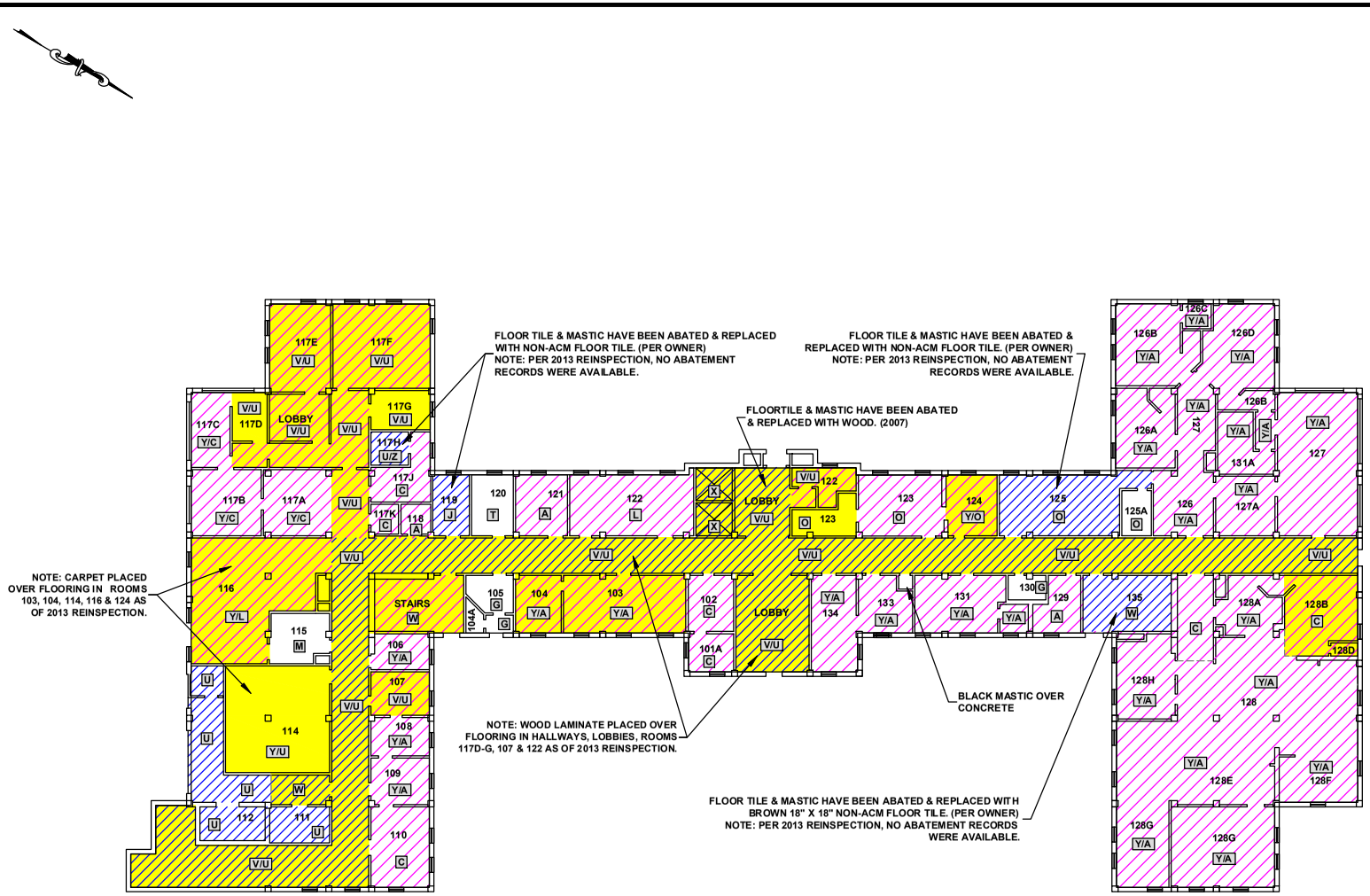
SHEET	**DATE**
B - 11 X 17	2-12-17



TITLE

BUILDING 2 - FIRST FLOOR
FLOORING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

- HMA-2-1-FT & M - FLOOR TILE AND/OR MASTIC - 11,720 SQ FT
- ABATED AREAS
- AREA UPDATED AS OF 2013 REINSPECTION

FLOORING LEGEND

- A LIGHT YELLOW/LIGHT BROWN 12" X 12"
- B YELLOWISH / TAN 12" X 12"
- C GRAY / RED 12" X 12" UNDER CARPET
- D GREEN CERAMIC
- E WHITE / BLUE 12" X 12"
- F GRAY LINOLEUM
- G GRAY CERAMIC
- H YELLOWISH 12" X 12"
- I OFF WHITE WITH PURPLE SPECKS 12" X 12"
- J BROWN CERAMIC
- K GRAY / GREEN CERAMIC
- L WHITE / BLUE LINOLEUM
- M YELLOW CERAMIC
- N BLACK MASTIC UNDER RED / BLUE CARPET
- O OFF WHITE WITH MAROON SPECKS 12" X 12"
- P LIGHT GREEN 12" X 12"
- Q CARPET OVER CONCRETE
- R DARK GREEN 12" X 12"
- S WHITE WITH BLUE SPECKS 12" X 12"
- T WHITE WITH GREEN STRIPES 12" X 12"
- U CONCRETE
- V WOOD LAMINATE
- W BROWN 18" X 18" PEEL & STICK
- X GREEN 18" X 18" PEEL & STICK
- Y CARPET
- Z BLACK MASTIC

USFin

PROJECT NO.	SCALE
17001	1" = 25'
PAGE	**DRAWN BY**
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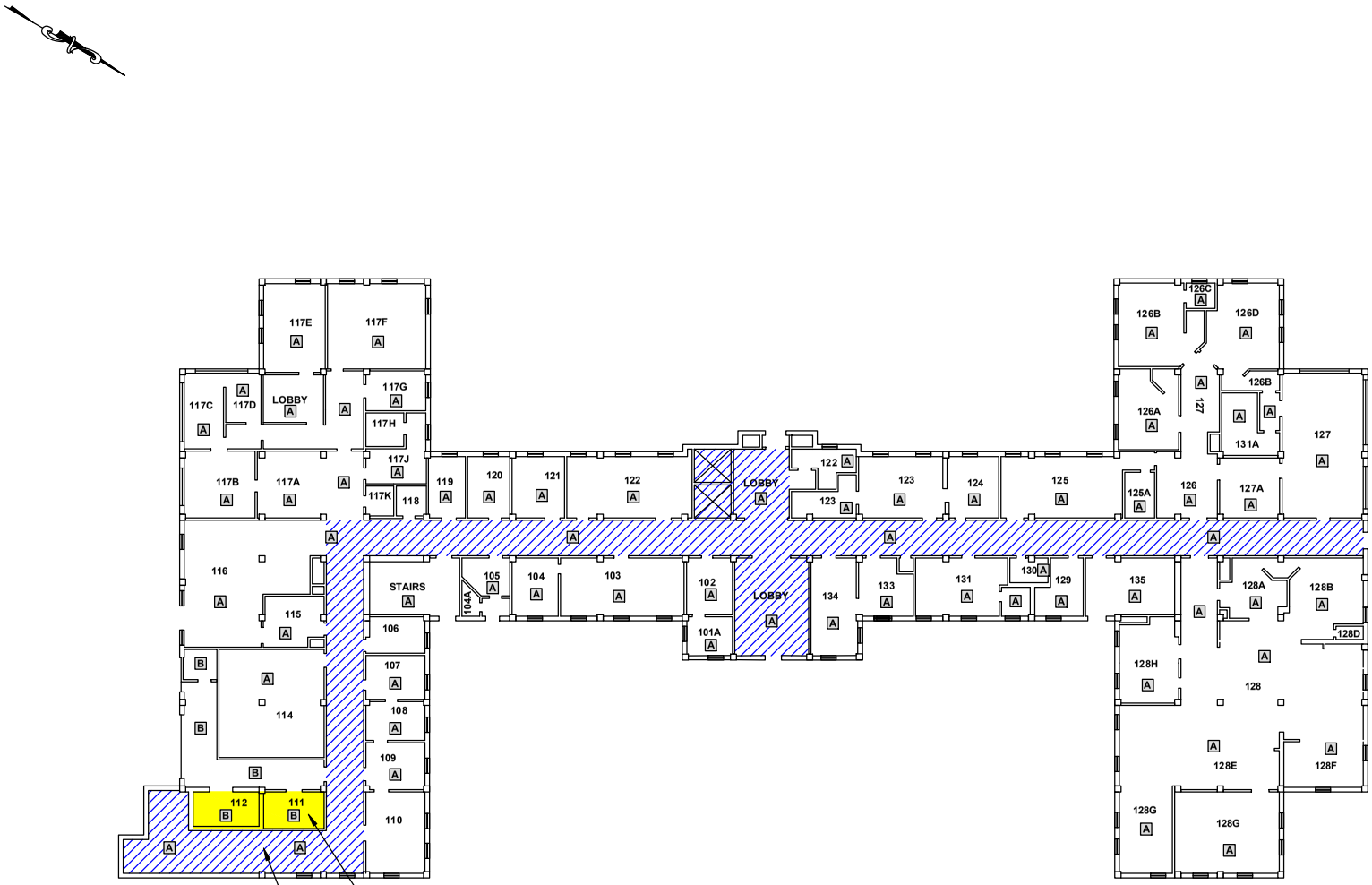
SHEET	**DATE**
B - 11 X 17	2-12-17



TITLE

BUILDING 2 - FIRST FLOOR
CEILING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

ABATED AREAS

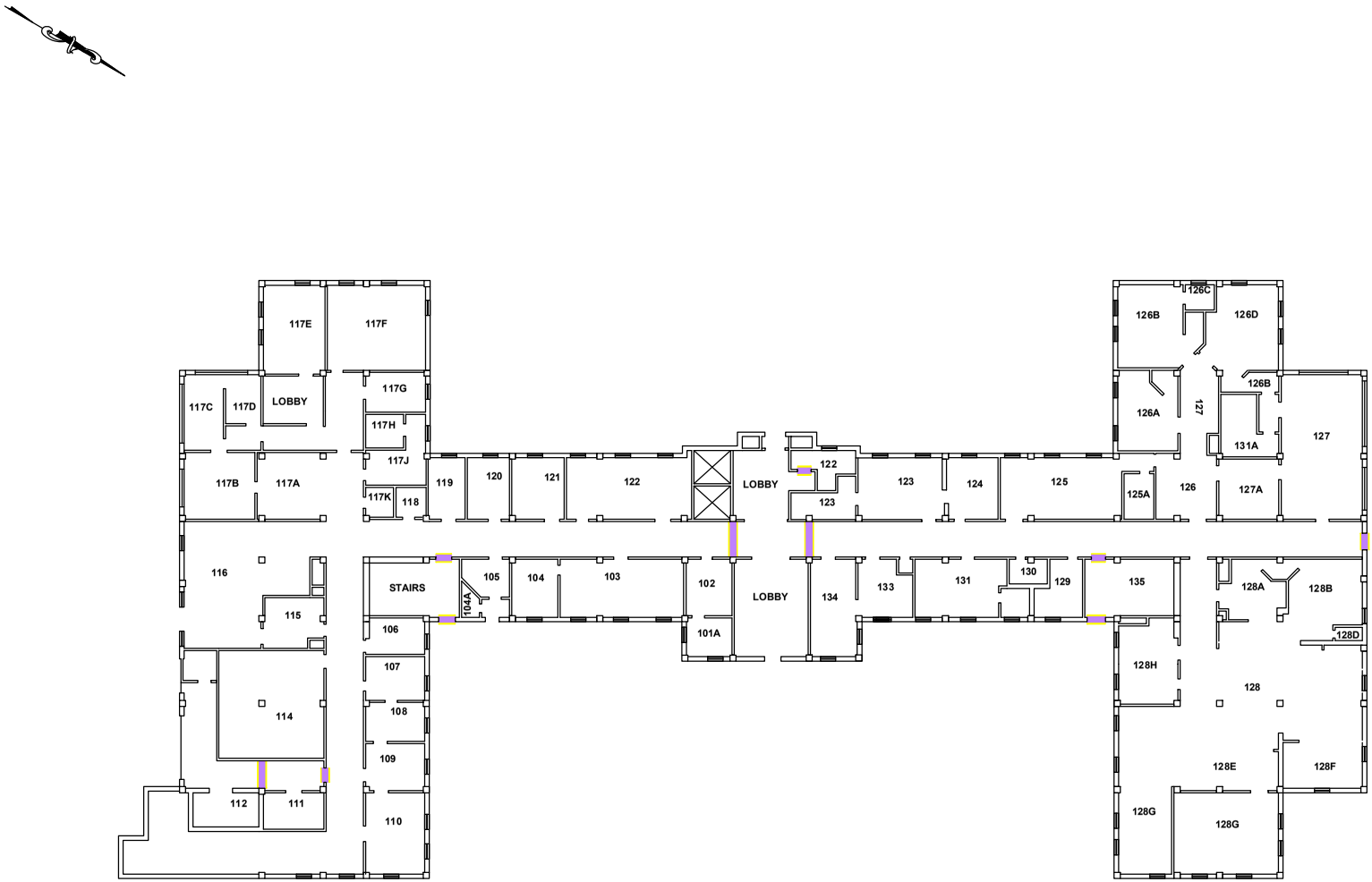
AREA UPDATED AS OF 2013 REINSPECTION

CEILING LEGEND

A 24" X 48" WHITE CEILING TILE W/ HOLES
B PLASTER

USFin

PROJECT NO.	SCALE
17001	1" = 25'
PAGE	**DRAWN BY**
1	BLB
SHEET	**DATE**
B - 11 X 17	2-12-17



TITLE

BUILDING 2 - FIRST FLOOR
MISCELLANEOUS ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

HMA-01 FIRE DOORS
1ST FLOOR TOTAL - 10 DOORS

AREA UPDATED AS OF
2013 REINSPECTION

NOTE: FIRE DOORS FOUND DURING
2013 REINSPECTION.

USFin

PROJECT NO.	SCALE
17001	1" = 25'
PAGE	**DRAWN BY**
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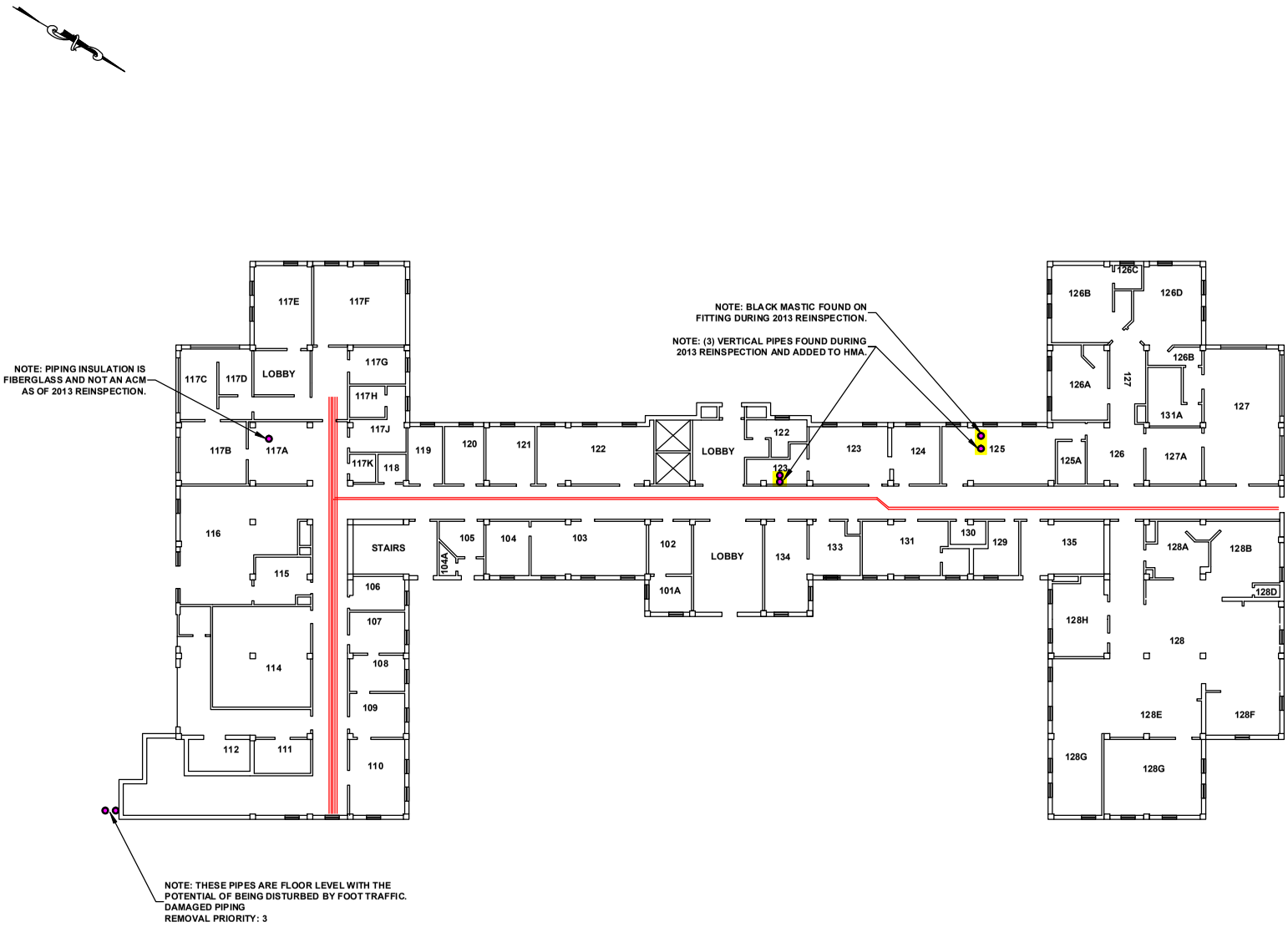
SHEET	**DATE**
B - 11 X 17	2-12-17



TITLE

BUILDING 2 - FIRST FLOOR
PIPING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

HMA-2-1-TSI PIPE INSULATION
(5) VERTICAL PIPES; (1) FITTING

HMA-2-1-TSI STEAM PIPES
2,250 LIN FT

AREA UPDATED AS OF
2013 REINSPECTION

NOTE: ALL BLACK MASTIC COATINGS ARE TO BE ASSUMED THEY CONTAIN ASBESTOS DUE TO SAMPLES VA-05-073-105B & VA-05-073-109B. INSULATION ON CHILLED WATER PUMPS TESTED POSITIVE FOR ASBESTOS - OCTOBER OF 2004

USFin

PROJECT NO.	SCALE
17001	1" = 25'
PAGE	**DRAWN BY**
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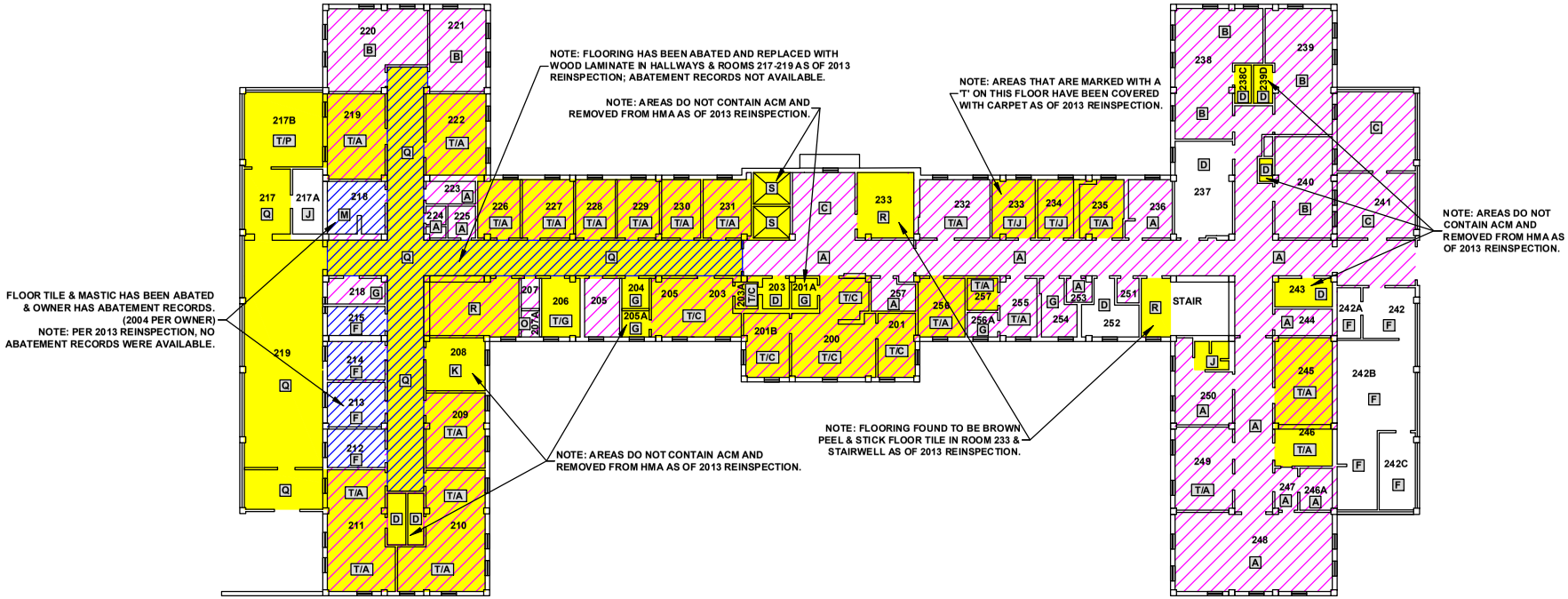
SHEET	**DATE**
B - 11 X 17	2-12-17



TITLE

BUILDING 2 - SECOND FLOOR
FLOORING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

- HMA-2-2-FT & M - FLOOR TILE AND/OR MASTIC - 14,160 SQ FT
- ABATED AREAS
- AREA UPDATED AS OF 2013 REINSPECTION

FLOORING LEGEND

A	LIGHT YELLOW / LIGHT BROWN 12" X 12"
B	YELLOWISH / TAN 12" X 12"
C	GRAY / RED 12" X 12"
D	GREEN CERAMIC
E	WHITE / BLUE 12" X 12"
F	GRAY LINOLEUM
G	GRAY CERAMIC
H	YELLOWISH 12" X 12"
I	OFF WHITE W/ PURPLE SPECKS 12" X 12"
J	BROWN CERAMIC
K	GRAY / GREEN CERAMIC
L	WHITE / BLUE LINOLEUM
M	PURPLE W/ PURPLE SPECKS 12" X 12"
N	CARPET OVER CONCRETE
O	DARK GREEN 9" X 9"
P	CONCRETE
Q	WOOD LAMINATE
R	BROWN 18" X 18" PEEL & STICK
S	GREEN 18" X 18" PEEL & STICK
T	CARPET
U	BLACK MASTIC

USFin

PROJECT NO.	SCALE
17001	1" = 25'
PAGE	**DRAWN BY**
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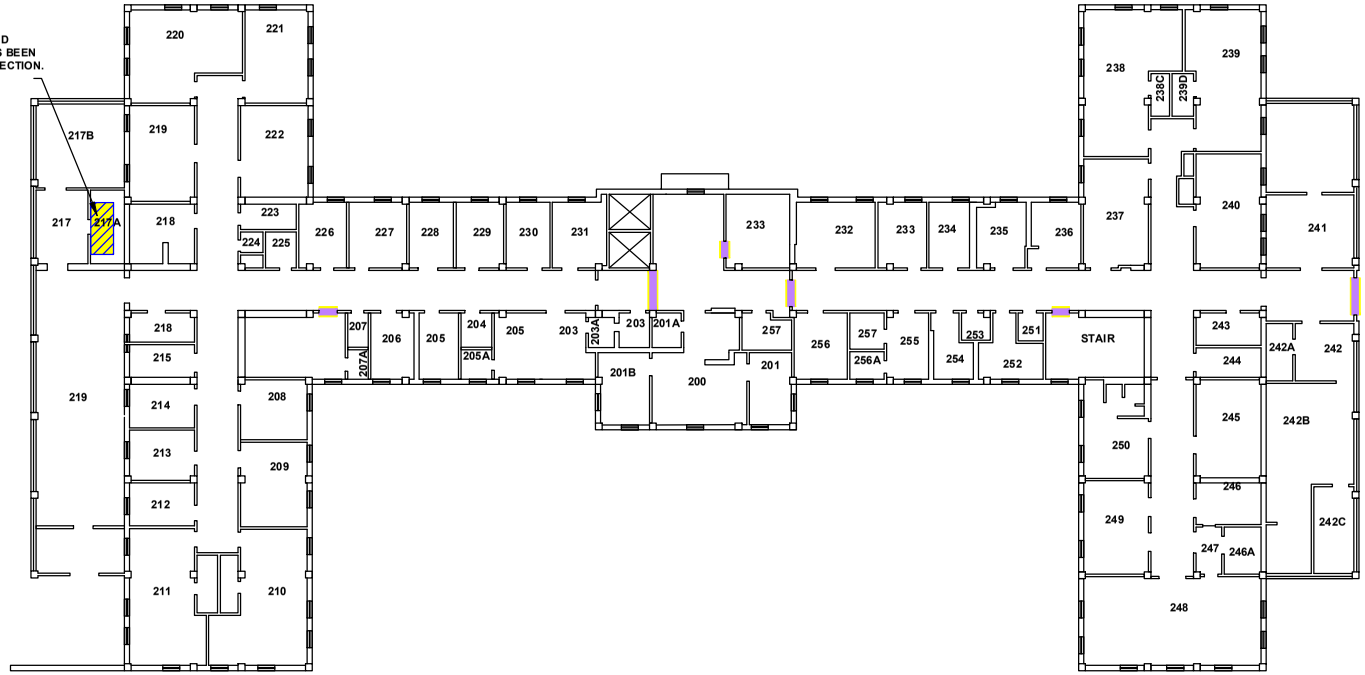
SHEET	**DATE**
B - 11 X 17	2-12-17

NOTE: AIR HANDLING UNIT AND ASSOCIATED DUCTWORK HAS BEEN REMOVED AS OF 2013 REINSPECTION.



TITLE

BUILDING 2 - SECOND FLOOR
MISCELLANEOUS ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

ABATED AREAS

HMA-01 FIRE DOORS
2ND FLOOR TOTAL - 6 DOORS

AREA UPDATED AS OF
2013 REINSPECTION

NOTE: FIRE DOORS FOUND DURING
2013 REINSPECTION.

USFin

PROJECT NO.	SCALE
17001	1" = 25'
PAGE	**DRAWN BY**
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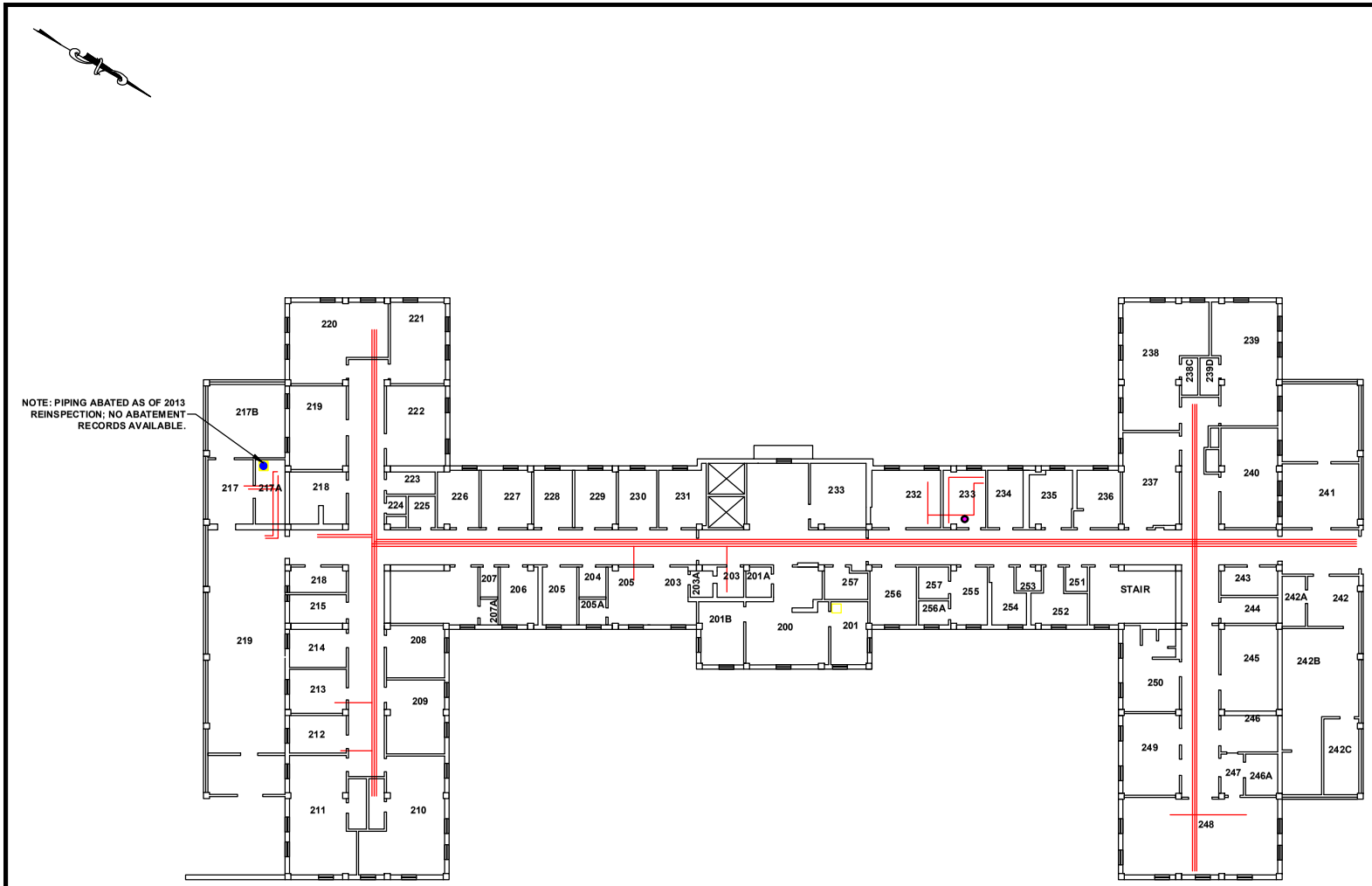
SHEET	**DATE**
B - 11 X 17	2-12-17



TITLE

BUILDING 2 - SECOND FLOOR
PIPING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

HMA-2-2-TSI PIPE INSULATION (1) VERTICAL

HMA-2-2-TSI STEAM PIPES 2,300 LIN FT

ABATED PIPING

AREA UPDATED AS OF 2013 REINSPECTION

NOTES:

ALL BLACK MASTIC COATINGS ARE TO BE ASSUMED THEY CONTAIN ASBESTOS DUE TO SAMPLES VA-05-073-105B & VA-05-073-109B. INSULATION ON CHILLED WATER PUMPS TESTED POSITIVE FOR ASBESTOS - OCTOBER OF 2004

ALL PIPING IS FIBERGLASS & PLASTIC UNLESS OTHERWISE NOTED.

USFin

PROJECT NO.	SCALE
17001	1" = 25'
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B - 11 X 17	2-12-17

TITLE

BUILDING 2 - THIRD FLOOR
FLOORING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

- HMA-2-3-FT & M - FLOOR TILE AND/OR MASTIC - 16,055 SQ FT
- ABATED AREAS
- AREA UPDATED AS OF 2013 REINSPECTION

FLOORING LEGEND

- A LIGHT YELLOW / LIGHT BROWN 12" X 12"
- B YELLOWISH / TAN 12" X 12"
- C GREEN / RED 12" X 12"
- D GREEN CERAMIC
- E WHITE / BLUE 12" X 12"
- F ORANGE / YELLOWISH 12" X 12"
- G GRAY CERAMIC
- H YELLOWISH 12" X 12"
- I OLIVE 12" X 12"
- J BLUE / BLUE 12" X 12" UNDER CARPET
- K GRAY / GREEN CERAMIC
- L WOOD LAMINATE
- M BROWN 18" X 18" PEEL & STICK
- N BLACK MASTIC
- O CARPET
- P CONCRETE

USFin

PROJECT NO.	SCALE
17001	1" = 25'
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SHEET	**DATE**
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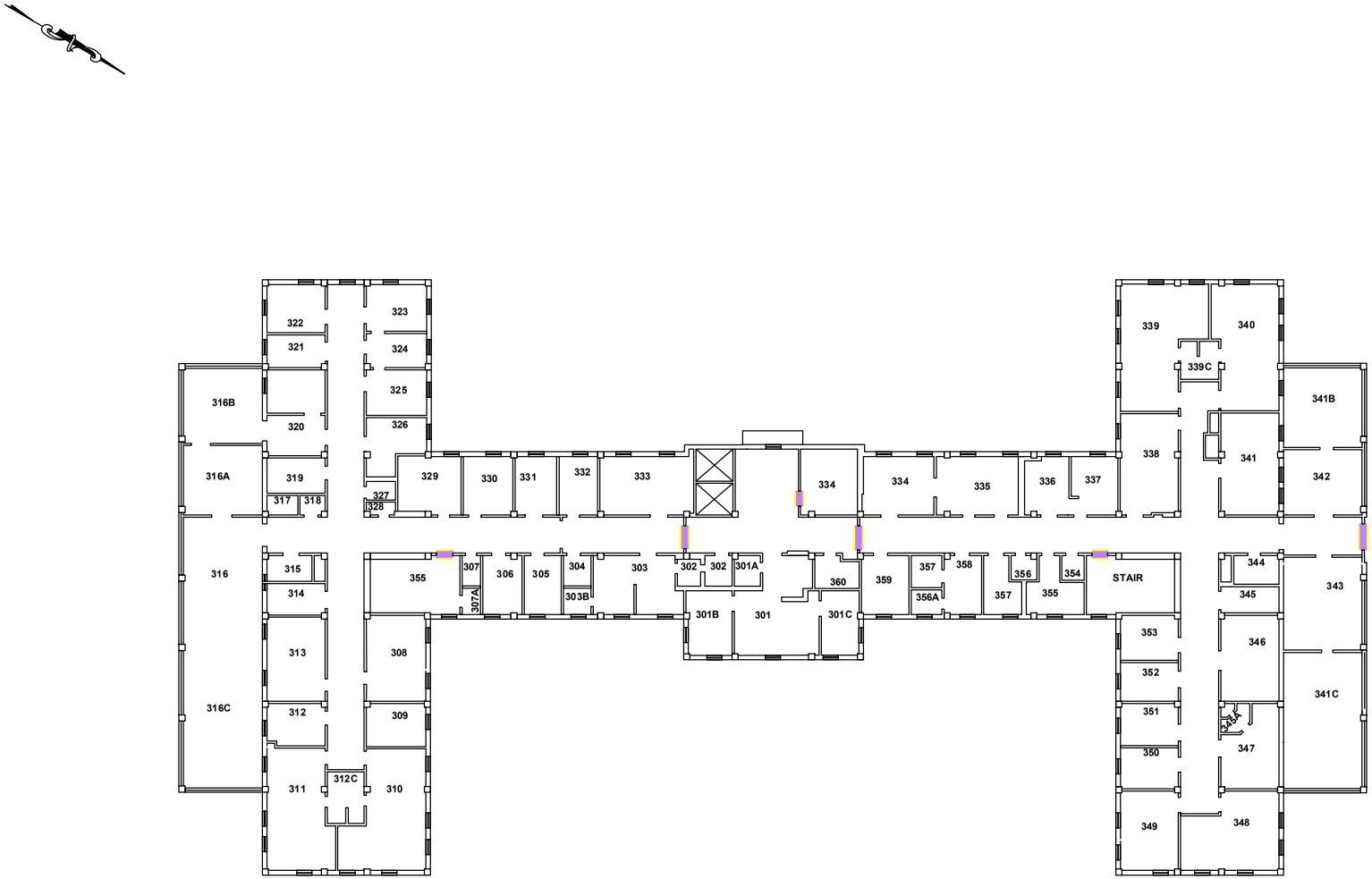

TITLE

BUILDING 2 - THIRD FLOOR
MISCELLANEOUS ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

HMA-01 FIRE DOORS
3RD FLOOR TOTAL - 6 DOORS

AREA UPDATED AS OF
2013 REINSPECTION

NOTE: FIRE DOORS FOUND DURING
2013 REINSPECTION.

USFin

PROJECT NO.	SCALE
17001	1" = 25'
PAGE	**DRAWN BY**
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B - 11 X 17	2-12-17

TITLE

BUILDING 2 - THIRD FLOOR
PIPING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

HMA-2-3-TSI PIPE INSULATION (1) VERTICAL

NOTE: WHITE INSULATION IN THESE AREAS CONTAIN ASBESTOS.

HMA-2-3-TSI STEAM PIPES 1,750 LIN FT

ABATED AREAS

AREA UPDATED AS OF 2013 REINSPECTION

USFin

PROJECT NO.	SCALE
17001	1" = 25'
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SHEET	**DATE**
B - 11 X 17	2-12-17

TITLE

BUILDING 2 - FOURTH FLOOR
FLOORING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

HMA-2-4-FT & M - FLOOR TILE AND/OR MASTIC - 1,115 SQ FT

AREA UPDATED AS OF 2013 REINSPECTION

FLOORING LEGEND

- A BLACK CERAMIC
- B BROWN / BROWN 12" X 12"
- C TAN / CREAM 12" X 12"
- D GREEN 9" X 9" UNDER CARPET
- E CONCRETE
- F RED 9" X 9"
- G WHITE CERAMIC
- H GREEN CERAMIC UNDER CARPET
- I BROWN 9" X 9"
- J BLUE 9" X 9"
- K RED LINOLEUM W/ BROWN GLUE MASTIC
- L CARPET
- M GREEN 9" X 9"

USFin

PROJECT NO.	SCALE
17001	1" = 25'
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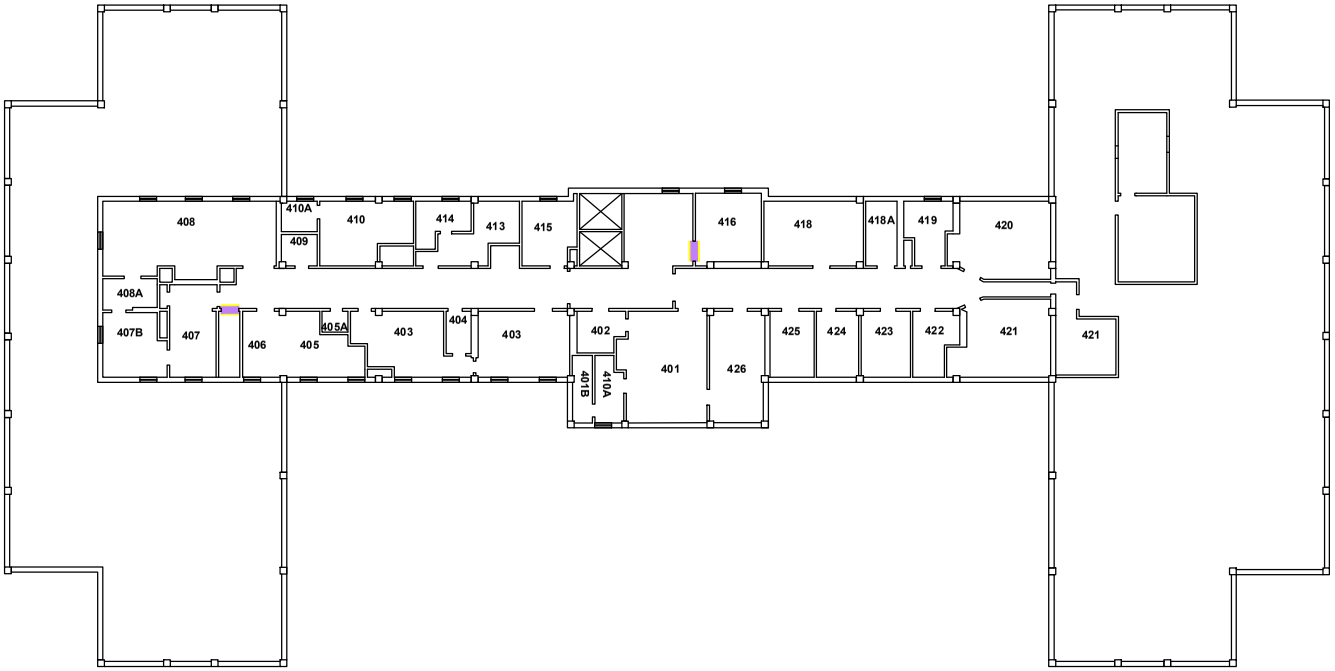
B - 11 X 17	2/2/17



TITLE

BUILDING 2 - FOURTH FLOOR
MISCELLANEOUS ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

HMA-01 FIRE DOORS
4TH FLOOR TOTAL - 2 DOORS

AREA UPDATED AS OF
2013 REINSPECTION

NOTE: FIRE DOORS FOUND DURING
2013 REINSPECTION.

USFin

PROJECT NO.	SCALE
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PAGE	**DRAWN BY**
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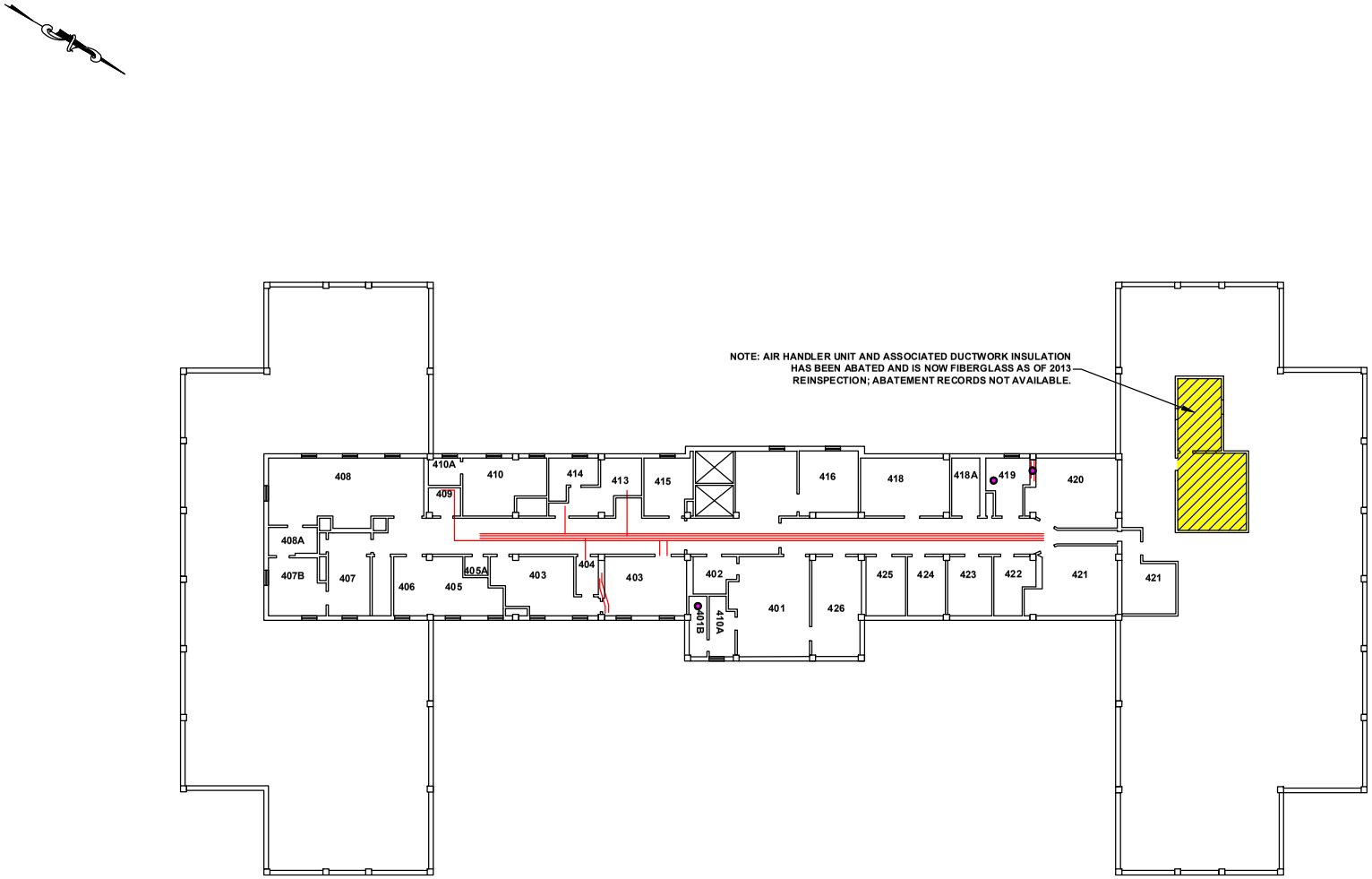
SHEET	**DATE**
B - 11 X 17	2/2/17



TITLE

BUILDING 2 - FOURTH FLOOR
PIPING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

- ABATED AIR HANDLERS & DUCTWORK
- HMA-2-4-TSI PIPE INSULATION & FITTINGS (3) VERTICAL
- HMA-2-4-TSI STEAM PIPES 800 LIN FT
- AREA UPDATED AS OF 2013 REINSPECTION

NOTE: PIPE INSULATION AND FITTINGS IN THESE AREAS CONTAIN ASBESTOS. ANY OTHER THERMAL SYSTEM INSULATION ON THIS FLOOR CONSISTING OF THE SAME MATERIAL IS ASSUMED TO CONTAIN ASBESTOS.

USFin

PROJECT NO.	SCALE
17001	1" = 25'
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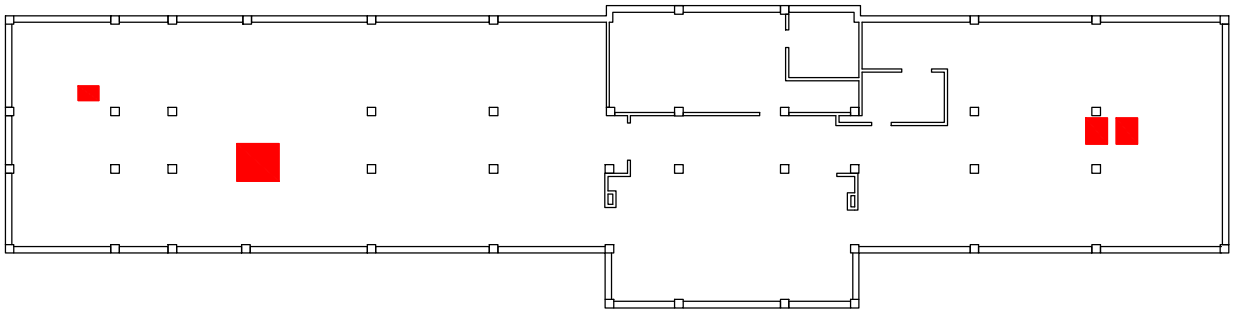
B - 11 X 17	2/2/17



TITLE

BUILDING 2 - ATTIC
MISCELLANEOUS ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

VIBRATION ISOLATORS

USFin

PROJECT NO.	SCALE
17001	1" = 20'
PAGE	**DRAWN BY**
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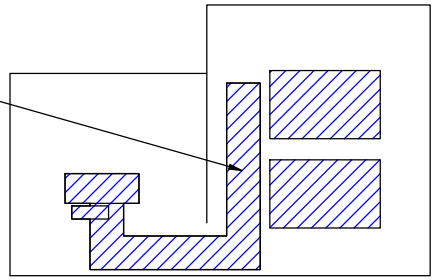
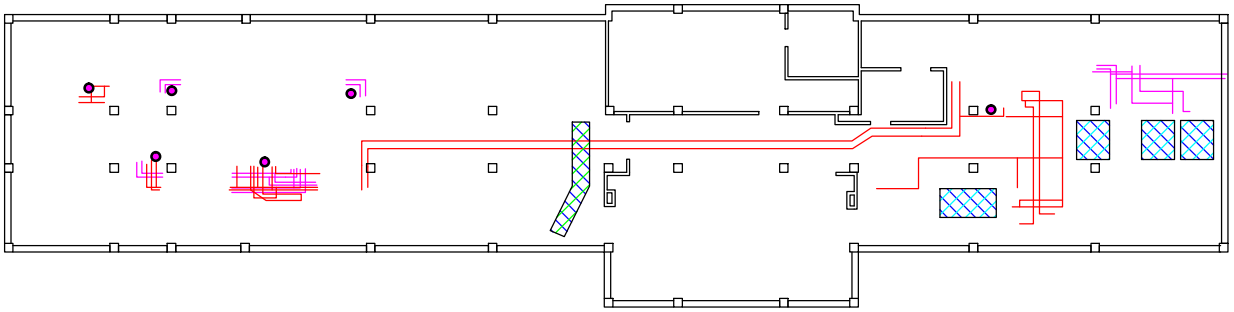
SHEET	**DATE**
B - 11 X 17	2/2/17

ALL INSULATION ON AIR HANDLER AND DUCT WORK IN THE PENTHOUSE HAS BEEN ABATED. (JAN 2006 PER OWNER)



PENTHOUSE



TITLE

BUILDING 2 - ATTIC
PIPING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

- HMA-2-A-TSI EXHAUST BLOWER
- HMA-2-A-TSI INSULATION ON AIR HANDLERS & DUCTS
- HMA-2-A-TSI PIPE INSULATION & FITTINGS (6) VERTICAL
- HMA-2-A-TSI STEAM PIPES 200 LIN FT
- ABATED AREAS
- AIR HANDLER & DUCTS ABATED; EXHAUST BLOWER REMOVED (FEB 2006 PER OWNER)

ASBESTOS ELBOWS IN SOUTH END OF ATTIC & ASBESTOS VIBRATION CLOTHS ON AIR HANDLER IN NORTH END OF ATTIC REMAIN.

USFin

PROJECT NO.	SCALE
17001	1" = 20'
PAGE	**DRAWN BY**
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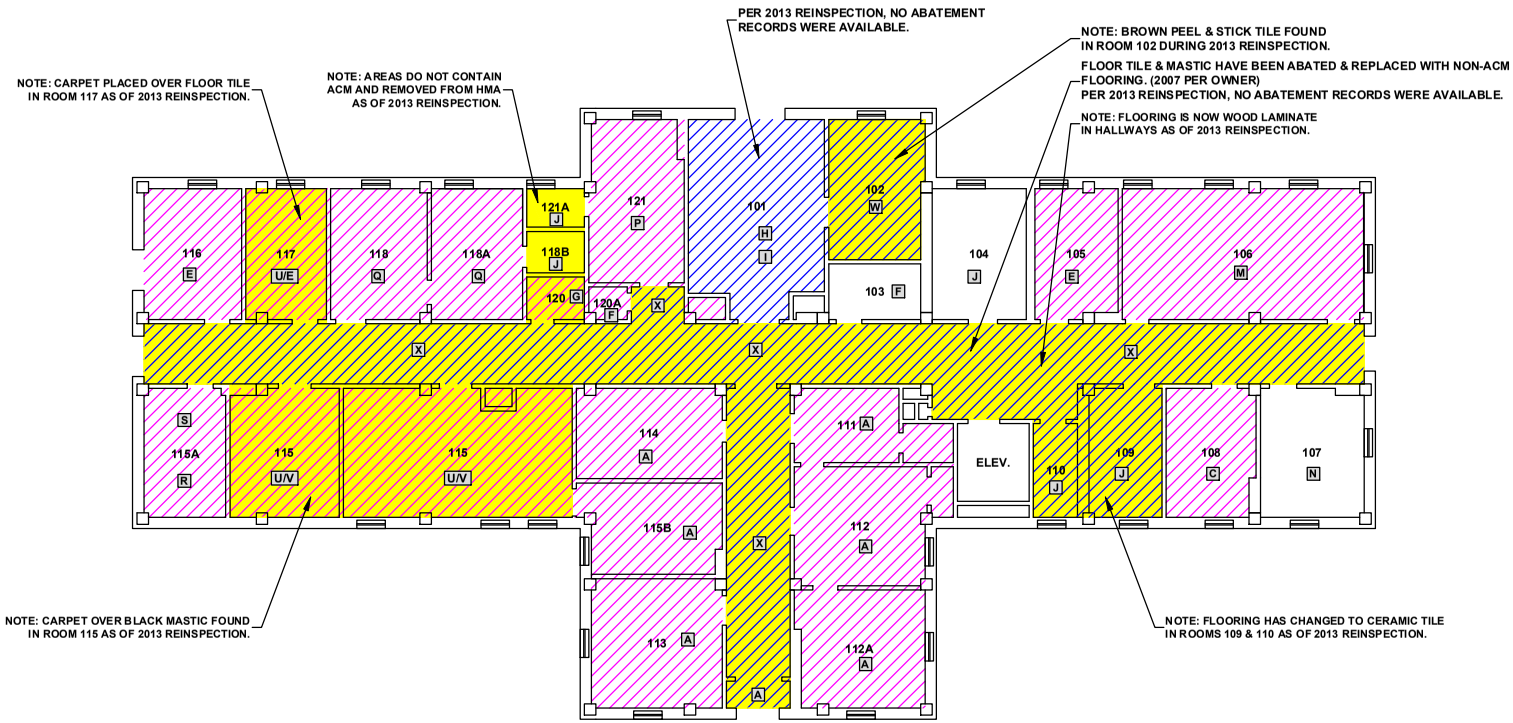
SHEET	**DATE**
B - 11 X 17	2/2/17

Building 3



TITLE

BUILDING 3 - FIRST FLOOR
FLOORING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

- HMA-3-1-FT & M - FLOOR TILE AND/OR MASTIC - 3,770 SQ FT
- ABATED AREAS
- AREA UPDATED AS OF 2013 REINSPECTION

FLOORING LEGEND

- A CREAM 12" X 12" UNDER CARPET
- B MAROON 12" X 12"
- C LIGHT GREEN 12" X 12" UNDER CARPET
- D YELLOW / ORANGE 12" X 12"
- E GRAY / GREEN / WHITE 12" X 12"
- F CONCRETE
- G GREEN / WHITE W/ GREEN SPECKS 12" X 12"
- H PINK W/ GREEN SPECKS 12" X 12" BLACK MASTIC
- I GREEN W/ BLUE SPECKS 12" X 12"BLACK MASTIC
- J CERAMIC
- K GREEN / WHITE 12" X 12"
- L WHITE W/ BLACK SPECKS 12" X 12"
- M LIGHT GREEN 12" X 12" BLACK MASTIC UNDER CARPET
- N CARPET
- O 9" X 9" FLOOR TILE
- P BLUE / BROWN / WHITE 12" X 12"
- Q GRAY / GREEN / WHITE 12" X 12" BLACK MASTIC UNDER CARPET
- R GREEN / WHITE 9" X 9"
- S BLACK 9" X 9"
- T BLACK MASTIC ON CONCRETE
- U CARPET
- V BLACK MASTIC
- W BROWN 12" X 12" PEEL & STICK
- X WOOD LAMINATE

USFin

PROJECT NO.	SCALE
17001	1" = 15'
PAGE	**DRAWN BY**
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SHEET	**DATE**
B - 11 X 17	2/2/17

TITLE

BUILDING 3 - FIRST FLOOR
MISCELLANEOUS ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

HMA-01 FIRE DOORS
1ST FLOOR TOTAL - 3 DOORS

AREA UPDATED AS OF
2013 REINSPECTION

NOTE: FIRE DOORS FOUND DURING
2013 REINSPECTION.

USFin

PROJECT NO.	SCALE
17001	1" = 15'
PAGE	**DRAWN BY**
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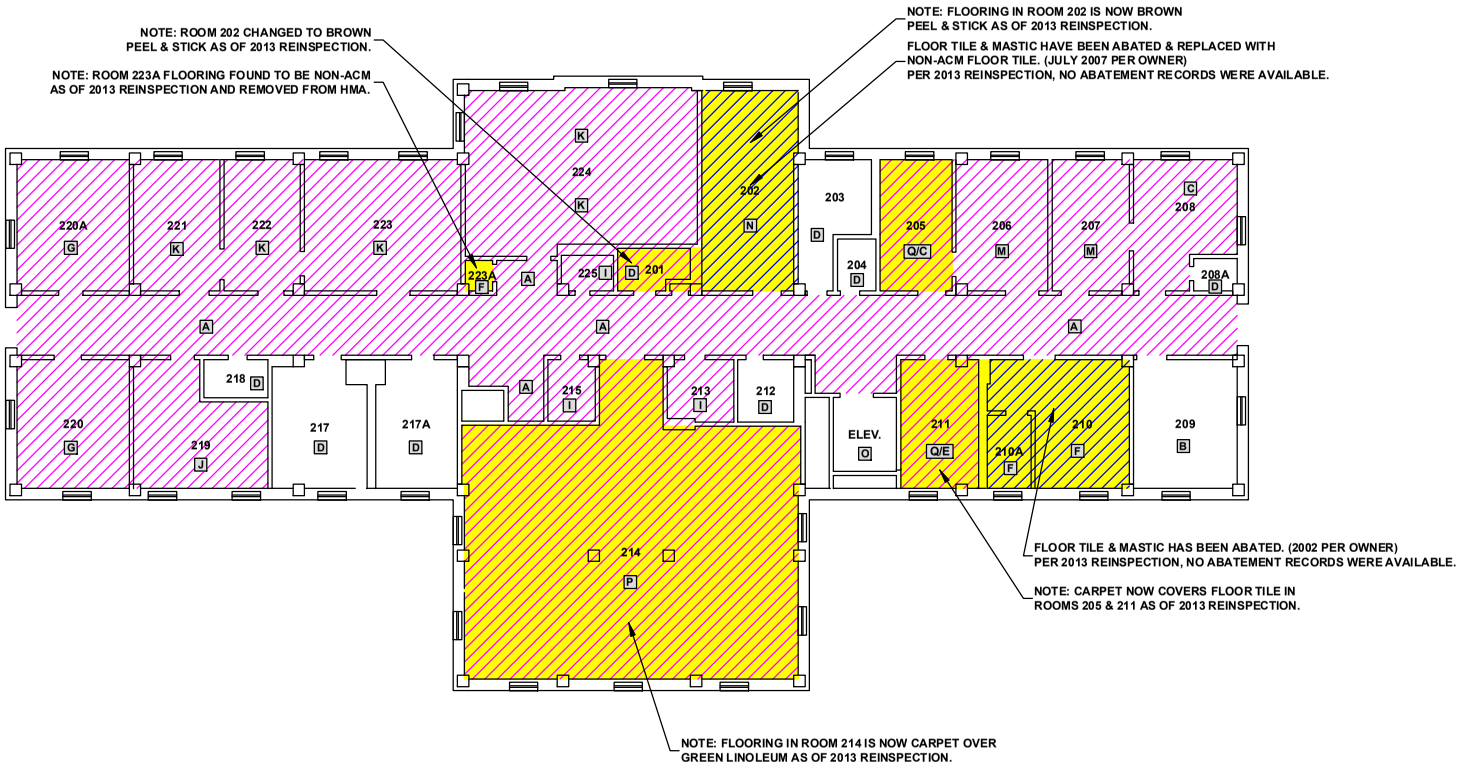
SHEET	**DATE**
B - 11 X 17	2/2/17



TITLE

BUILDING 3 - SECOND FLOOR
FLOORING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

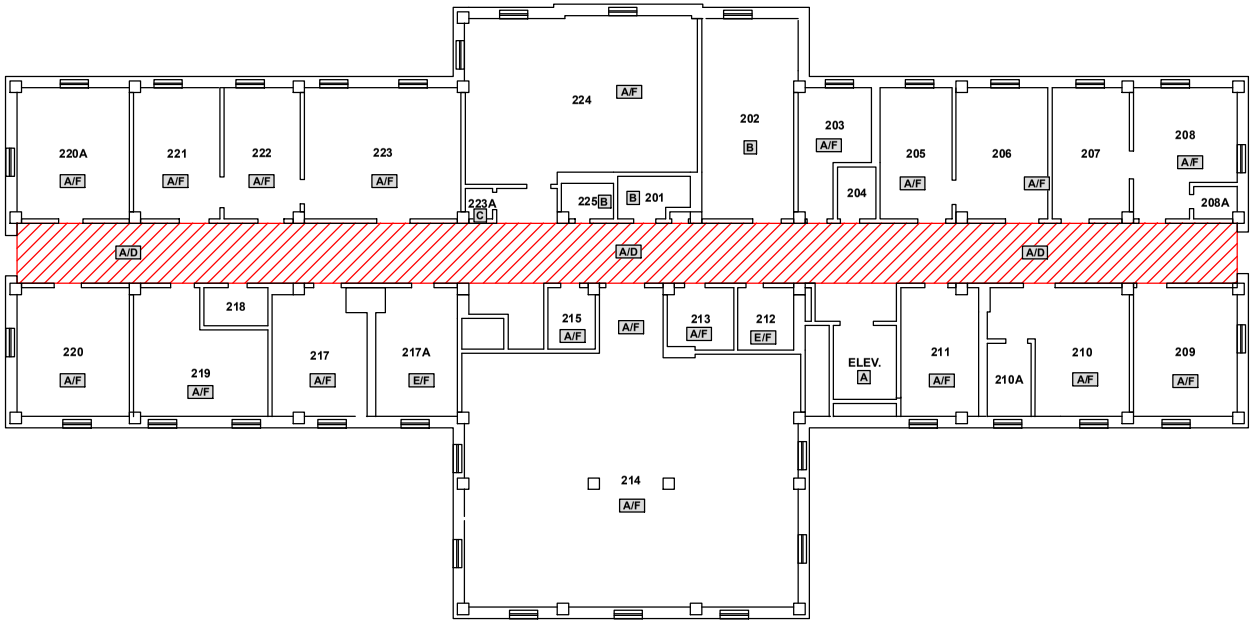
- HMA-3-2-FT & M - FLOOR TILE AND/OR MASTIC - 5,180 SQ FT
- ABATED AREAS
- AREA UPDATED AS OF 2013 REINSPECTION

FLOORING LEGEND

- A CREAM / BROWN 12" X 12"
- B BLACK 12" X 12"
- C LIGHT GREEN 9" X 9"
- D CERAMIC
- E GRAY / GREEN /WHITE 12" X 12"
- F CONCRETE
- G CARPET ON BLACK MASTIC
- H BROWN / BROWN & WHITE 12" X 12" BLACK MASTIC
- I 9" X 9" WITH BLACK MASTIC
- J BRIGHT GREEN 12" X 12" BLACK MASTIC
- K CARPET ON 9" X 9"
- L GREEN 9" X 9" BLACK MASTIC
- M LIGHT GREEN 12" X 12" BLACK MASTIC UNDER CARPET
- N BROWN 12" X 12" PEEL & STICK
- O GREEN 18" X 18" PEEL & STICK
- P CARPET OVER GREEN LINOLEUM
- Q CARPET

USFin

PROJECT NO.	SCALE
17001	1" = 15'
PAGE	DRAWN BY
1	BB
SHEET	DATE
B - 11 X 17	2/2/17



TITLE

BUILDING 3 - SECOND FLOOR
CEILING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

HMA-3-2-CT BLACK GLUE DOTS UNDER 12" X 12" CEILING TILE - 1,020 SQ FT

CEILING LEGEND

- A 24" X 48" WHITE CEILING TILE WITH HOLES
- B PLASTER
- C CONCRETE
- D 12" X 12" CEILING TILE WITH GLUE DOTS ABOVE DROP CEILING
- E 24" X 24" WHITE CEILING TILE WITH HOLES
- F PLASTER CEILING ABOVE DROP CEILING

USFin

PROJECT NO.	SCALE
17001	1" = 15'
PAGE	DRAWN BY
1	BB
SHEET	DATE
B - 11 X 17	2/2/17

TITLE

BUILDING 3 - SECOND FLOOR
MISCELLANEOUS ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

HMA-01 FIRE DOORS
2ND FLOOR TOTAL - 1 DOOR

AREA UPDATED AS OF
2013 REINSPECTION

NOTE: FIRE DOORS FOUND DURING
2013 REINSPECTION.

USFin

PROJECT NO.	SCALE
17001	1" = 15'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17

TITLE

BUILDING 3 - THIRD FLOOR
FLOORING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

HMA-3-3-FT & M - FLOOR TILE AND/OR MASTIC - 5,095 SQ FT

ABATED AREAS

AREA UPDATED AS OF 2013 REINSPECTION

FLOORING LEGEND

- A LIGHT GREEN WITH DARK BLUE SPECKS 12" X 12"
- B CERAMIC
- C LIGHT PINK WITH GREEN SPECKS 12" X 12"
- D GRAY LINOLEUM
- E CARPET OVER CERAMIC
- F OFF WHITE / BROWN 12" X 12" UNDER CARPET
- G OFF WHITE / BROWN 12" X 12" UNDER LINOLEUM
- H LIGHT GREEN W/ DARK BLUE SPECKS 12" X 12" UNDER OFF WHITE / BROWN 12" X 12"
- I CARPET
- J GREEN 18" X 18" PEEL & STICK
- K CONCRETE

USFin

PROJECT NO.	SCALE
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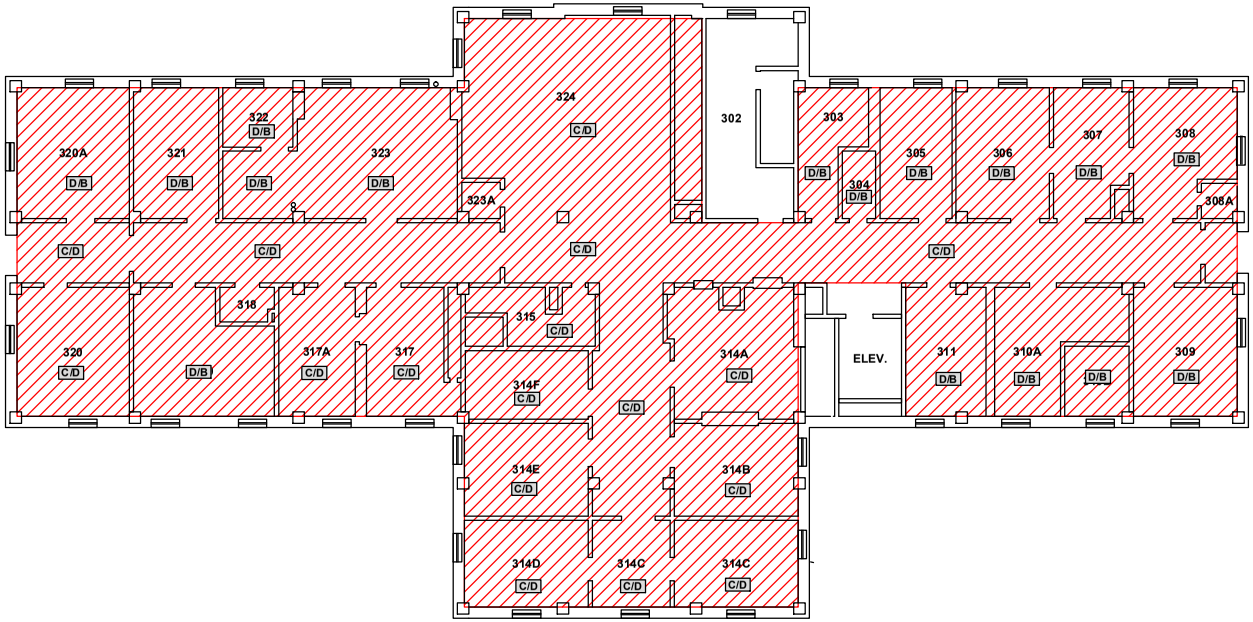
SHEET	**DATE**
B - 11 X 17	2/2/17



TITLE

BUILDING 3 - THIRD FLOOR
CEILING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

HMA-3-3-CT BLACK GLUE DOTS UNDER 12" X 12" CEILING TILE - 6,270 SQ FT

CEILING LEGEND

- A 12" X 12" CEILING TILE WITH HOLES ON BLACK GLUE DOTS
- B 24" X 48" WHITE CEILING TILE WITH HOLES
- C 24" X 24" WHITE CEILING TILE WITH HOLES ABOVE LAY-IN TILE
- D 12" X 12" CEILING TILE WITH HOLES ON BLACK GLUE DOTS ABOVE DROP CEILING

USFin

PROJECT NO.	SCALE
17001	1" = 15'
PAGE	DRAWN BY
1	BB
SHEET	DATE
B - 11 X 17	2/2/17

TITLE

BUILDING 3 - THIRD FLOOR
MISCELLANEOUS ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

HMA-01 FIRE DOORS
3RD FLOOR TOTAL - 7 DOORS

AREA UPDATED AS OF
2013 REINSPECTION

NOTE: FIRE DOORS FOUND DURING
2013 REINSPECTION.

USFin

PROJECT NO.	SCALE
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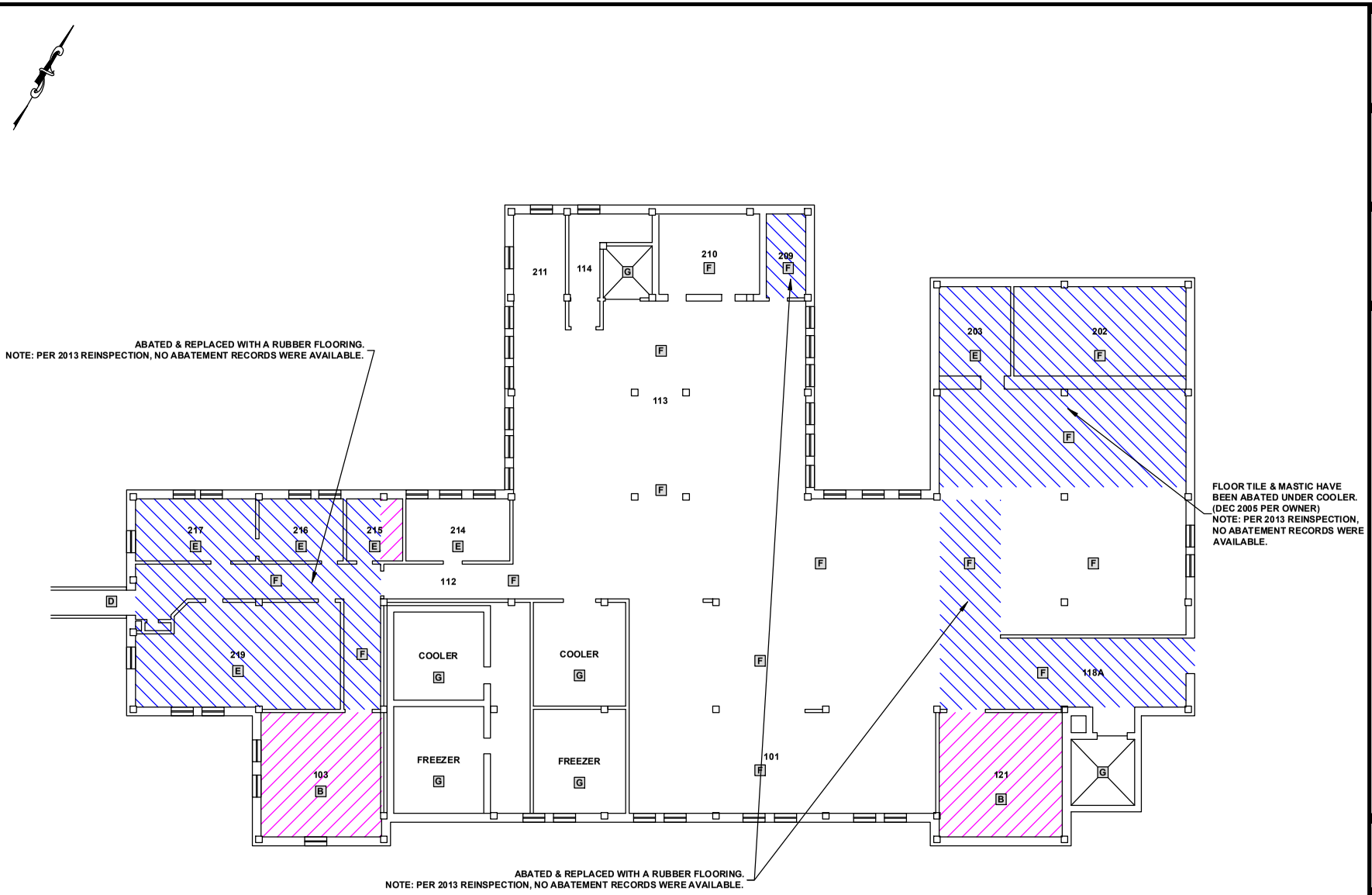
SHEET	**DATE**
B - 11 X 17	2/2/17

Building 4



TITLE

BUILDING 4 - FIRST FLOOR
FLOORING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

HMA-4-1-FT & M - FLOOR TILE AND/OR MASTIC - 725 SQ FT

ABATED AREAS

FLOORING LEGEND

- A CERAMIC
- B OFF WHITE W/ BLACK SPECKS 12" X 12"
- C MASTIC
- D GRAY & GREEN WHITE 12" X 12"
- E GRAY 12" X 12"
- F RUBBER
- G METAL

USFin

PROJECT NO.	SCALE
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PAGE	**DRAWN BY**
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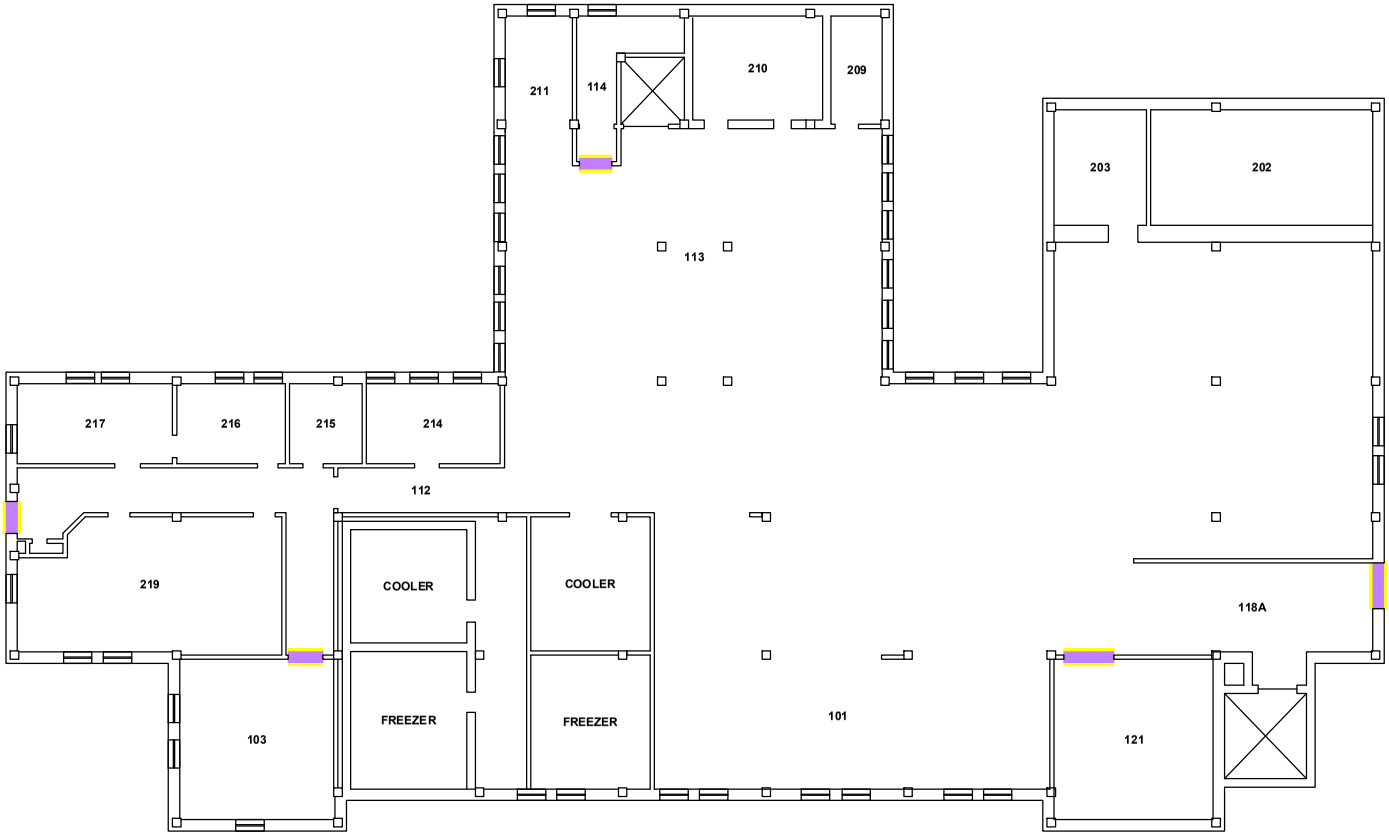
SHEET	**DATE**
B - 11 X 17	2/2/17



TITLE

BUILDING 4 - FIRST FLOOR
MISCELLANEOUS ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

HMA-01 FIRE DOORS
1ST FLOOR TOTAL - 5 DOORS

AREA UPDATED AS OF
2013 REINSPECTION

NOTE: FIRE DOORS FOUND DURING
2013 REINSPECTION.

USFin

PROJECT NO.	SCALE
17001	1" = 15'
PAGE	**DRAWN BY**
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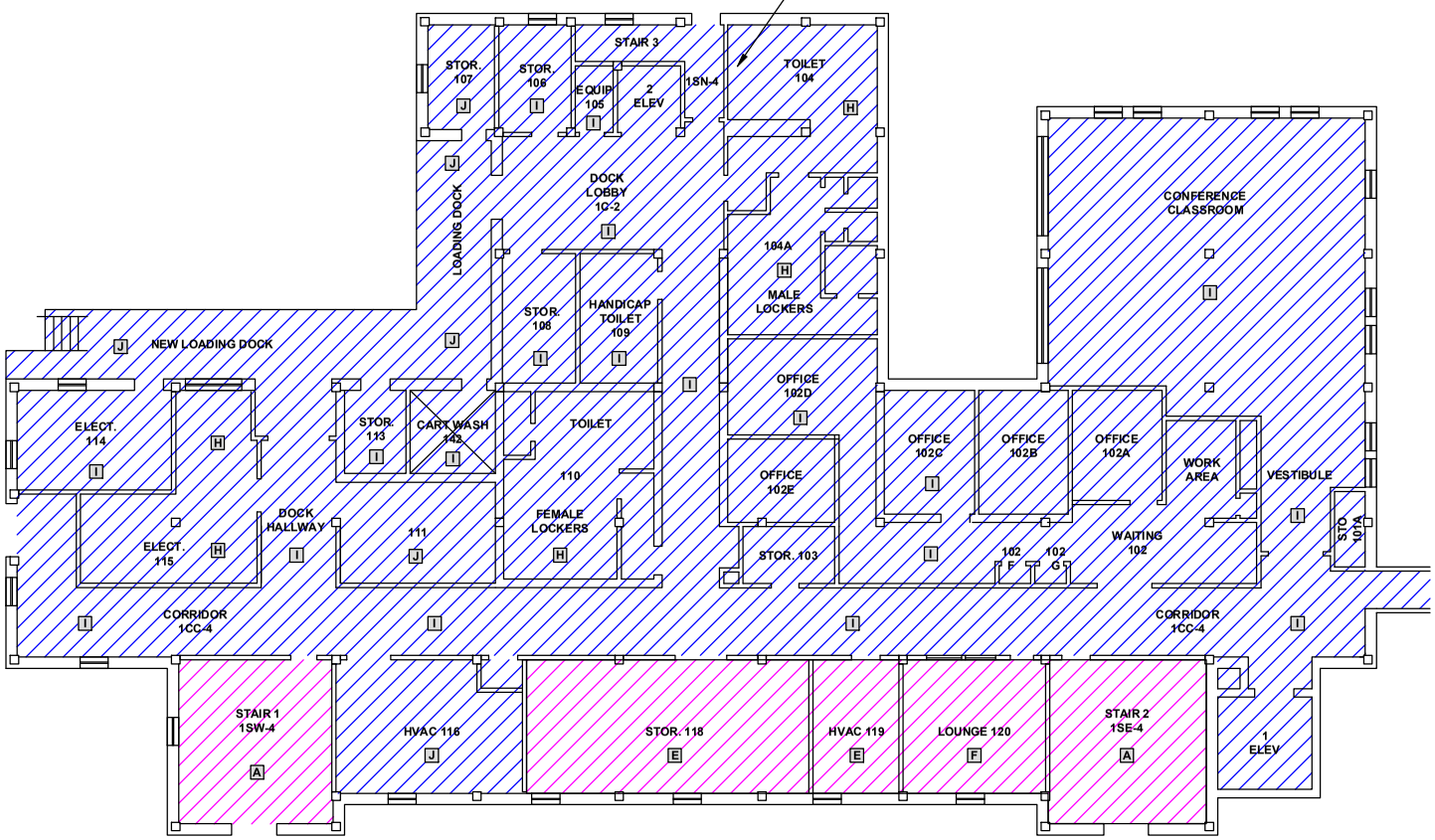
SHEET	**DATE**
B - 11 X 17	2/2/17

NOTE: PER 2013 REINSPECTION, NO ABATEMENT RECORDS WERE AVAILABLE.



TITLE

BUILDING 4 - BASEMENT
FLOORING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

HMA-4-B-FT & M - FLOOR TILE AND/OR MASTIC - 1,690 SQ FT

ABATED AREAS

FLOORING LEGEND

- A OFF WHITE W/ BLACK SPECKS 12" X 12"
- B GREEN W/ WHITE / GREEN SPECKS 12" X 12"
- C LIGHT ORANGE W/ ORANGE SPECKS 12" X 12"
- D PINK W/ DARK SPECKS 12" X 12"
- E WHITE W/ BROWN SPECKS 12" X 12"
- F BLUE/ BROWN 12" X 12"
- G GRAY MAROON 12" X 12"
- H CERAMIC TILE
- I BLUE WITH GRAY 12" X 12"
- J CONCRETE

USFin

PROJECT NO.	SCALE
17001	1" = 15'
PAGE	DRAWN BY
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SHEET	DATE
B - 11 X 17	2/2/17

TITLE

BUILDING 4 - BASEMENT
MISCELLANEOUS ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

HMA-01 FIRE DOORS
BASEMENT TOTAL - 6 DOORS

AREA UPDATED AS OF
2013 REINSPECTION

NOTE: FIRE DOORS FOUND DURING
2013 REINSPECTION.

USFin

PROJECT NO.	SCALE
17001	1" = 15'
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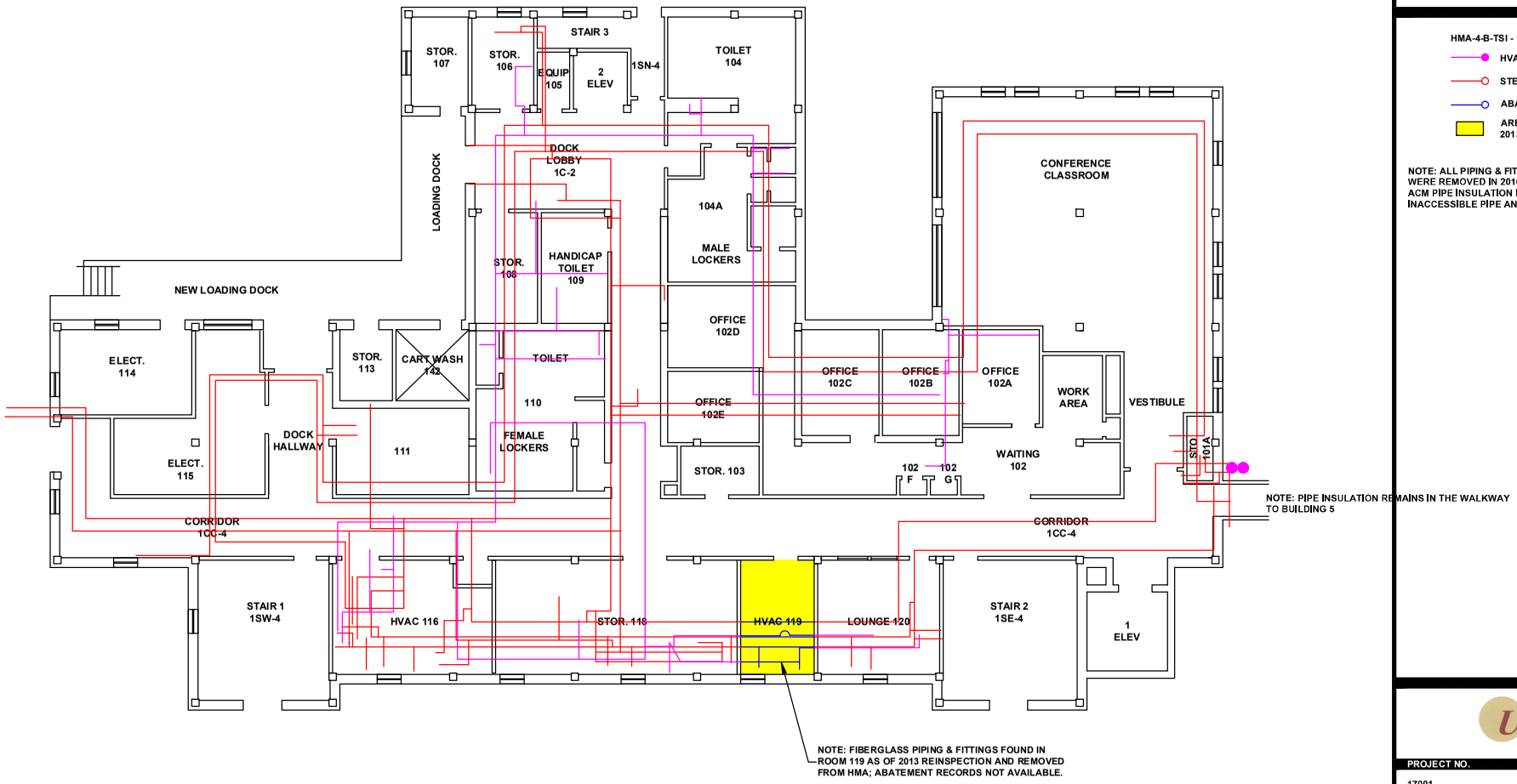

TITLE

BUILDING 4 - BASEMENT
PIPING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

HMA-4-B-TSI - 1,950 LIN FT

- HVAC PIPES
- STEAM PIPES
- ABATED PIPING
- AREA UPDATED AS OF 2013 REINSPECTION

NOTE: ALL PIPING & FITTINGS IN THE BASEMENT WERE REMOVED IN 2016. THE ONLY POSSIBLE ACM PIPE INSULATION IS LOCATED IN INACCESSIBLE PIPE AND WALL CHASES.

USFin

PROJECT NO.	SCALE
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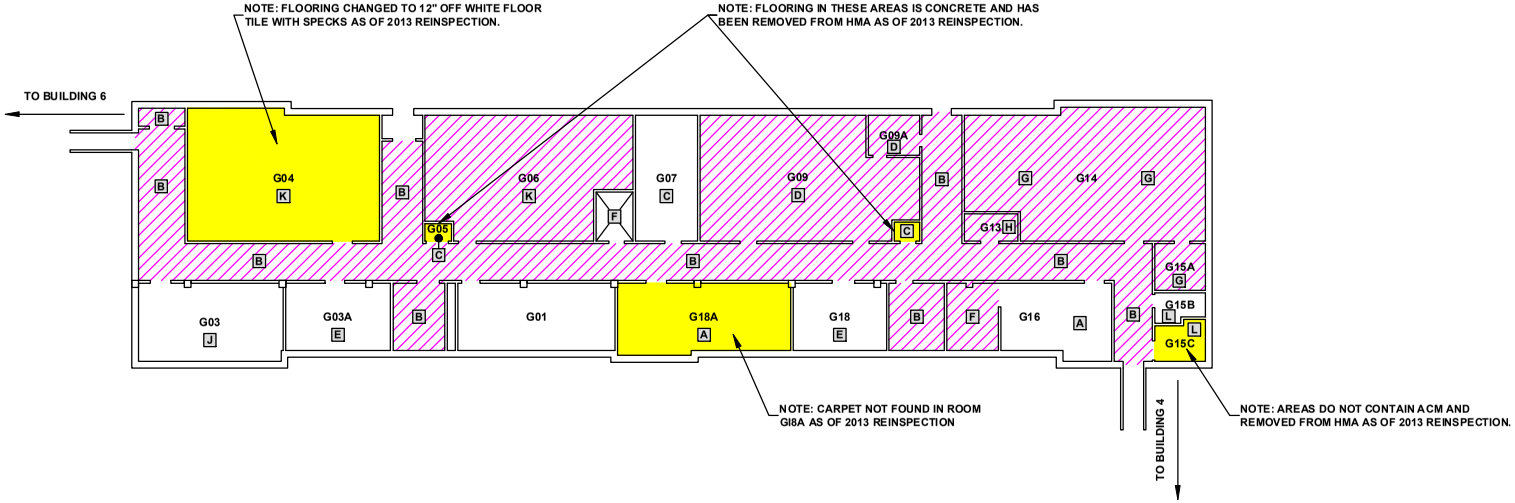
SHEET	**DATE**
B - 11 X 17	2/2/17

Building 5



TITLE

BUILDING 5 - GROUND FLOOR
FLOORING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

HMA-5-G-FT & M - FLOOR TILE AND/OR MASTIC - 6,340 SQ FT

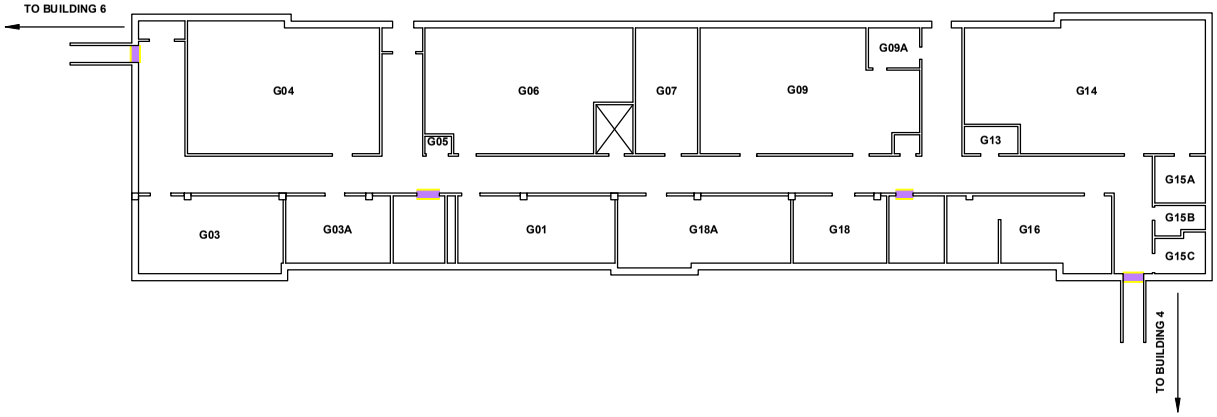
AREA UPDATED AS OF 2013 REINSPECTION

FLOORING LEGEND

- A LIGHT GREEN W/ DARK GREEN SPECKS 12" X 12"
- B LIGHT BROWN W/ BROWN SPECKS 12" X 12"
- C CONCRETE
- D GRAY W/ STREAKS 12" X 12"
- E BLUE LINOLEUM
- F LIGHT GREEN W/ DARK GREEN SPECKS 12" X 12" UNDER CARPET
- G CARPET OVER BLACK MASTIC
- H BLACK MASTIC ON CONCRETE
- I GRAYISH VINYL FLOORING WITH MASTIC
- J 24" X 24" FLOOR TILE
- K OFF WHITE W/ SPECKS 12" X 12"
- L CERAMIC TILE

USFin

PROJECT NO.	SCALE
17001	1" = 25'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17



TITLE

BUILDING 5 - GROUND FLOOR
MISCELLANEOUS ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

HMA-01 FIRE DOORS
GROUND FLOOR TOTAL - 4 DOORS

AREA UPDATED AS OF
2013 REINSPECTION

NOTE: FIRE DOORS FOUND DURING
2013 REINSPECTION.

USFin

PROJECT NO.	SCALE
17001	1" = 25'
PAGE	**DRAWN BY**
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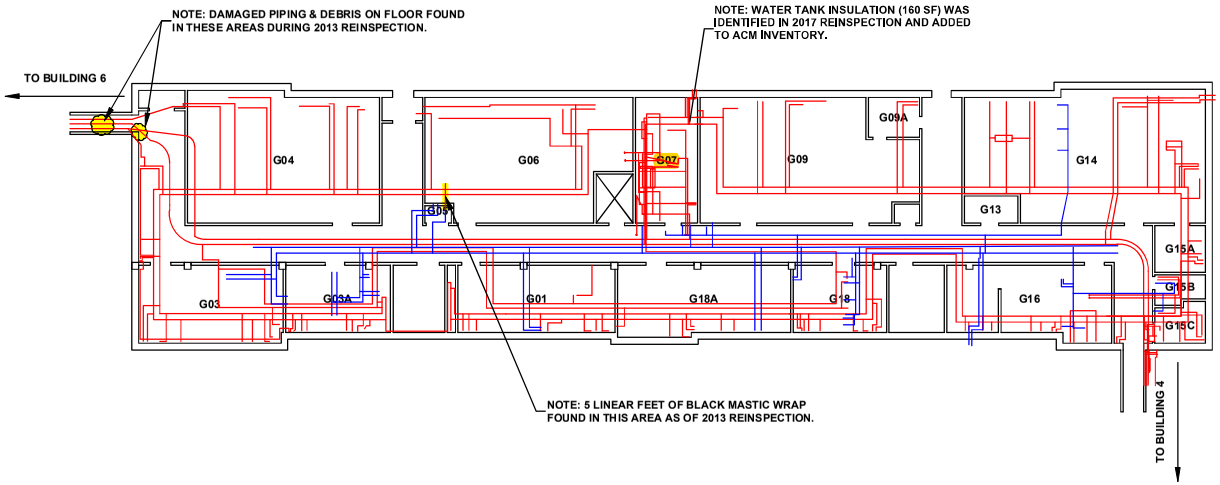
SHEET	**DATE**
B - 11 X 17	2/2/17



TITLE

BUILDING 5 - GROUND FLOOR
PIPING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

- HMA-5-G-TSI - STEAM PIPES 3,485 LIN FT
- HMA-5-G-TSI - WATER PIPES 840 LIN FT
- AREA UPDATED AS OF 2017 REINSPECTION

USFin

PROJECT NO.	SCALE
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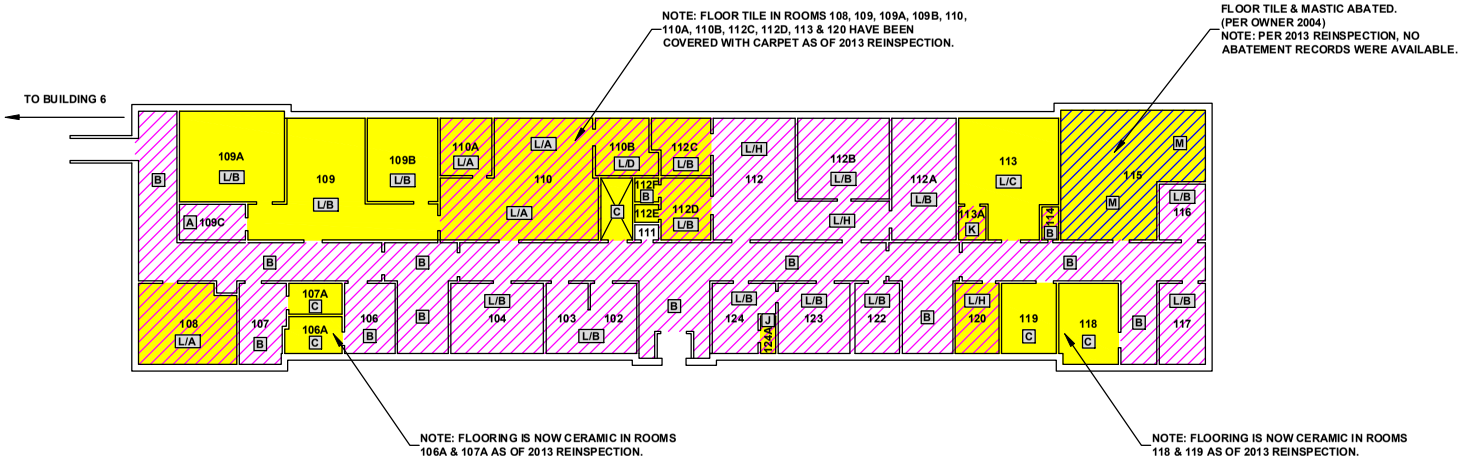
SHEET	**DATE**
B - 11 X 17	2/2/17



TITLE

BUILDING 5 - FIRST FLOOR
FLOORING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

- HMA-5-1-FT & M - FLOOR TILE AND/OR MASTIC - 6,890 SQ FT
- ABATED AREAS
- AREA UPDATED AS OF 2013 REINSPECTION

FLOORING LEGEND

- A BEIGE / GREEN 12" X 12"
- B WHITE / BROWN 12" X 12"
- C CERAMIC
- D AQUA / WHITE 12" X 12" UNDER CARPET
- E BLACK MASTIC UNDER CARPET
- F DARK BLUE 12" X 12"
- G GREEN 9" X 9" UNDER CARPET
- H BEIGE / BROWN 9" X 9" WITH MASTIC
- I WHITE / GRAY 9" X 9" WITH MASTIC
- J GRAY / GREEN / WHITE 12" X 12"
- K PINK / BROWN 12" X 12"
- L CARPET
- M GRAY 12" X 12"

USFin

PROJECT NO.	SCALE
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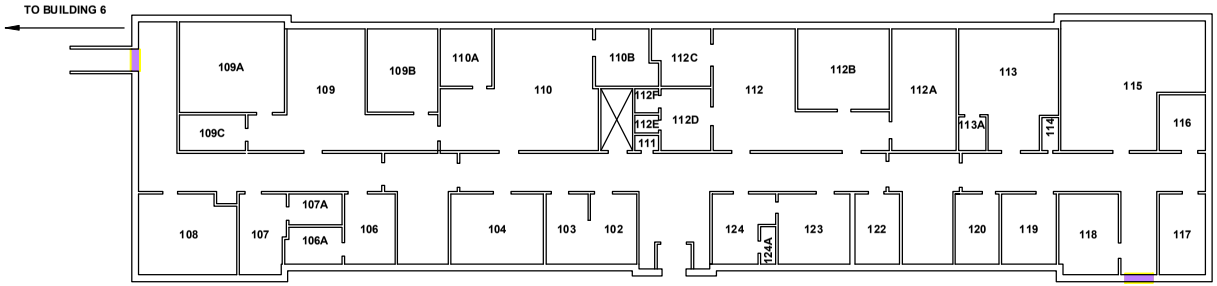
SHEET	**DATE**
B - 11 X 17	2/2/17



TITLE

BUILDING 5 - FIRST FLOOR
MISCELLANEOUS ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

HMA-01 FIRE DOORS
1ST FLOOR TOTAL - 2 DOORS

AREA UPDATED AS OF
2013 REINSPECTION

NOTE: FIRE DOORS FOUND DURING
2013 REINSPECTION.

USFin

PROJECT NO.	SCALE
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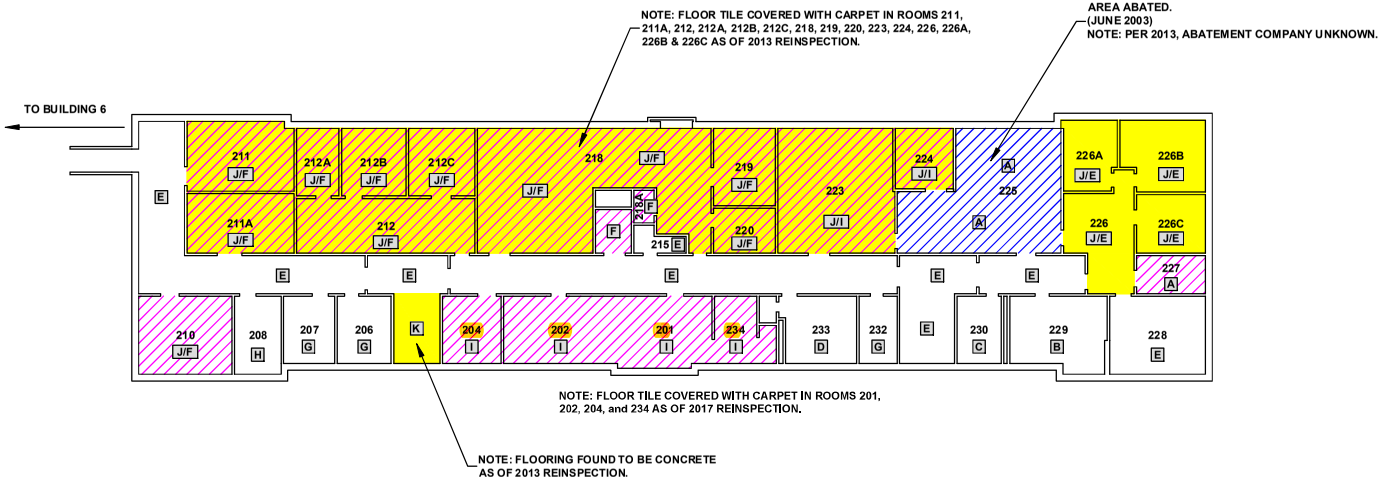
SHEET	**DATE**
B - 11 X 17	2/2/17



TITLE

BUILDING 5 - SECOND FLOOR
FLOORING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

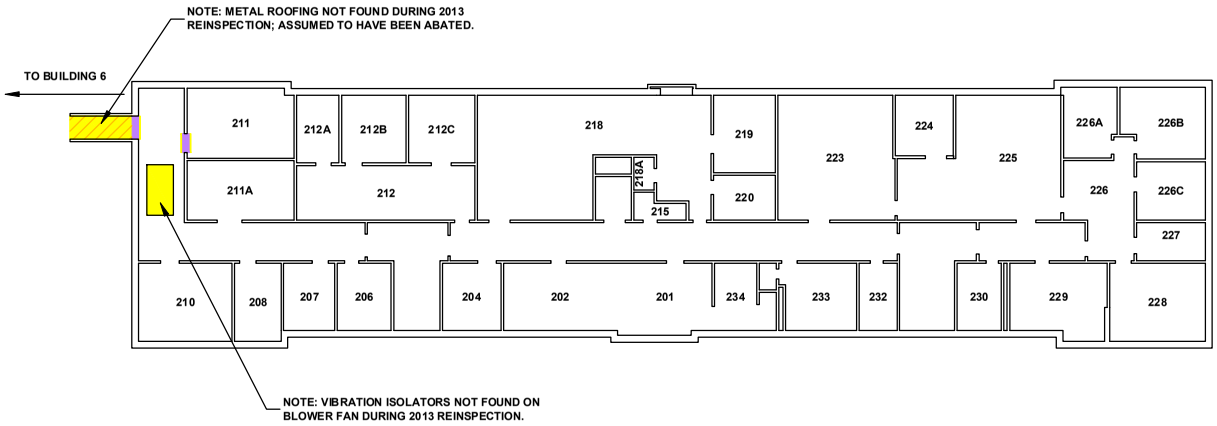
- HMA-5-2-FT & M - FLOOR TILE AND/OR MASTIC - 4,630 SQ FT
- ABATED AREAS
- AREA UPDATED AS OF 2013 REINSPECTION

FLOORING LEGEND

- A WHITE / BROWN 12" X 12"
- B WHITE W/ LIGHT BROWN SPECKS 12" X 12"
- C OFF WHITE W/ BLUE SPECKS 12" X 12"
- D WHITE W/ BLUE SPECKS 12" X 12"
- E CREAM W/ LIGHT BROWN SPECKS 12" X 12"
- F LIGHT GREEN W/ DARK GREEN SPECKS 9" X 9"
- G CERAMIC
- H BLUE W/ BLUE SPECKS 12" X 12"
- I CARPET OVER MASTIC
- J CARPET
- K CONCRETE

USFin

PROJECT NO.	SCALE
17001	1" = 25'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17



TITLE

BUILDING 5 - SECOND FLOOR
MISCELLANEOUS ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

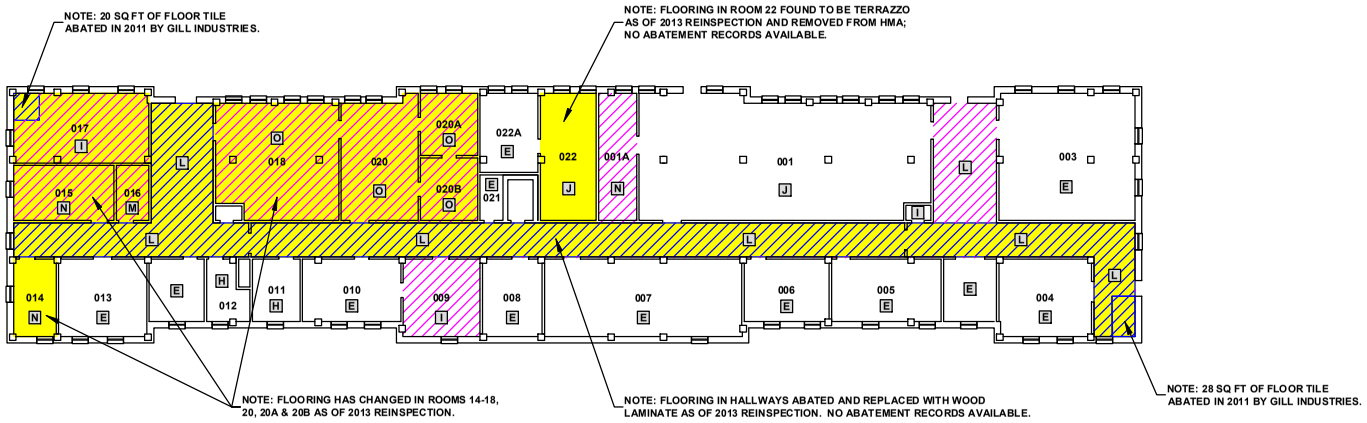
- HMA-5-2-M - ROOFING MATERIAL
- HMA-01 FIRE DOORS BASEMENT TOTAL - 2 DOORS
- AREA UPDATED AS OF 2013 REINSPECTION

NOTE: FIRE DOORS FOUND DURING 2013 REINSPECTION.

USFin

PROJECT NO.	SCALE
17001	1" = 25'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17

Building 6



TITLE

BUILDING 6 - GROUND FLOOR
FLOORING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

- HMA-6-B-FT & M - FLOOR TILE AND/OR MASTIC - 5,270 SQ FT
- ABATED AREAS
- AREA UPDATED AS OF 2013 REINSPECTION

FLOORING LEGEND

- A RED 9" X 9" UNDER CARPET
- B GRAY / MAROON 12" X 12"
- C CREAM 12" X 12"
- D BROWN / WHITE 12" X 12"
- E CONCRETE
- F CREAM W/ BROWN SPECKS 12" X 12"
- G WHITE 9" X 9" W/ BLACK MASTIC
- H CERAMIC
- I MASTIC ON CONCRETE
- J TERRAZZO
- K CREAM 12" X 12" & BROWN / WHITE 12" X 12" UNDER CARPET
- L WOOD LAMINATE
- M BROWN 12" X 12"
- N BROWN 18" X 18"
- O GREEN 18" X 18"

USFin

PROJECT NO.	SCALE
17001	1" = 25'
PAGE	**DRAWN BY**
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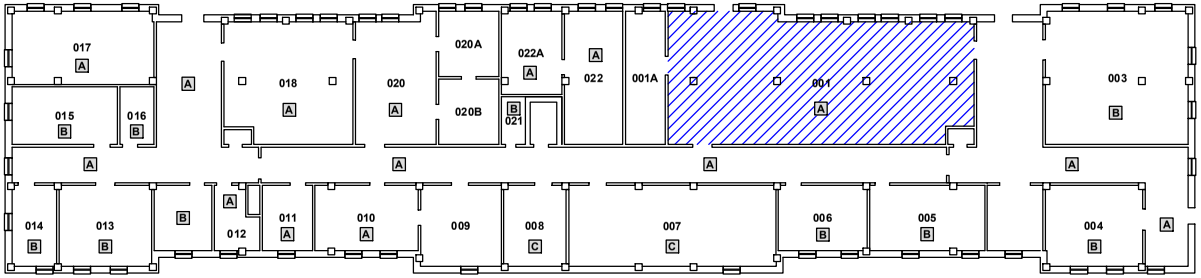
SHEET	**DATE**
B - 11 X 17	2/2/17



TITLE

BUILDING 6 - GROUND FLOOR
CEILING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

12" PERFORATED CEILING TILE
WAS ABATED AUGUST OF 2001
ABATEMENT COMPANY UNKNOWN

CEILING LEGEND

A 24" X 48" WHITE CEILING TILE
B CONCRETE
C CEILING PLASTER

USFin

PROJECT NO.	SCALE
17001	1" = 25'
PAGE	**DRAWN BY**
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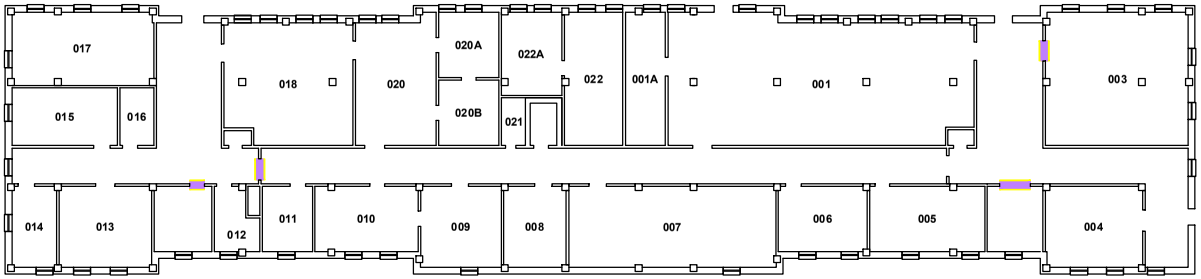
SHEET	**DATE**
B - 11 X 17	2/2/17



TITLE

BUILDING 6 - GROUND FLOOR
MISCELLANEOUS ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

HMA-01 FIRE DOORS
GROUND FLOOR TOTAL - 4 DOORS

AREA UPDATED AS OF
2013 REINSPECTION

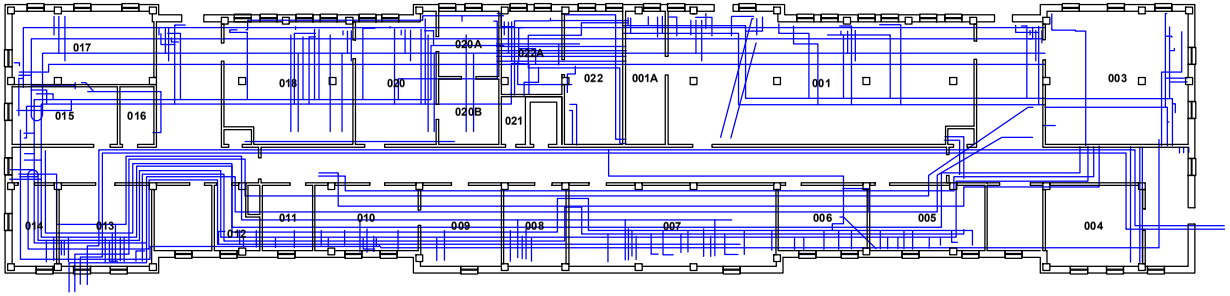
NOTE: FIRE DOORS FOUND DURING
2013 REINSPECTION.

USFin

PROJECT NO.	SCALE
17001	1" = 25'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17

ABATED PIPING

NOTE: PIPING ABATED IN 2011 BY GILL INDUSTRIES.
PIPING REMAINS IN WALLS & CHASES AS OF 2013
REINSPECTION AND ASSUMED TO BE ASBESTOS
CONTAINING MATERIAL.



TITLE

BUILDING 6 - GROUND FLOOR
PIPING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

ABATED PIPING

NOTE: PIPING ABATED IN 2011 BY GILL INDUSTRIES. PIPING REMAINS IN WALLS & CHASES AS OF 2013 REINSPECTION AND ASSUMED TO BE ASBESTOS CONTAINING MATERIAL.

USFin

PROJECT NO.	SCALE
17001	1" = 25'
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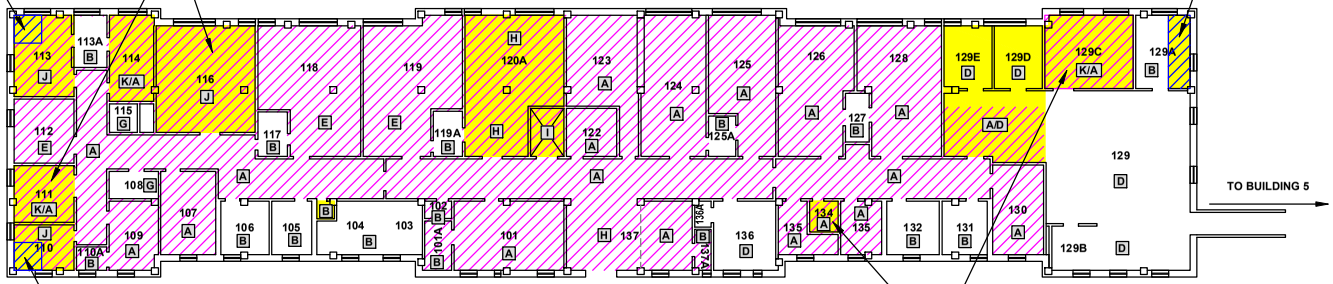
SHEET	DATE
B - 11 X 17	2/2/17

NOTE: 27 SQ FT OF FLOOR TILE ABATED IN 2011 BY GILL INDUSTRIES.

NOTE: FLOORING MATERIAL HAS CHANGED IN ROOMS 110, 111, 113, 116 120A AS OF 2013 REINSPECTION.

NOTE: 52 SQ FT OF FLOOR TILE ABATED IN 2011 BY GILL INDUSTRIES.



NOTE: 30 SQ FT OF FLOOR TILE ABATED IN 2011 BY GILL INDUSTRIES.

NOTE: FLOORING FOUND TO CONTAIN ACM IN ROOMS 134 & 129C AS OF 2013 REINSPECTION. AREAS ADDED TO HMA.

TITLE

BUILDING 6 - FIRST FLOOR
FLOORING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

- HMA-6-1-FT & M - FLOOR TILE AND/OR MASTIC - 7,930 SQ FT
- ABATED AREAS
- AREA UPDATED AS OF 2013 REINSPECTION

FLOORING LEGEND

- A GRAY / MAROON 12" X 12"
- B CERAMIC
- C GREEN CARPET
- D TERRAZZO
- E GRAY / MAROON 12" X 12" UNDER GREEN CARPET
- F BEIGE / BLUE / BROWN 12" X 12" W/ MASTIC
- G CONCRETE
- H BEIGE / BLUE / BROWN 12" X 12" W/ MASTIC
- I GREEN 18" X 18"
- J BROWN 18" X 18"
- K CARPET

USFin

PROJECT NO.	SCALE
17001	1" = 25'
PAGE	**DRAWN BY**
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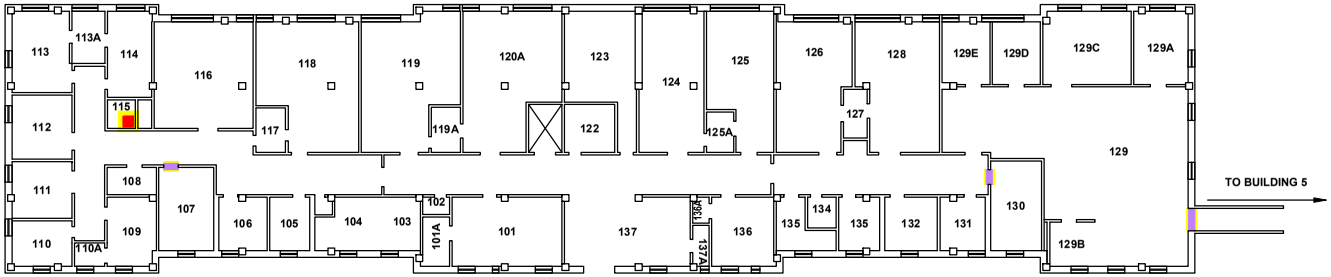
SHEET	**DATE**
B - 11 X 17	2/2/17



TITLE

BUILDING 6 - FIRST FLOOR
MISCELLANEOUS ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

HMA-01 FIRE DOORS
1ST FLOOR TOTAL - 3 DOORS

HMA-02 LINEN CHUTE

AREA UPDATED AS OF
2013 REINSPECTION

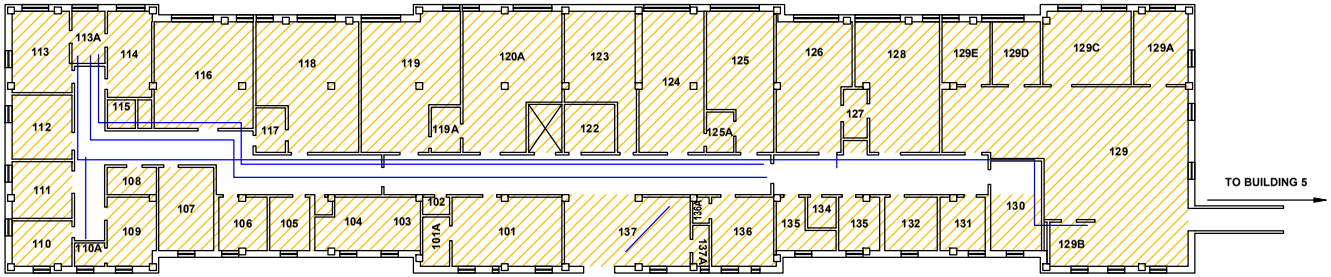
NOTE: FIRE DOORS FOUND DURING
2013 REINSPECTION.

USFin

PROJECT NO.	SCALE
17001	1" = 25'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17

ALL WHITE & GRAY INSULATION CONTAINS ASBESTOS. THIS FLOOR ALSO CONTAINS FIBERGLASS INSULATION (YELLOW) THAT DOES NOT CONTAIN ASBESTOS.

PIPING ABATED IN 2011 BY GILL INDUSTRIES. PIPING REMAINS IN WALLS & CHASES AS OF 2013 REINSPECTION AND ASSUMED TO BE ASBESTOS CONTAINING MATERIAL.



TITLE

BUILDING 6 - FIRST FLOOR
PIPING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

ABATED PIPING

NOTES:

ALL WHITE & GRAY INSULATION CONTAINS ASBESTOS. THIS FLOOR ALSO CONTAINS FIBERGLASS INSULATION (YELLOW) THAT DOES NOT CONTAIN ASBESTOS.

PIPING ABATED IN 2011 BY GILL INDUSTRIES. PIPING REMAINS IN WALLS & CHASES AS OF 2013 REINSPECTION AND ASSUMED TO BE ASBESTOS CONTAINING MATERIAL.

USFin

PROJECT NO.	SCALE
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PAGE	**DRAWN BY**
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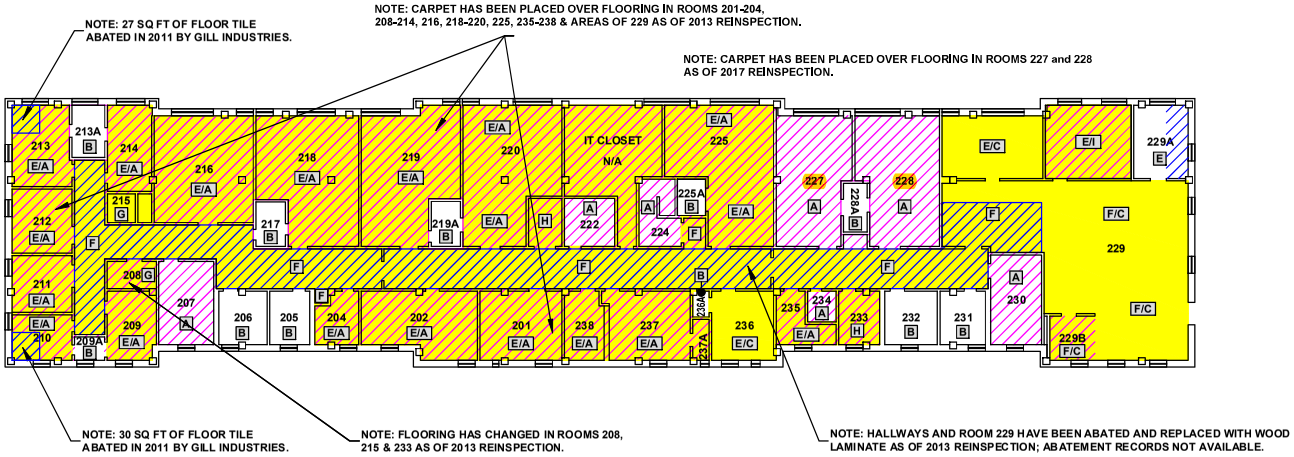
SHEET	**DATE**
B - 11 X 17	2/2/17



TITLE

BUILDING 6 - SECOND FLOOR
FLOORING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

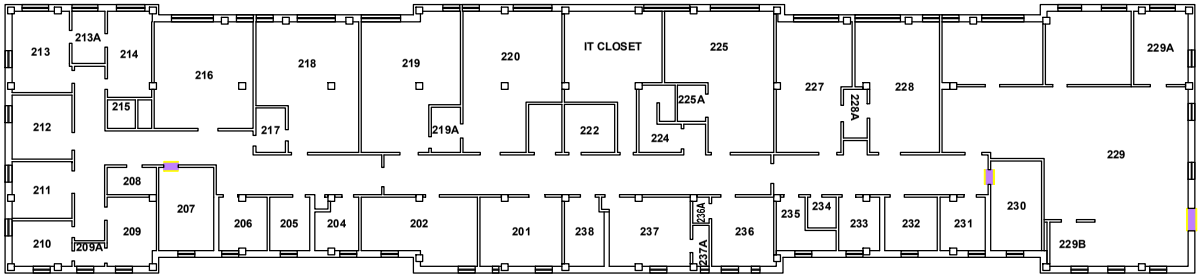
- HMA-6-2-FT & M - FLOOR TILE AND/OR MASTIC - 8,795 SQ FT
- ABATED AREAS
- AREA UPDATED AS OF 2013 REINSPECTION

FLOORING LEGEND

- A GRAY / MAROON 12" X 12" W/ MASTIC
- B CERAMIC
- C TERRAZZO
- D GRAY / MAROON 12" X 12" UNDER GREEN CARPET W/ BLACK MASTIC
- E CARPET
- F WOOD LAMINATE
- G BROWN 18" X 18" PEEL & STICK
- H GRAY 18" X 18" PEEL & STICK
- I CONCRETE

USFin

PROJECT NO.	SCALE
17001	1" = 25'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17



TITLE

BUILDING 6 - SECOND FLOOR
MISCELLANEOUS ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

HMA-01 FIRE DOORS
2ND FLOOR TOTAL - 3 DOORS

AREA UPDATED AS OF
2013 REINSPECTION

NOTE: FIRE DOORS FOUND DURING
2013 REINSPECTION.

USFin

PROJECT NO.	SCALE
17001	1" = 25'
PAGE	**DRAWN BY**
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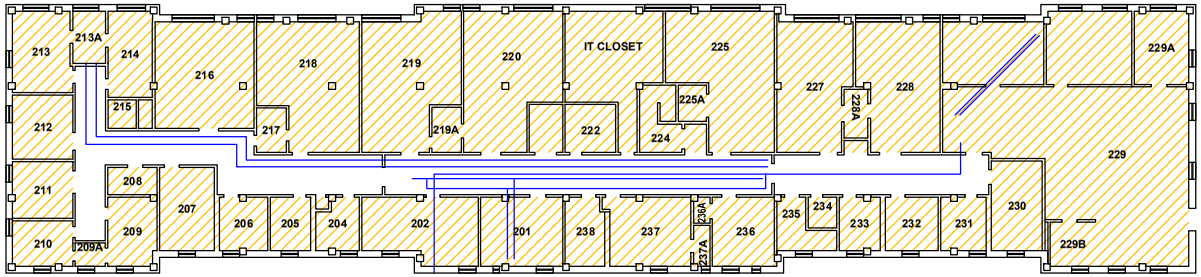
SHEET	**DATE**
B - 11 X 17	2/2/17



TITLE

BUILDING 6 - SECOND FLOOR
PIPING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

ABATED PIPING

NOTES:

ALL WHITE & GRAY INSULATION CONTAINS ASBESTOS. THIS FLOOR ALSO CONTAINS FIBERGLASS INSULATION (YELLOW) THAT DOES NOT CONTAIN ASBESTOS.

PIPING ABATED IN 2011 BY GILL INDUSTRIES. PIPING REMAINS IN WALLS & CHASES AS OF 2013 REINSPECTION AND ASSUMED TO BE ASBESTOS CONTAINING MATERIAL.

USFin

PROJECT NO.	SCALE
17001	1" = 25'
PAGE	**DRAWN BY**
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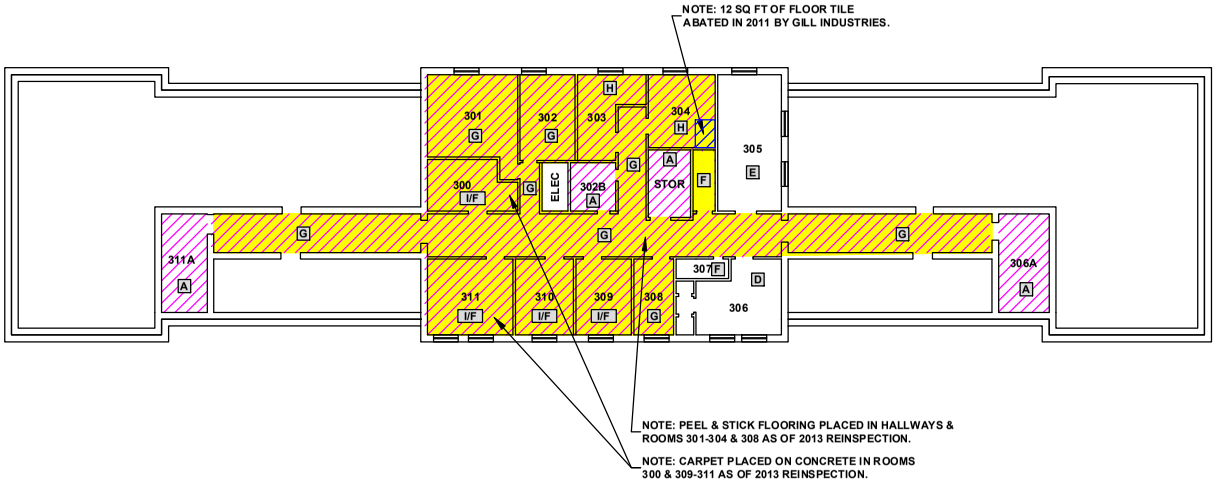
SHEET	**DATE**
B - 11 X 17	2/2/17



TITLE

BUILDING 6 - THIRD FLOOR
FLOORING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

- HMA-6-3-FT & M - FLOOR TILE AND/OR MASTIC - 3,765 SQ FT
- ABATED AREAS
- AREA UPDATED AS OF 2013 REINSPECTION

FLOORING LEGEND

- A WHITE / BROWN 12" X 12" W/ BLACK MASTIC
- B LIGHT GRAY WITH BLACK SPOTS 12" X 12" W/ BLACK MASTIC
- C WHITE / BROWN W/ BLACK MASTIC 12" X 12" UNDER RED CARPET
- D CERAMIC
- E GRAY / MAROON 12" X 12" WITH BLACK MASTIC
- F CONCRETE
- G GRAY 18" X 18" PEEL & STICK
- H BROWN 18" X 18" PEEL & STICK
- I CARPET

USFin

PROJECT NO.	SCALE
17001	1" = 25'
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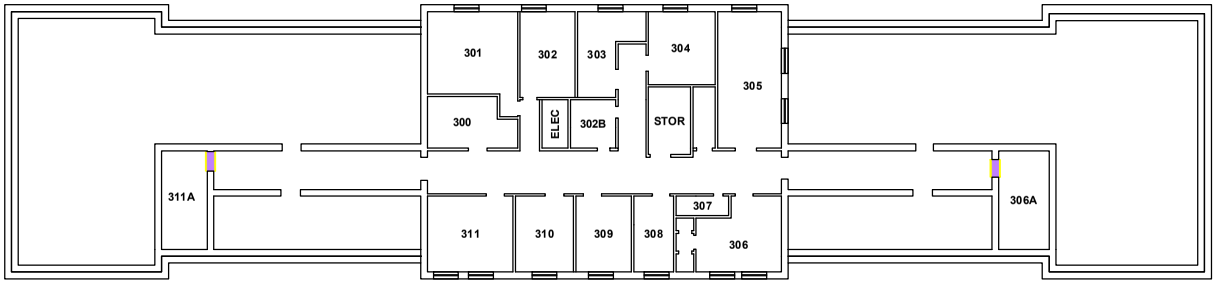
SHEET	**DATE**
B - 11 X 17	2/2/17



TITLE

BUILDING 6 - THIRD FLOOR
MISCELLANEOUS ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

HMA-01 FIRE DOORS
3RD FLOOR TOTAL - 2 DOORS

AREA UPDATED AS OF
2013 REINSPECTION

NOTE: FIRE DOORS FOUND DURING
2013 REINSPECTION.

USFin

PROJECT NO.	SCALE
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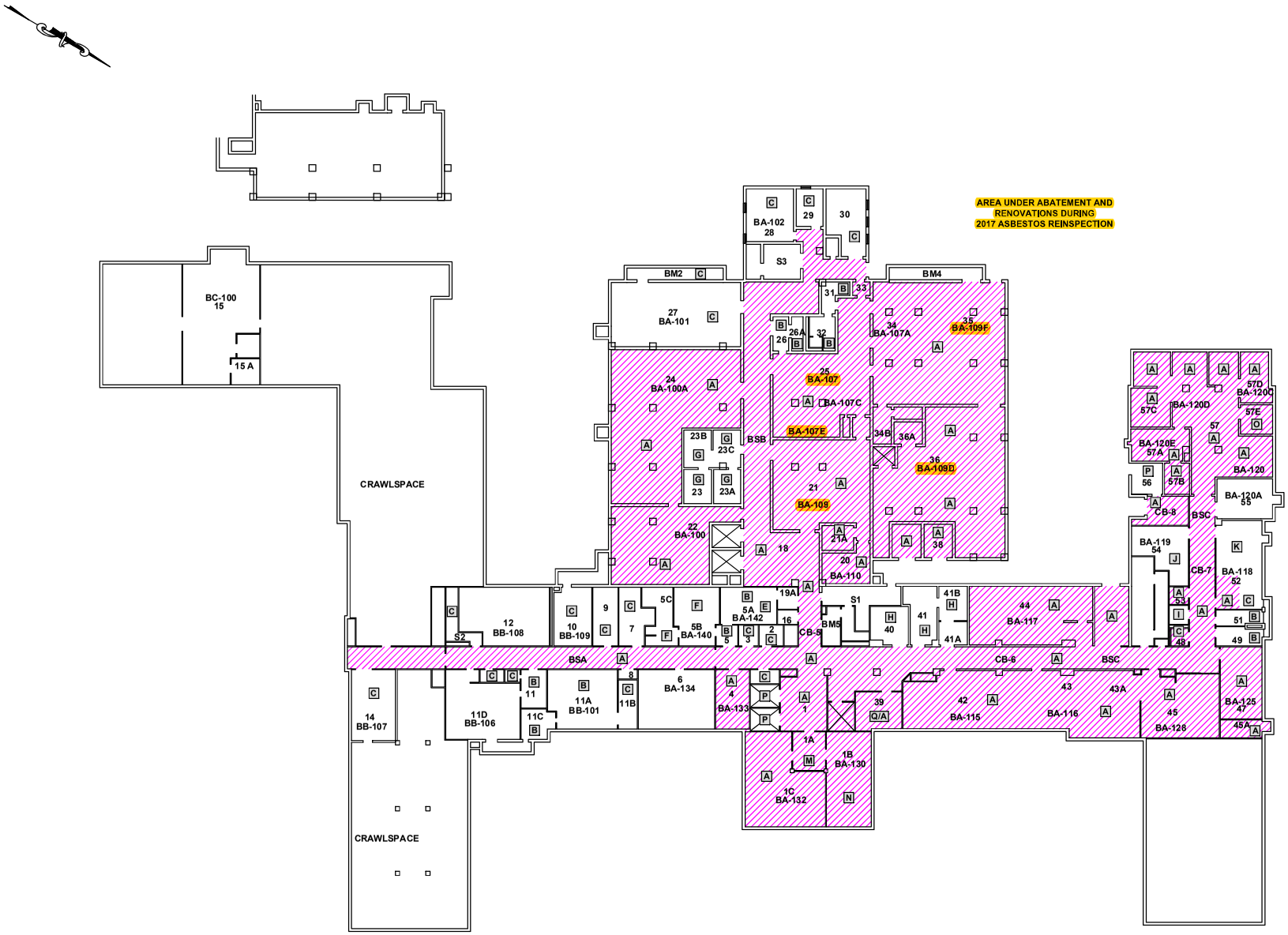
SHEET	**DATE**
B - 11 X 17	2/2/17

Building 7



TITLE

BUILDING 7 - BASEMENT
FLOORING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

HMA-7-B-FT & M - FLOOR TILE AND/OR MASTIC - 17,010 SQ FT

FLOORING LEGEND

- A OFF WHITE W/ BROWN SPECKS
- B CERAMIC
- C CONCRETE
- D BLUE W/ BLUE SPECKS 12" X 12"
- E BROWN W/ BROWN SPECKS 12" X 12"
- F PINK W/ PINK SPECKS 12" X 12"
- G CARPET OVER CONCRETE
- H CARPET OVER MASTIC
- I MULTICOLOR 12" X 12"
- J GRAY WITH MAROON
- K CARPET ON GREEN W/ STRIPES
- L CHARCOAL W/ BLACK SPECKS 12" X 12"
- M OFF WHITE W/ GREEN STRIPES 12" X 12"
- N WHITE W/ BLUE SPECKS 12" X 12"
- O GRAY 12" X 12"
- P TAN 18" X 18"
- Q CARPET

USFin

PROJECT NO.	SCALE
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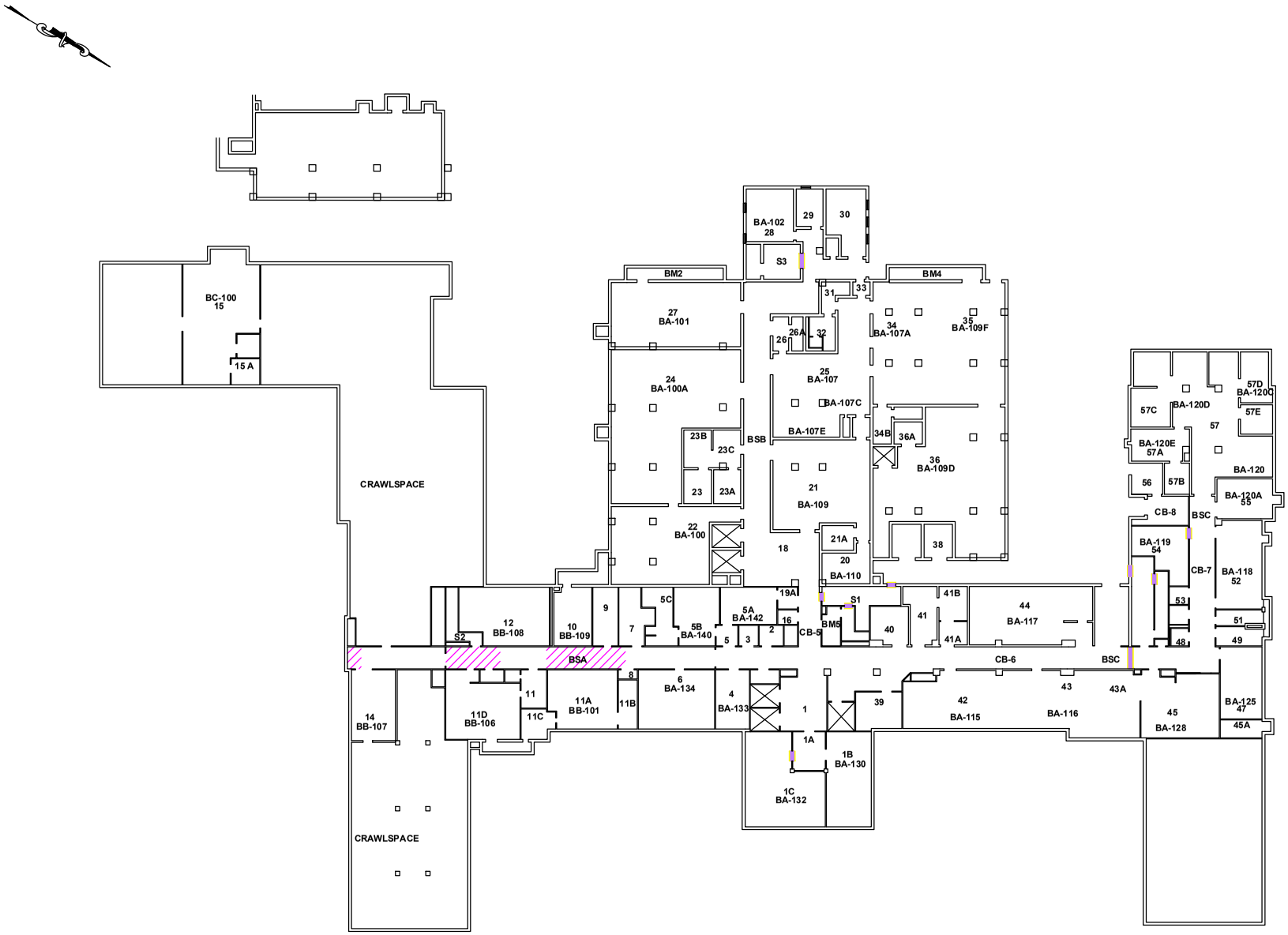
SHEET	DATE
B - 11 X 17	2/2/17



TITLE

BUILDING 7 - BASEMENT
MISCELLANEOUS ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

- HMA-7-B-M - DUCTWORK
- HMA-01 FIRE DOORS BASEMENT TOTAL - 9 DOORS
- AREA UPDATED AS OF 2013 REINSPECTION

NOTE: FIRE DOORS FOUND DURING 2013 REINSPECTION.

USFin

PROJECT NO.	SCALE
17001	1" = 35'
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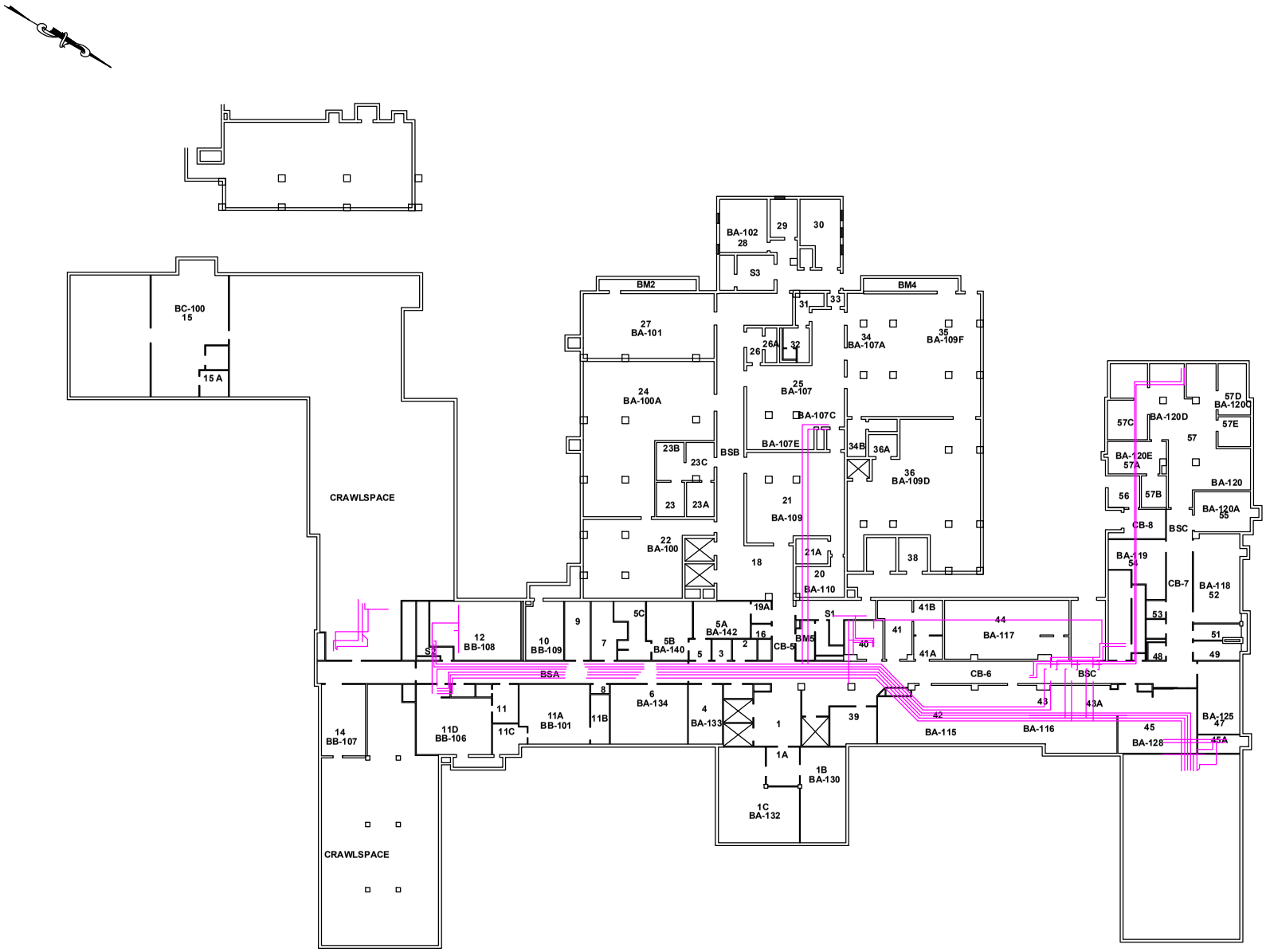
SHEET	**DATE**
B - 11 X 17	2/2/17



TITLE

BUILDING 7 - BASEMENT
PIPING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

HMA-7-B-TSI - HVAC PIPES
2,650 LIN FT

USFin

PROJECT NO.	SCALE
17001	1" = 35'
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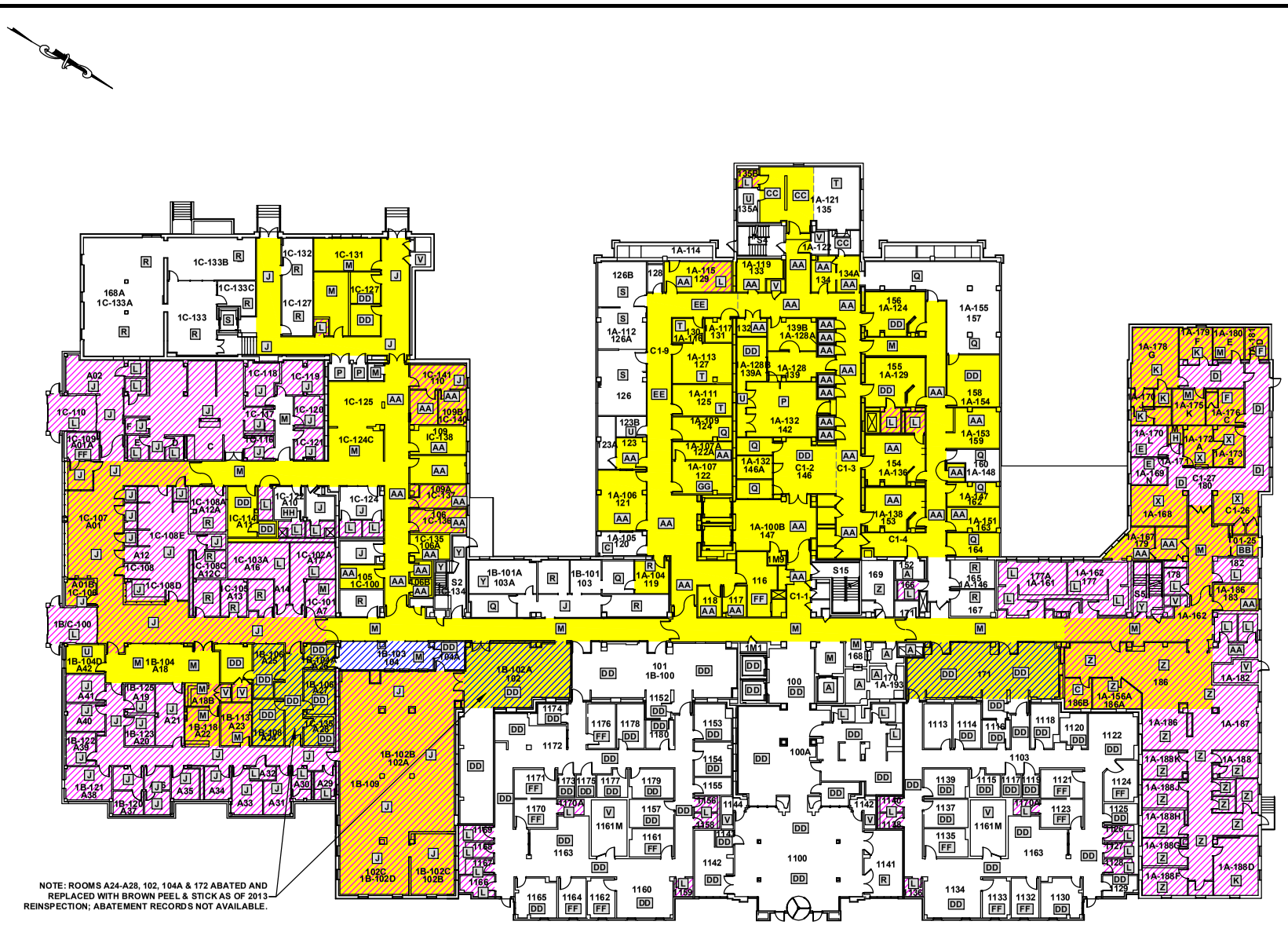
SHEET	**DATE**
B - 11 X 17	2/2/17



NOTE: ROOMS A24-A28, 102, 104A & 172 ABATED AND REPLACED WITH BROWN PEEL & STICK AS OF 2013 REINSPECTION; ABATEMENT RECORDS NOT AVAILABLE.

TITLE

BUILDING 7 - FIRST FLOOR
FLOORING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

- HMA-7-1-FT & M - FLOOR TILE AND/OR MASTIC - 30,700 SQ FT
- ABATED AREAS IN 2003 ABATEMENT COMPANY UNKNOWN
- AREA UPDATED AS OF 2013 REINSPECTION

FLOORING LEGEND

A	WHITE WITH SPECKS 12" X 12"
B	YELLOW / ORANGE 12" X 12"
C	TAN / MAROON 12" X 12"
D	CREAM BROWN STRIPE 12" X 12"
E	WHITE / LIGHT BLUE 12" X 12"
F	WHITE W/ BROWN LINOLEUM
G	GREEN CARPET
H	TAN LINOLEUM WITH BLACK MASTIC
I	LIGHT GREEN W/ DARK GREEN SPECS 12" X 12"
J	CREAM W/ LIGHT BROWN SPECKS 12" X 12"
K	WHITE W/ AQUA SPECKS LINOLEUM
L	WHITE W/ GRAY & BLUE SPECKS 12" X 12"
M	WHITE W/ BLACK SPECKS 12" X 12"
N	WHITE W/ BLUE SPECKS 12" X 12"
O	YELLOW CERAMIC
P	BLUISH GREEN 12" X 12"
Q	CARPET OVER TILE
R	CARPET OVER CONCRETE
S	GRAY LINOLEUM
T	LIGHT & DARK PINK
U	WHITE CERAMIC 16" X 16"
V	CONCRETE
W	OFF WHITE W/ MAROON / BLUE SPECKS
X	CARPET ON MASTIC
Y	TERRAZZO
Z	WHITE / AQUA 12" X 12"
AA	GRAY 12" X 12"
BB	BROWN 9" X 9" W/ BLACK MASTIC
CC	GRAY 9" X 9" W/ BLACK MASTIC
DD	BROWN 18" X 18" PEEL & STICK
EE	MULTI COLORED 18" X 18"
FF	WOOD LAMINATE
GG	GREEN 12" X 12"
HH	BLUE 18" X 18" PEEL & STICK

USFin

PROJECT NO.	SCALE
17001	1" = 35'
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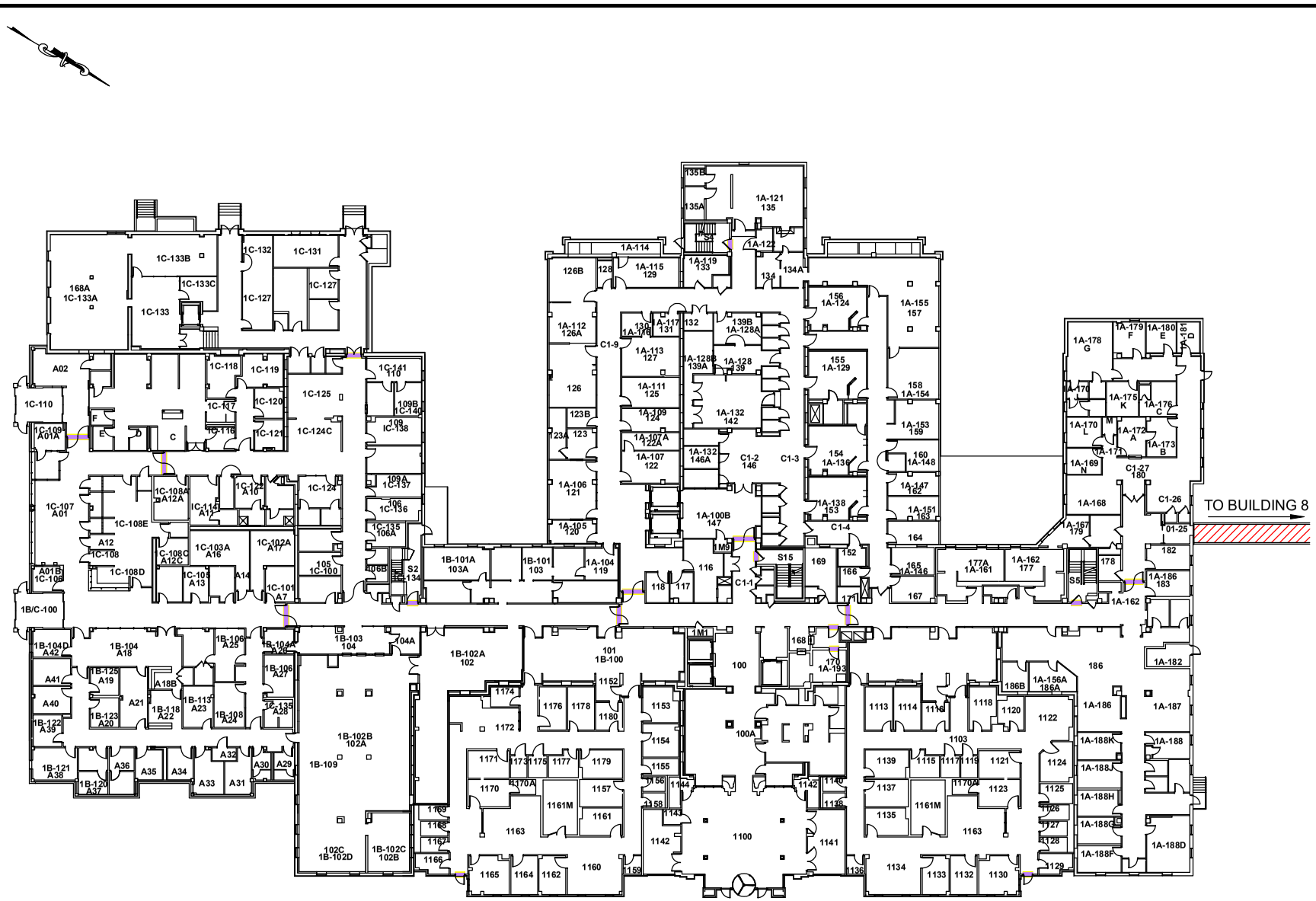
SHEET	**DATE**
B - 11 X 17	2/2/17



TITLE

BUILDING 7 - FIRST FLOOR
MISCELLANEOUS ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

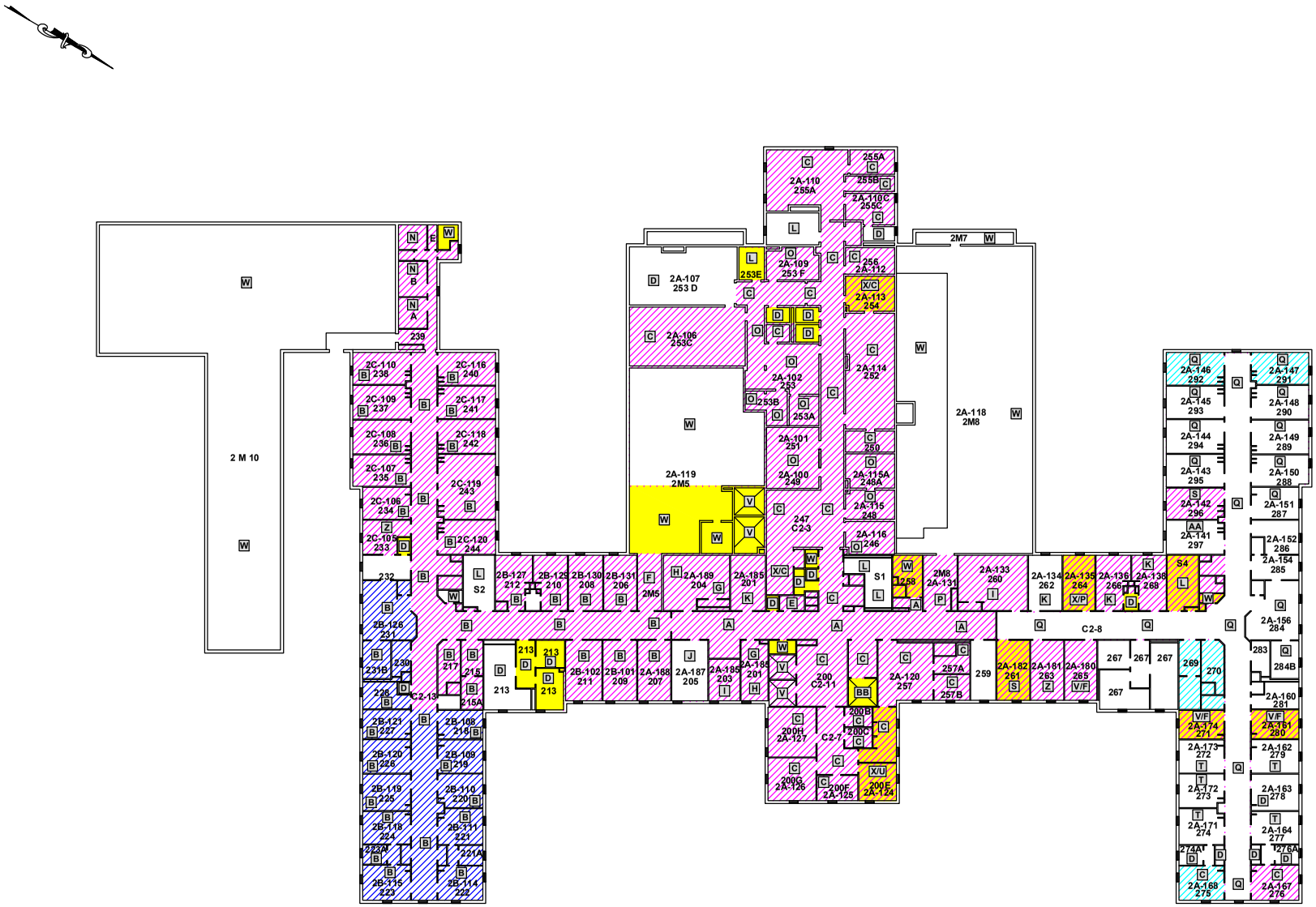
LEGEND

- HMA-7-1-M - ROOFING MATERIAL 275 SQ FT
- HMA-01 FIRE DOORS 1ST FLOOR TOTAL - 17 DOORS
- AREA UPDATED AS OF 2013 REINSPECTION

NOTE: FIRE DOORS FOUND DURING 2013 REINSPECTION.

USFin

PROJECT NO.	SCALE
17001	1" = 35'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17



TITLE

BUILDING 7 - SECOND FLOOR
FLOORING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

- HMA-7-2-FT & M - FLOOR TILE AND/OR MASTIC - 22,195 SQ FT
- AREAS ABATED IN 1997 ABATEMENT COMPANY UNKNOWN
- ABATED AREAS 2004 ABATEMENT COMPANY UNKNOWN
- AREA UPDATED AS OF 2013 REINSPECTION

FLOORING LEGEND

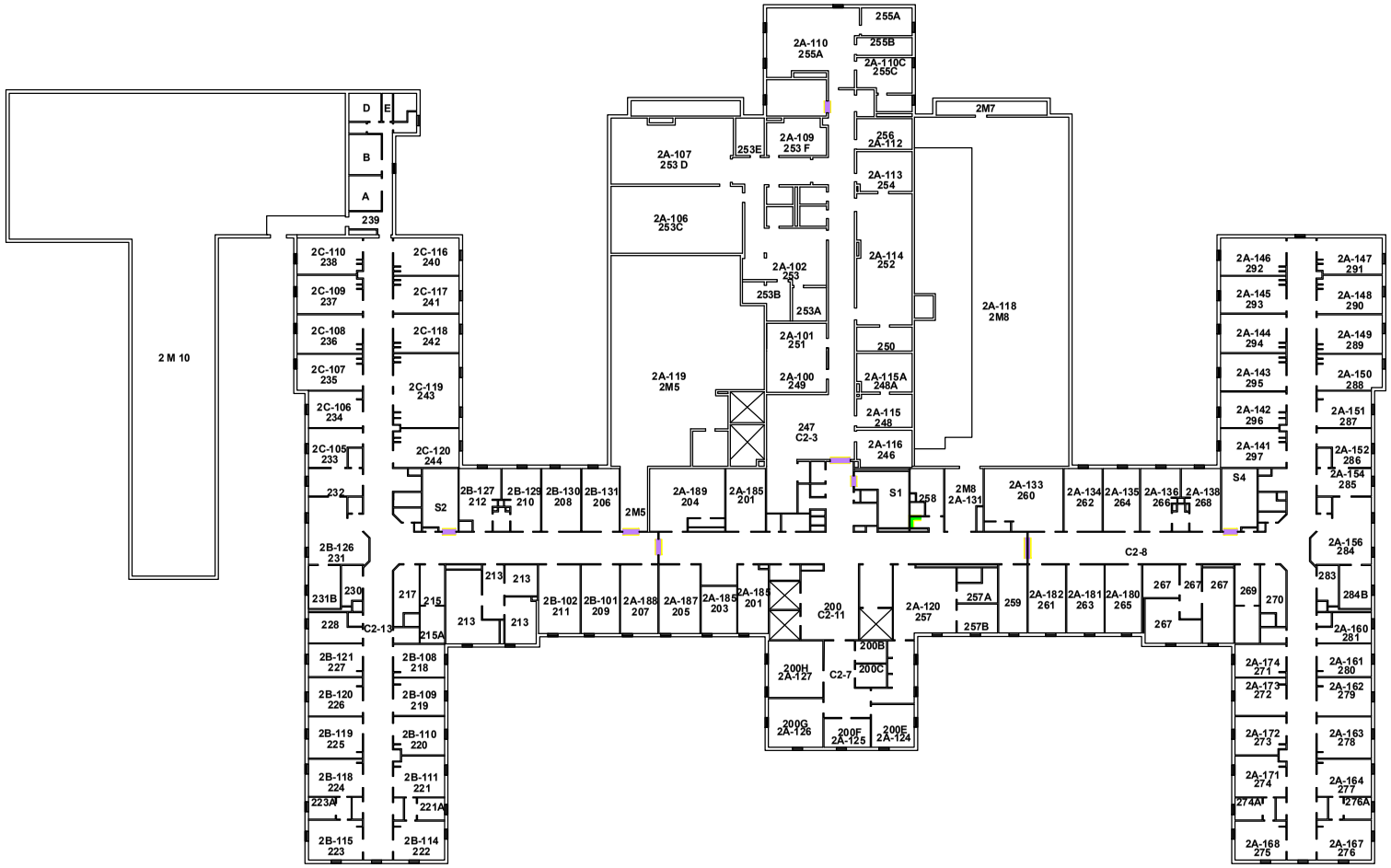
A	GRAY W/ GREEN / WHITE 12" X 12"
B	GREEN W/ GRAY 12" X 12"
C	OFF WHITE W/ BROWN SPECKS 12" X 12"
D	CERAMIC
E	BROWN 12" X 12"
F	MASTIC ON CONCRETE
G	BLACK 9" X 9"
H	GRAY 9" X 9"
I	GRAY W/ MAROON 12" X 12"
J	LIGHT AQUA 12" X 12"
K	CARPET ON MASTIC
L	TERRAZZO
M	CARPET OVER "B" TILE
N	CARPET OVER "A" TILE
O	OFF WHITE W/ MANY BROWN SPECKS 12" X 12"
P	CONCRETE W/ BLACK MASTIC
Q	WHITE W/ BLUE SPECKS 12" X 12"
R	PURPLE 12" X 12"
S	BLUE W/ BLUE SPECKS 12" X 12"
T	PINK W/ BLUE SPECKS LINOLEUM
U	WHITE W/ MAROON & BLUE SPECKS 12" X 12"
V	GRAY 18" X 18" PEEL & STICK
W	CONCRETE
X	CARPET
Y	BROWN 18" X 18"
Z	GRAY LINOLEUM
AA	AQUA 12" X 12"
BB	METAL

USFin

PROJECT NO.	SCALE
17001	1" = 35'

PAGE	DRAWN BY
1	BB

SHEET	DATE
B - 11 X 17	2/2/17



TITLE

BUILDING 7 - SECOND FLOOR
MISCELLANEOUS ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

HMA-01 FIRE DOORS
2ND FLOOR TOTAL - 8 DOORS

HMA-03 TRANSITE - 100 SQ FT

AREA UPDATED AS OF
2013 REINSPECTION

NOTE: FIRE DOORS FOUND DURING
2013 REINSPECTION.

USFin

PROJECT NO.	SCALE
17001	1" = 35'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17

TITLE

BUILDING 7 - THIRD FLOOR
FLOORING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

- HMA-7-3-FT & M - FLOOR TILE AND/OR MASTIC - 5,990 SQ FT
- ABATED AREAS
- AREA UPDATED AS OF 2013 REINSPECTION

FLOORING LEGEND

A	GRAY / WHITE W/ GREEN SPECKS 12" X 12"
B	DARK BLUE W/ BLUE SPECKS 12" X 12"
C	OFF WHITE W/ BROWN SPECKS 12" X 12"
D	CERAMIC
E	LIGHT BLUE W/ BLUE 12" X 12"
F	CONCRETE
G	BLACK 9" X 9"
H	GRAY 9" X 9"
I	GRAY / MAROON 12" X 12"
J	OFF WHITE W/ GRAY SPECKS 12" X 12"
K	MULTICOLOR LINOLEUM
L	OFF WHITE W/ MAROON / BLUE SPECKS 12" X 12"
M	BROWN W/ MANY SPECKS 12" X 12"
N	18" MULTICOLOR (GREY/RED) VINYL FLOOR TILE
O	YELLOW W/ YELLOW SPECKS 12" X 12"
P	LIGHT PINK W/ MAROON / BLUE SPECKS 12" X 12"
Q	DARK PINK W/ MAROON / BLUE SPECKS 12" X 12"
R	WHITE W/ MAROON / BLUE 12" X 12"
S	CARPET ON CONCRETE (YELLOW GLUE)
T	BROWN 18" X 18" PEEL & STICK
U	GRAY 18" X 18" PEEL & STICK
V	WOOD LAMINATE
W	TERRAZZO
X	RUBBER 18" X 18"

USFin

PROJECT NO.	SCALE
17001	1" = 30'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17

TITLE

BUILDING 7 - THIRD FLOOR
MISCELLANEOUS ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

HMA-01 FIRE DOORS
3RD FLOOR TOTAL - 8 DOORS

AREA UPDATED AS OF
2013 REINSPECTION

NOTE: FIRE DOORS FOUND DURING
2013 REINSPECTION.

USFin

PROJECT NO.	SCALE
17001	1" = 30'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17

TITLE

BUILDING 7 - FOURTH FLOOR
FLOORING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

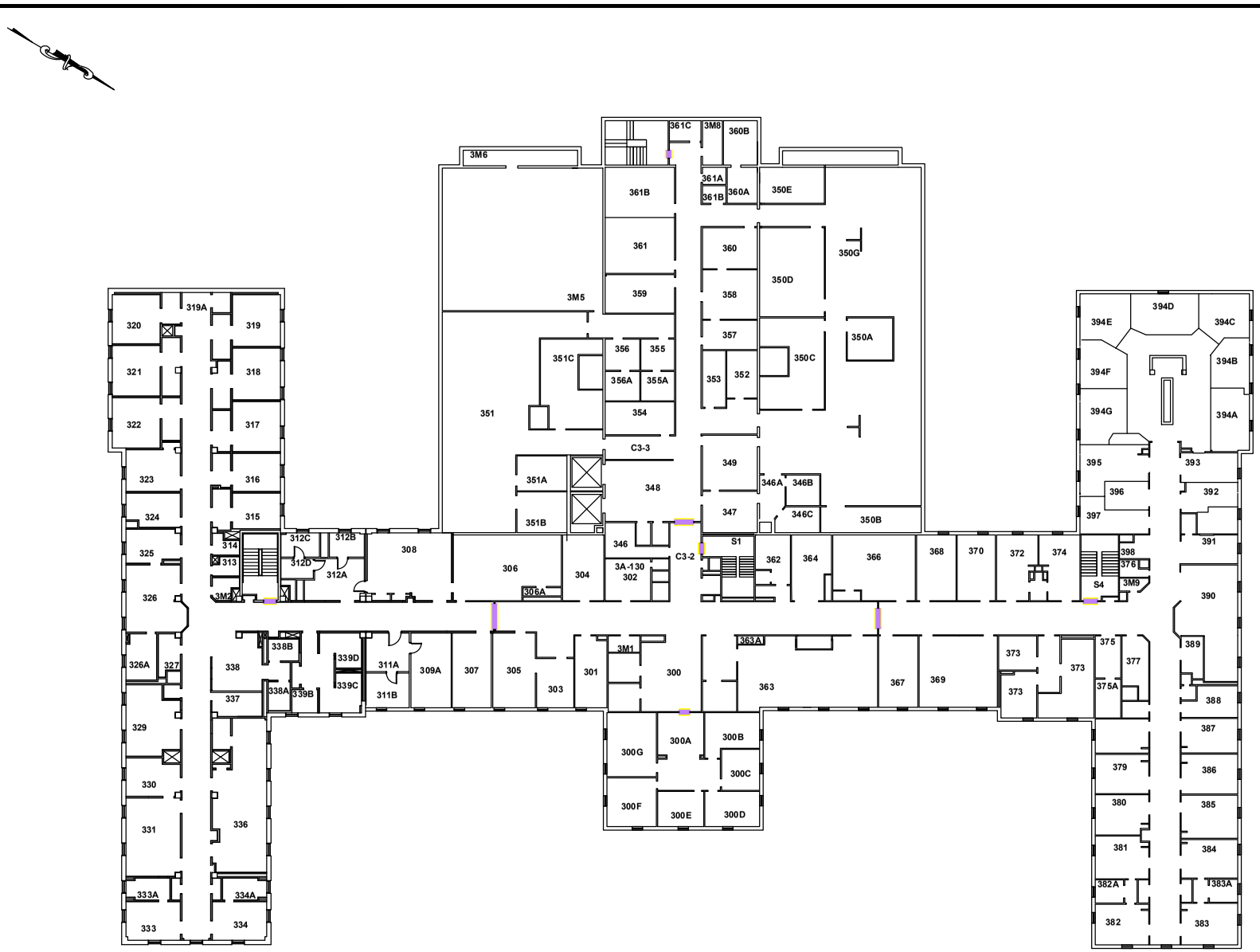
- HMA-7-4-FT & M - FLOOR TILE AND/OR MASTIC - 5,870 SQ FT
- ABATED AREAS
- AREA UPDATED AS OF 2013 REINSPECTION

FLOORING LEGEND

- A GRAY / WHITE W/ GREEN SPECKS 12" X 12"
- B OFF WHITE W/ BROWN SPECKS 12" X 12"
- C OFF WHITE W/ MAROON / BLUE SPECKS 12" X 12"
- D LIGHT GREEN W/ DARK GREEN SPECKS 12" X 12"
- E GRAY / MAROON 12" X 12"
- F CERAMIC
- G LIGHT-LIGHT GREEN W/ LIGHT GREEN SPECKS 12" X 12"
- H CARPET ON MASTIC
- I CONCRETE
- J MULTICOLOR LINOLEUM
- K WHITE W/ BLUE SPECKS 12" X 12"
- L TERRAZZO
- M LIGHT PINK W/ MAROON / BLUE SPECKS 12" X 12"
- N OFF WHITE W/ MANY BROWN SPECKS 12" X 12"
- O LIGHT BLUE W/ DARK BLUE SPECKS 12" X 12"
- P LIGHT PINK W/ MULTICOLOR LINOLEUM
- Q CARPET ON CONCRETE
- R LIGHT BLUE LINOLEUM
- S GRAY 18" X1 18"
- T WOOD LAMINATE
- U GRAY LINOLEUM
- V CARPET
- W WOOD

USFin

PROJECT NO.	SCALE
17001	1" = 30'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17



TITLE

BUILDING 7 - FOURTH FLOOR
MISCELLANEOUS ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

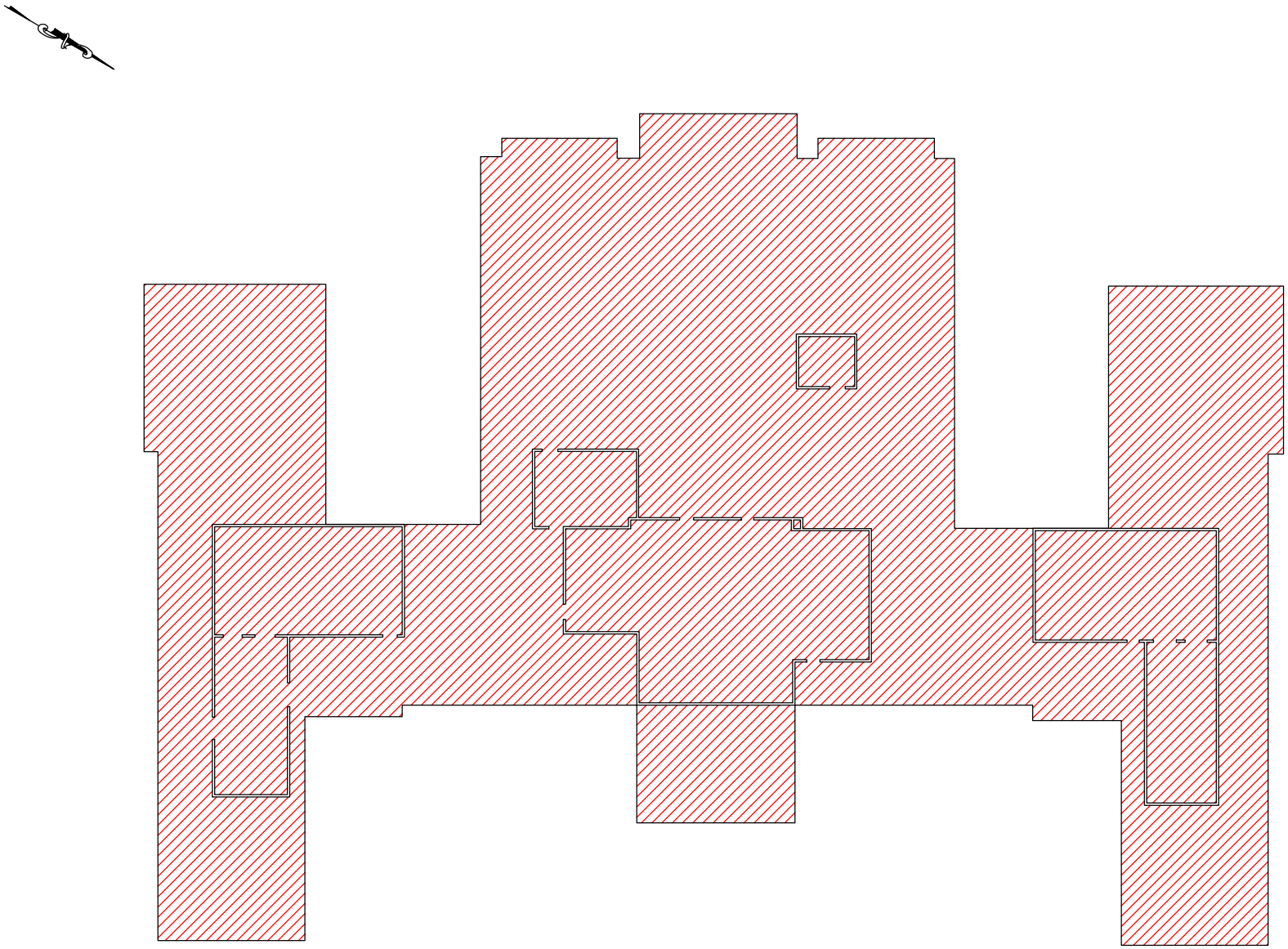
HMA-01 FIRE DOORS
4TH FLOOR TOTAL - 8 DOORS

AREA UPDATED AS OF
2013 REINSPECTION

NOTE: FIRE DOORS FOUND DURING
2013 REINSPECTION.

USFin

PROJECT NO.	SCALE
17001	1" = 30'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17



TITLE

ROOF
MISCELLANEOUS ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

HMA-7-R-M - ROOFING TAR
46,310 SQ FT

USFin

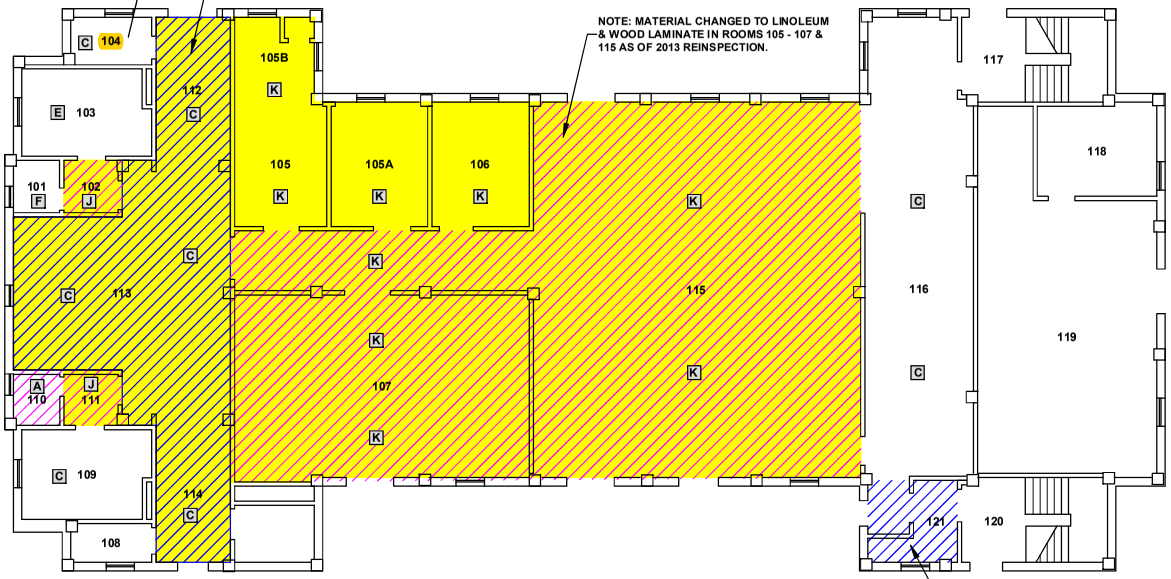
PROJECT NO.	SCALE
17001	1" = 30'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17

Building 8

NOTE: 12" RED FLOOR TILE WAS IDENTIFIED IN ROOM 104 DURING 2017 REINSPECTION

NOTE: FLOORING WAS ABATED IN ROOMS 112-114 AS OF 2013 REINSPECTION; ABATEMENT RECORDS NOT AVAILABLE.

NOTE: MATERIAL CHANGED TO LINOLEUM & WOOD LAMINATE IN ROOMS 105 - 107 & 115 AS OF 2013 REINSPECTION.



12" RED FLOOR TILE IN STORAGE ROOM 121

TITLE

BUILDING 8 - FIRST FLOOR
FLOORING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

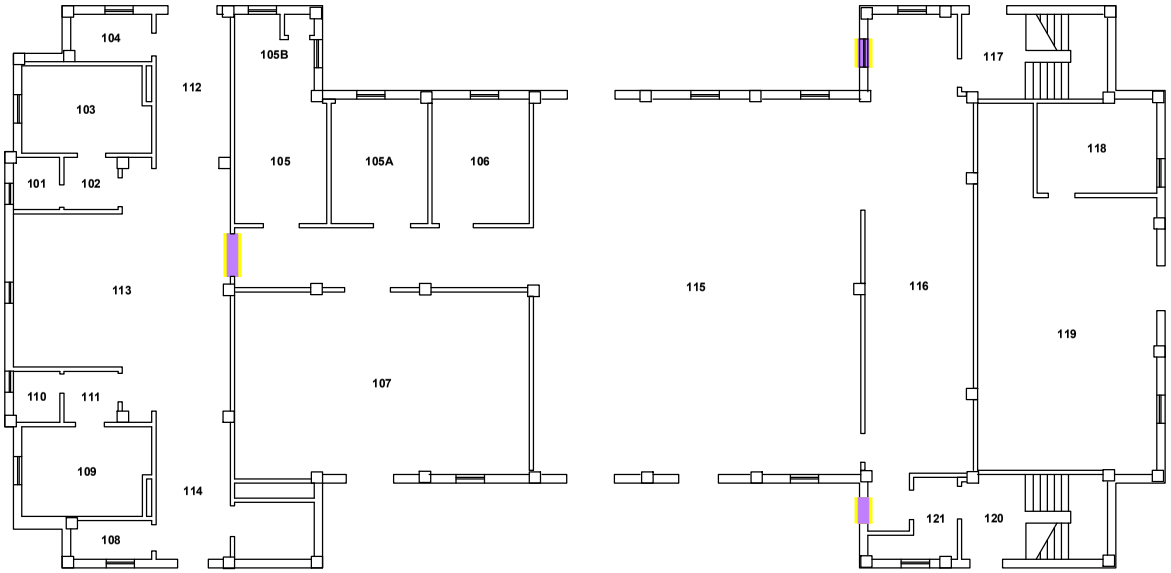
- HMA-8-1-FT & M - FLOOR TILE AND/OR MASTIC - 2,890 SQ FT
- ABATED AREAS
- AREA UPDATED AS OF 2013 REINSPECTION

FLOORING LEGEND

- A CREAM W/ BROWN SPECKS 12" X 12"
- B WHITE W/ BLUE SPECKS 12" X 12"
- C CERAMIC
- D GRAY SPARKLED FLOOR TILE
- E CREAM MULTICOLOR 12" X 12"
- F CONCRETE
- G LIME GREEN 12" X 12" UNDER CARPET
- H GREEN W/ WHITE STREAKED 12" X 12"
- I MASTIC UNDER CARPET
- J BROWN 12" X 12" PEEL & STICK FT
- K RED, BROWN & TAN LINOLEUM & WOOD LAMINATE

USFin

PROJECT NO.	SCALE
17001	1" = 15'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17



TITLE

BUILDING 8 - FIRST FLOOR
MISCELLANEOUS ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

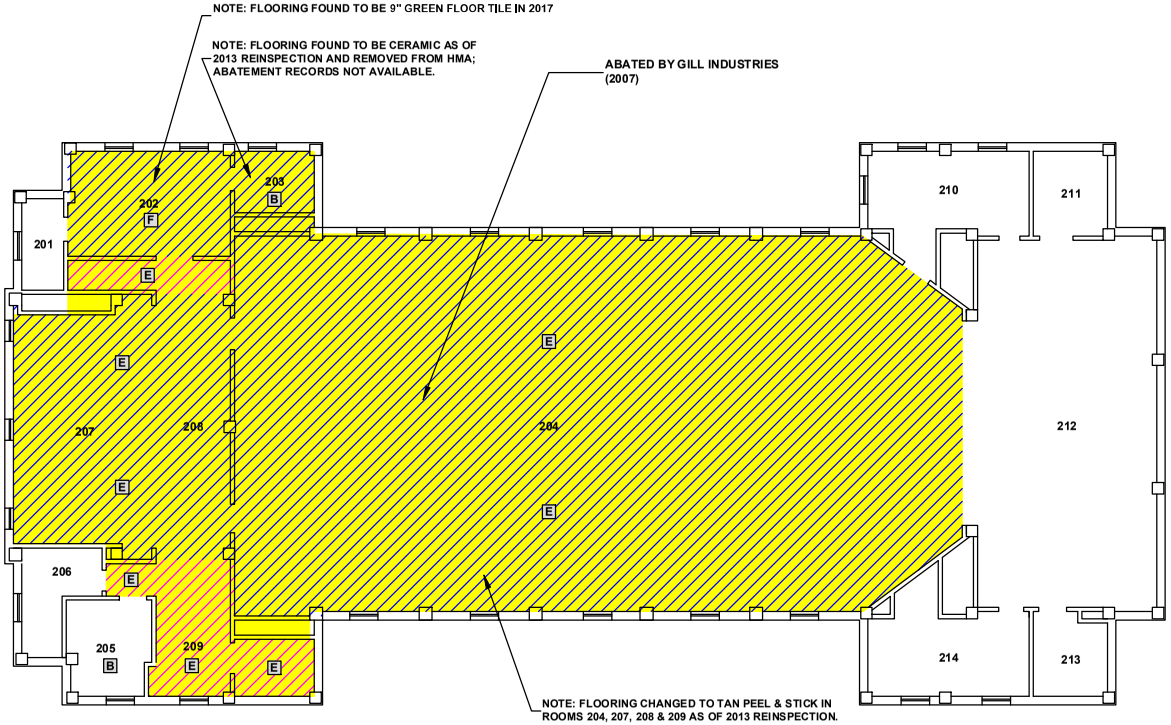
HMA-01 FIRE DOORS
1ST FLOOR TOTAL - 3 DOORS

AREA UPDATED AS OF
2013 REINSPECTION

NOTE: FIRE DOORS FOUND DURING
2013 REINSPECTION.

USFin

PROJECT NO.	SCALE
17001	1" = 15'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17



TITLE

BUILDING 8 - SECOND FLOOR
FLOORING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

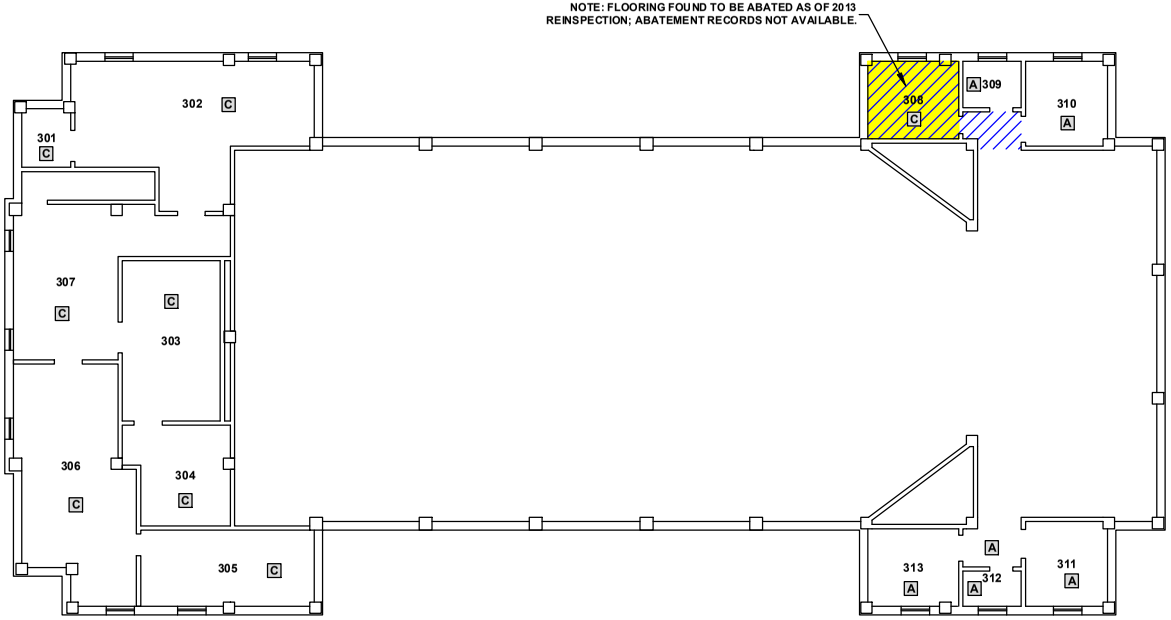
- HMA-8-2-FT & M - FLOOR TILE AND/OR MASTIC - 630 SQ FT
- ABATED AREAS
- AREA UPDATED AS OF 2013 REINSPECTION

FLOORING LEGEND

- A LIME GREEN 12" X 12"
- B CERAMIC
- C GRAY 9" X 9"
- D GOLD 12" X 12"
- E TAN 18" X 18" PEEL & STICK
- F CONCRETE

USFin

PROJECT NO.	SCALE
17001	1" = 15'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17



TITLE

BUILDING 8 - THIRD FLOOR
FLOORING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

ABATED AREAS

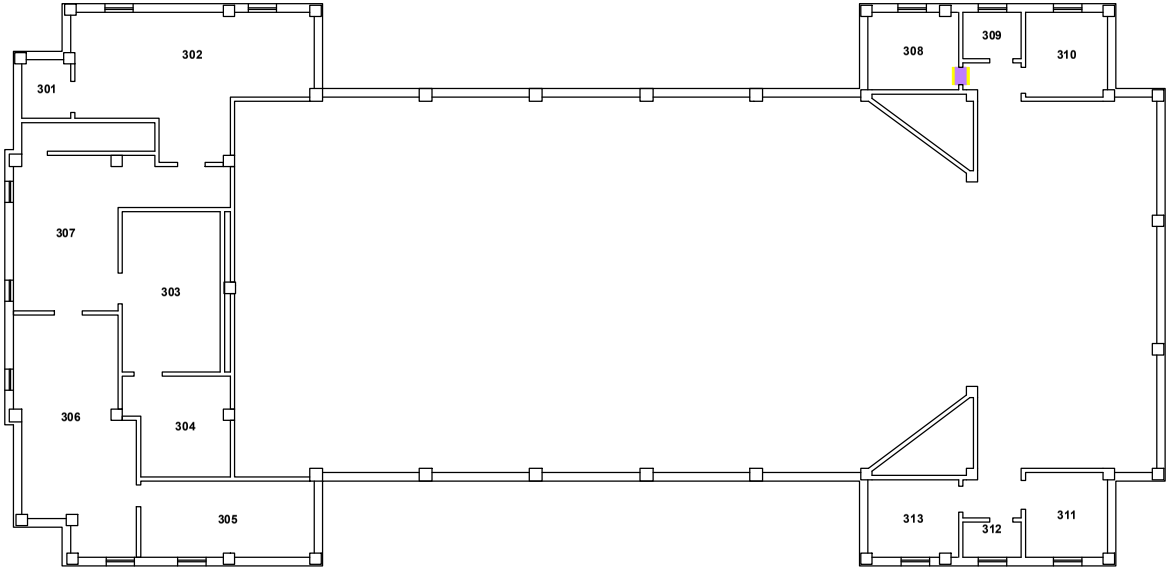
AREA UPDATED AS OF
2013 REINSPECTION

FLOORING LEGEND

A BEIGE LINOLEUM
B GRAY LINOLEUM
C CONCRETE

USFin

PROJECT NO.	SCALE
17001	1" = 15'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17



TITLE

BUILDING 8 - THIRD FLOOR
MISCELLANEOUS ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

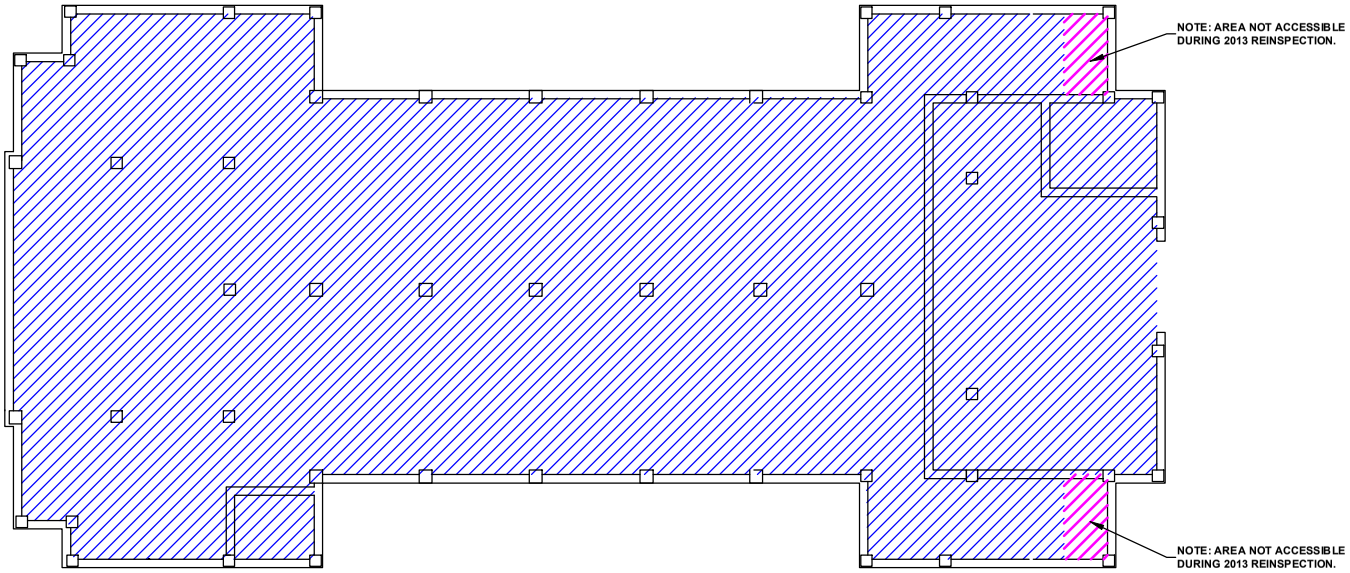
HMA-01 FIRE DOORS
3RD FLOOR TOTAL - 1 DOOR

AREA UPDATED AS OF
2013 REINSPECTION

NOTE: FIRE DOORS FOUND DURING
2013 REINSPECTION.

USFin

PROJECT NO.	SCALE
17001	1" = 15'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17



TITLE

BUILDING 8 - BASEMENT
PIPING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

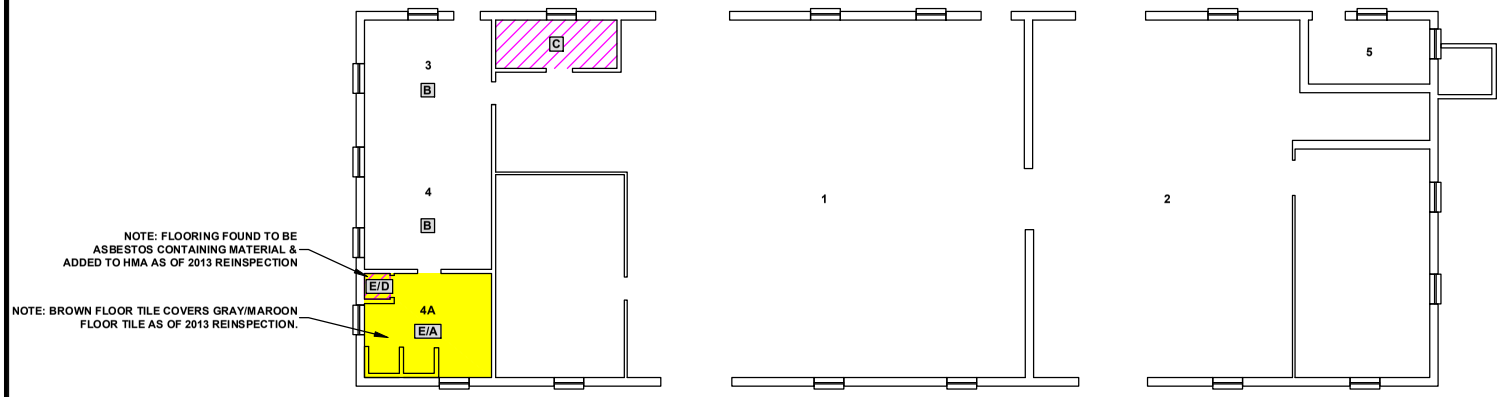
HMA-8-B-TSI - PIPE CHASES - ACM
DEBRIS AND THERMAL SYSTEMS
INSULATION - PPE REQUIRED FOR ENTRY

ABATED AREAS - MAY 2003
ABATEMENT COMPANY UNKNOWN

USFin

PROJECT NO.	SCALE
17001	1" = 15'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17

Building 13



TITLE

BUILDING 13 - FIRST FLOOR
FLOORING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

HMA-13-1-FT & M - FLOOR TILE AND/OR MASTIC - 105 SQ FT

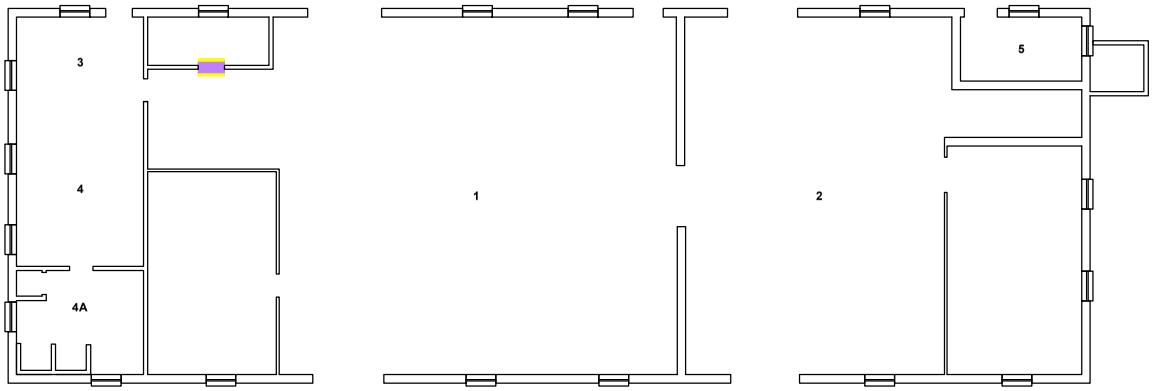
AREA UPDATED AS OF 2013 REINSPECTION

FLOORING LEGEND

- A GRAY / MAROON 12" X 12"
- B BLUE 12" X 12"
- C WHITE W/ BROWN STREAKS 12" X 12"
- D TAN W/ STREAKS 12" X 12"
- E BROWN 18" X 18"

USFin

PROJECT NO.	SCALE
17001	1" = 15'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17



TITLE

BUILDING 13 - FIRST FLOOR
MISCELLANEOUS ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

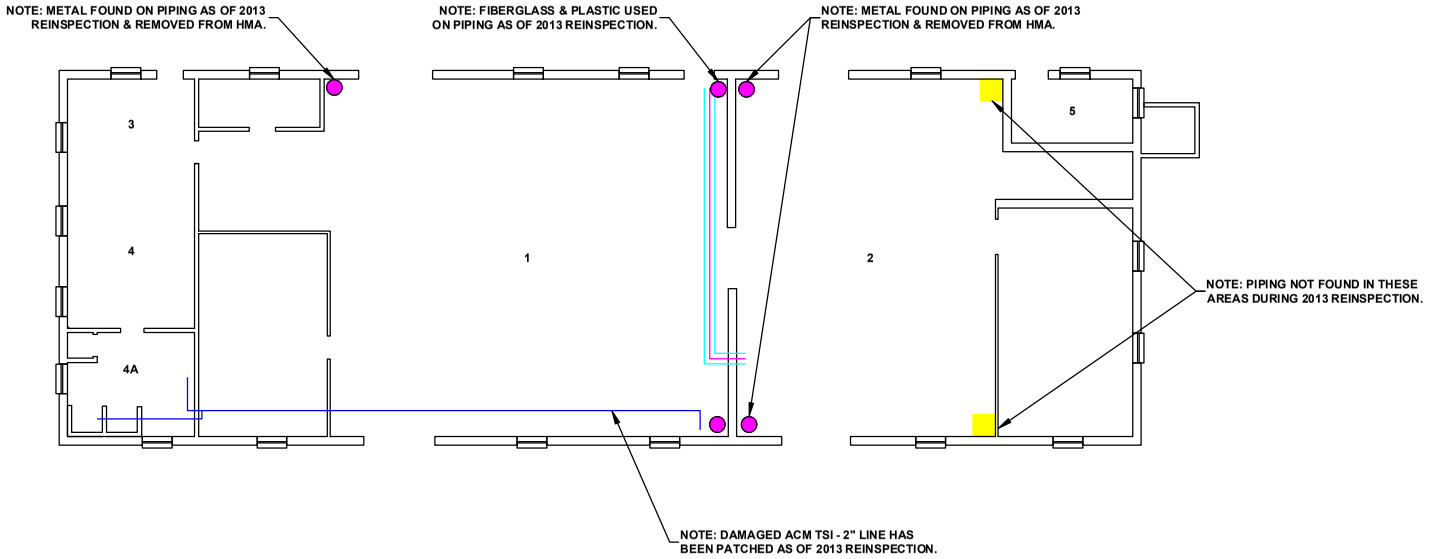
HMA-01 FIRE DOORS
1ST FLOOR TOTAL - 1 DOOR

AREA UPDATED AS OF
2013 REINSPECTION

NOTE: FIRE DOORS FOUND DURING
2013 REINSPECTION.

USFin

PROJECT NO.	SCALE
17001	1" = 15'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17



TITLE

BUILDING 13 - FIRST FLOOR
PIPING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

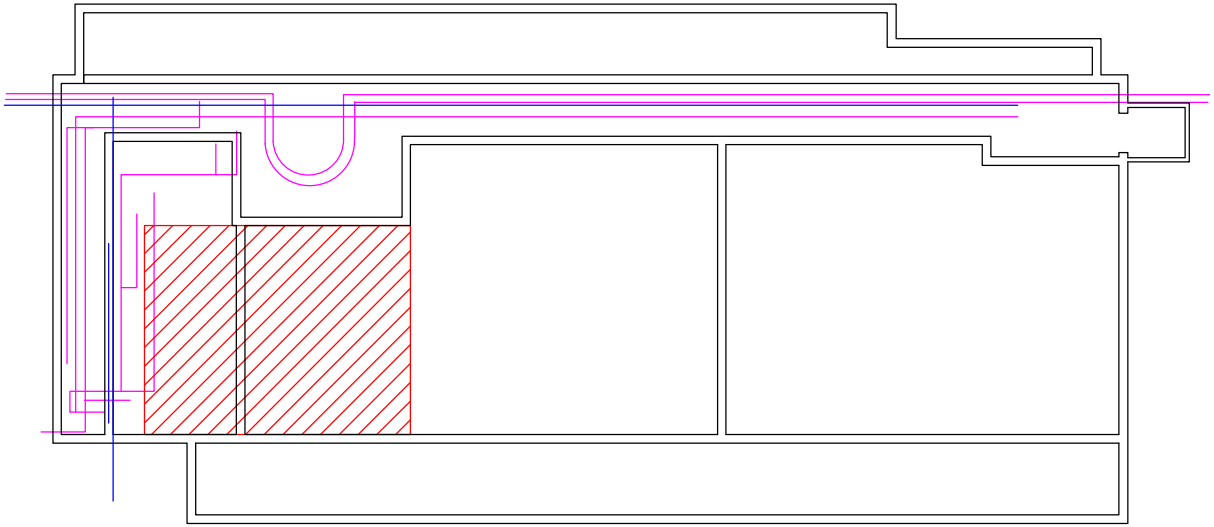
VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

- HMA-13-1-TSI - WATER PIPES
- HMA-13-1-TSI - VERTICAL PIPES
  135' LIN FT; (1) VERTICAL PIPE
- HVAC PIPES
- ABATED AREAS - AUGUST 2003
- AREA UPDATED AS OF 2013 REINSPECTION

USFin

PROJECT NO.	SCALE
17001	1" = 15'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17



TITLE

BUILDING 13 - BASEMENT
PIPING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

HMA-13-B-TSI - WATER PIPES
195 LIN FT

HMA13-B-TSI HVAC PIPES

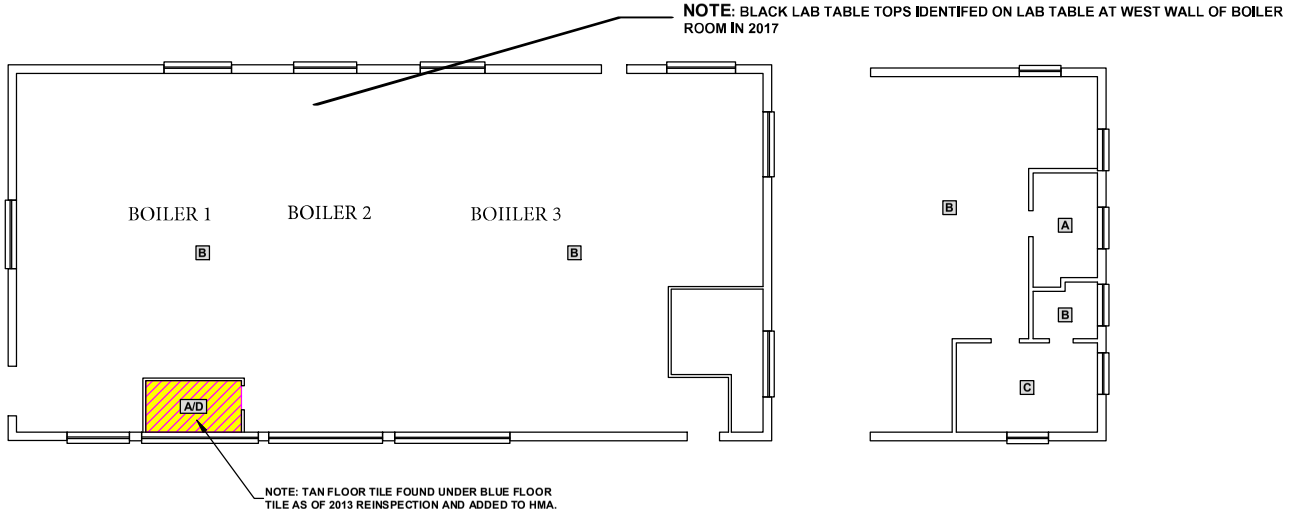
ASBESTOS PIPE INSULATION &
CONTAMINATED SOIL REMAINING

USFin

PROJECT NO.	SCALE
17001	1" = 15'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17

Building 14

NOTE: INTERNAL BOILER INSULATION AND GASKETS ASSUMED TO BE LOCATED INSIDE THE 3 BOILERS DURING THE 2017 REINSPECTION. TESTING SHOULD BE DONE PRIOR TO ANY MAINTENANCE OR DEMOLITION OF THE BOILERS



TITLE

BUILDING 14 - FIRST FLOOR & MEZZANINE
ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

HMA-14-FT & M - FLOOR TILE AND/OR MASTIC - 70 SQ FT

AREA UPDATED AS OF 2013 REINSPECTION

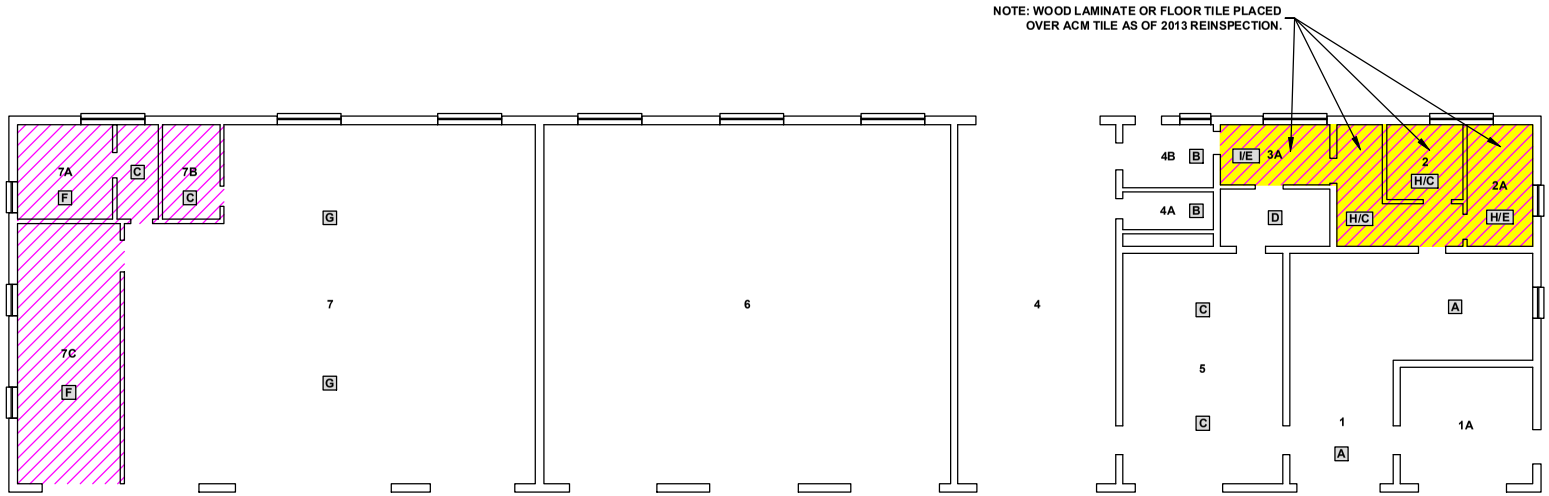
FLOORING LEGEND

A BLUE 12" X 12" W/ YELLOW GLUE
B CONCRETE
C CARPET OVER CONCRETE
D TAN 12" X 12"

USFin

PROJECT NO.	SCALE
17001	1" = 15'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17

Building 15



TITLE

BUILDING 15
FLOORING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

HMA-15-1-FT & M - FLOOR TILE AND/OR MASTIC - 1,100 SQ FT

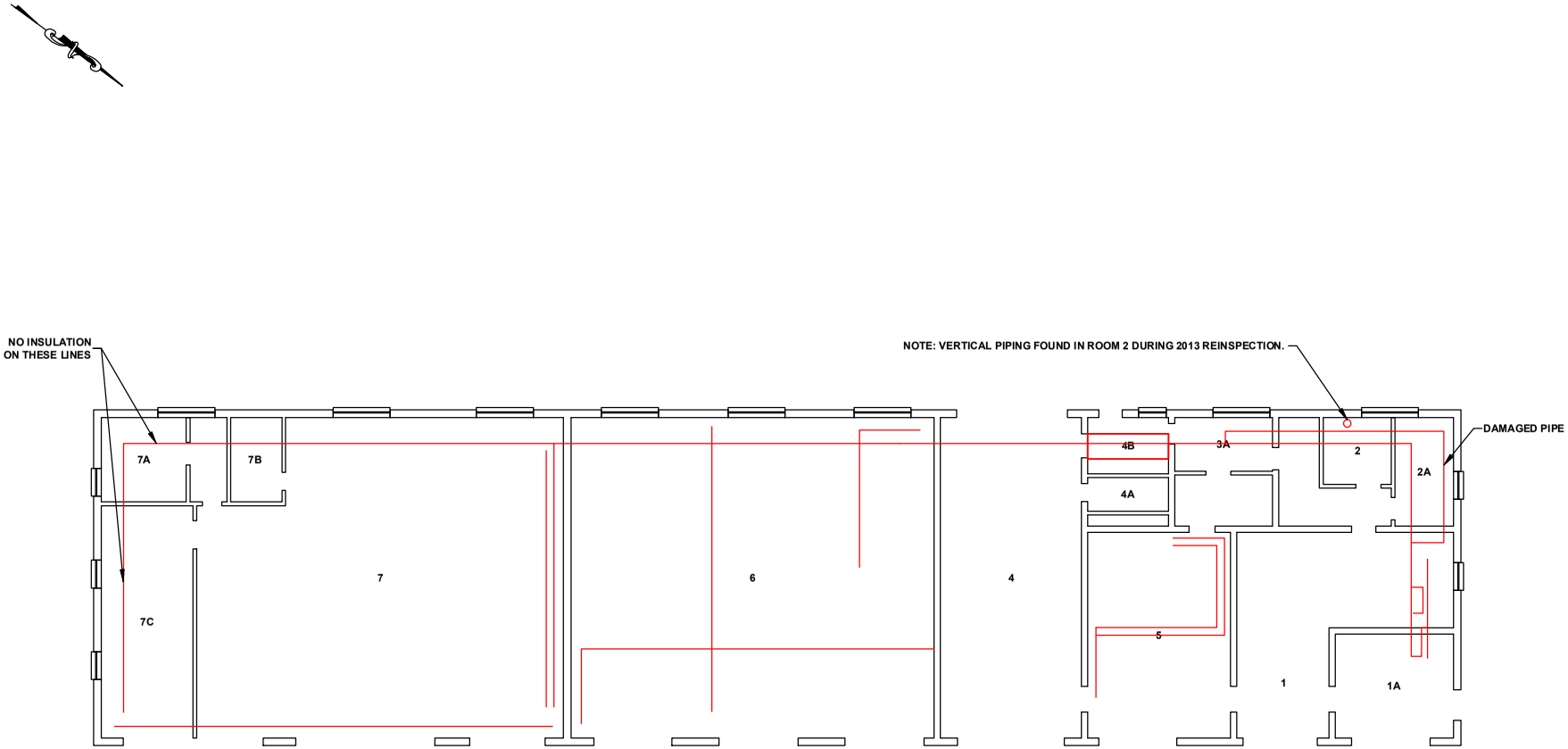
AREA UPDATED AS OF 2013 REINSPECTION

FLOORING LEGEND

- A RED 12" X 12"
- B CONCRETE
- C OFF WHITE W/ GREEN STREAKS 12" X 12"
- D OFF WHITE W/ BROWN SPECKS 12" X 12"
- E GREY / MAROON 12" X 12"
- F WHITE W/ BROWN SPECKS 12" X 12"
- G GREEN W/ GREY 12" X 12"
- H BROWN 18" X 18"
- I WOOD LAMINATE

USFin

PROJECT NO.	SCALE
17001	1" = 15'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17



TITLE

BUILDING 15
PIPING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

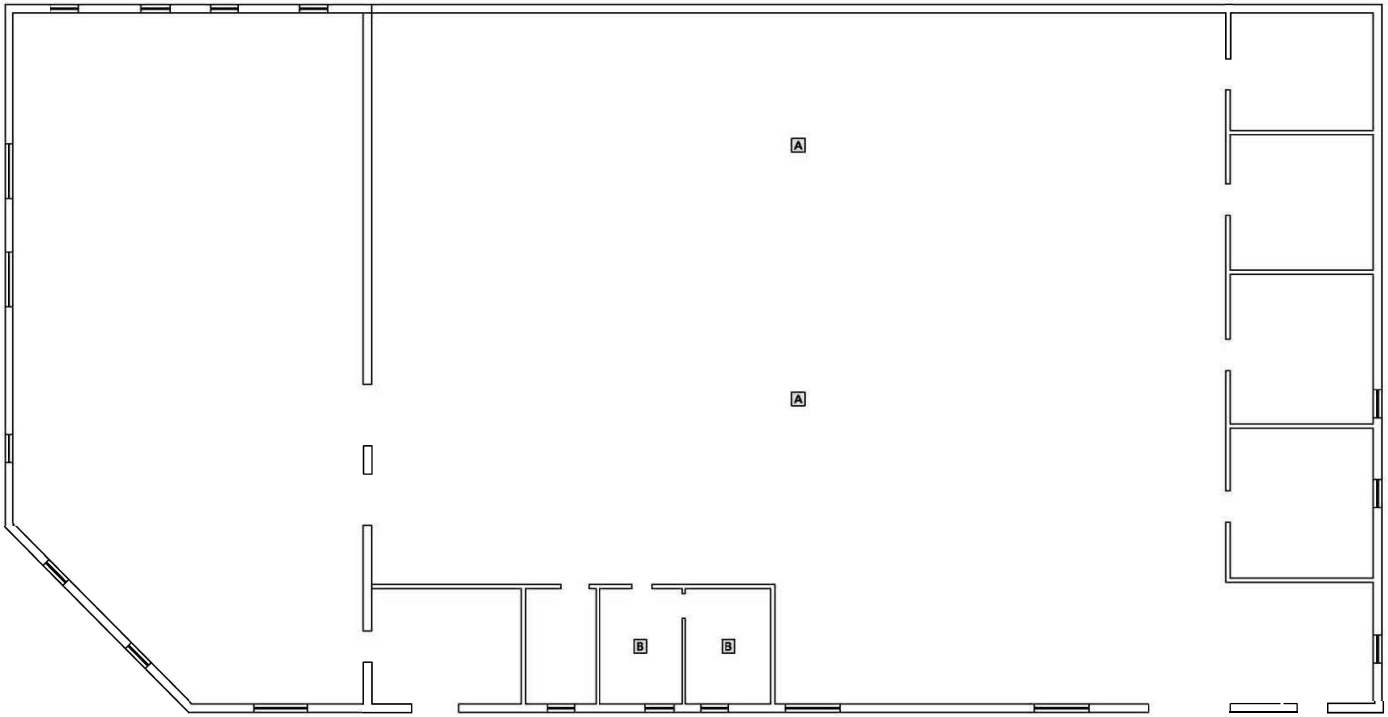
LEGEND

HMA-15-1-TSI - STEAM PIPES
450 LIN FT

USFin

PROJECT NO.	SCALE
17001	1" = 15'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17

Building 16



TITLE

BUILDING 16 - FIRST FLOOR
FLOORING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017ASBESTOS REINSPECTION

LEGEND

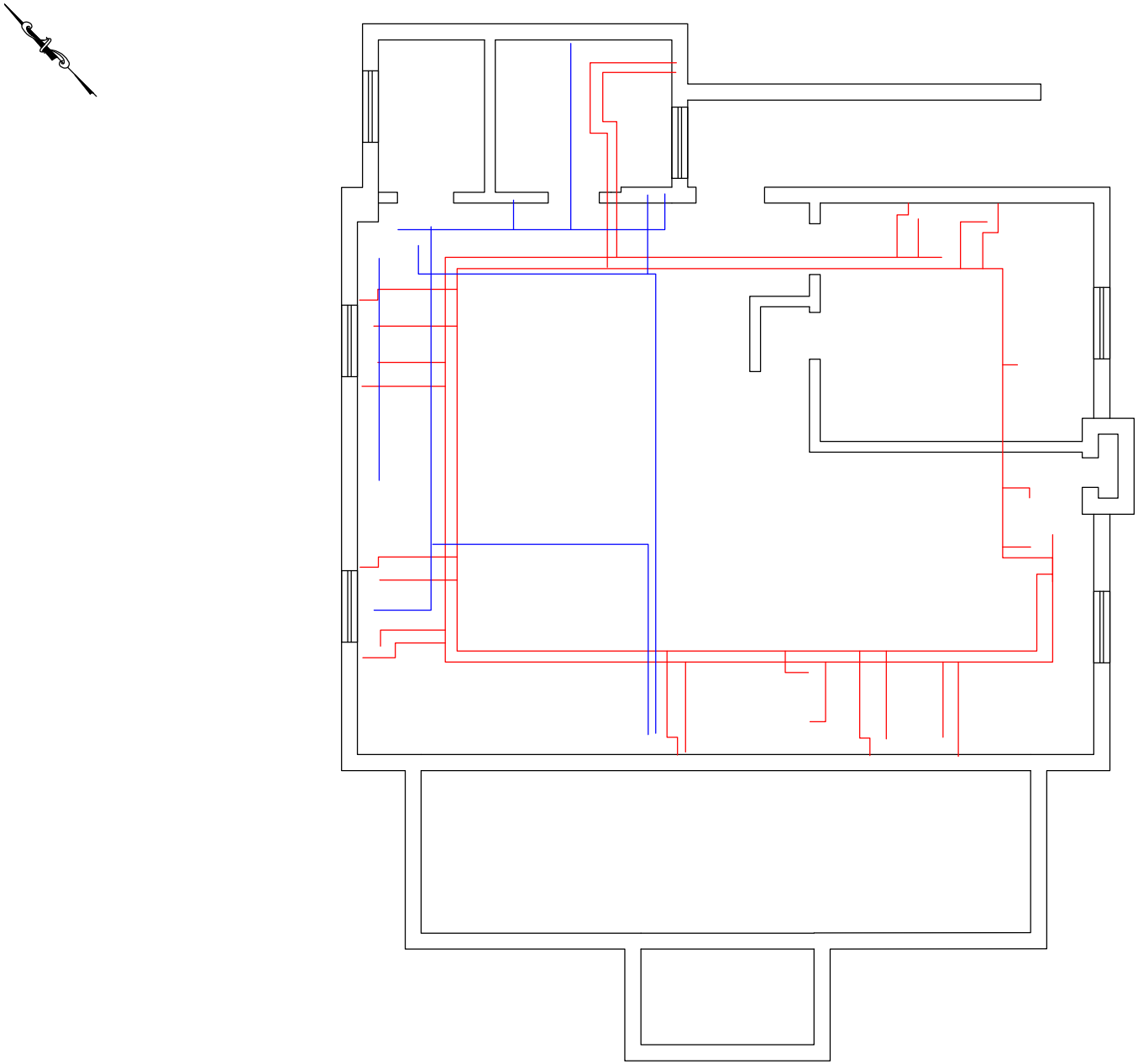
FLOORING LEGEND

NOTE: ALL FLOOR TILE WAS
ABATED AS OF AUGUST 2001.

USFin

PROJECT	SCALE
17001	1" = 15'
PAGE	DRAWN BY
1	BLB
SHEET	DATE
B - 11 X 17	2/2/17

Building 18



TITLE

BUILDING 18 - BASEMENT
PIPING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

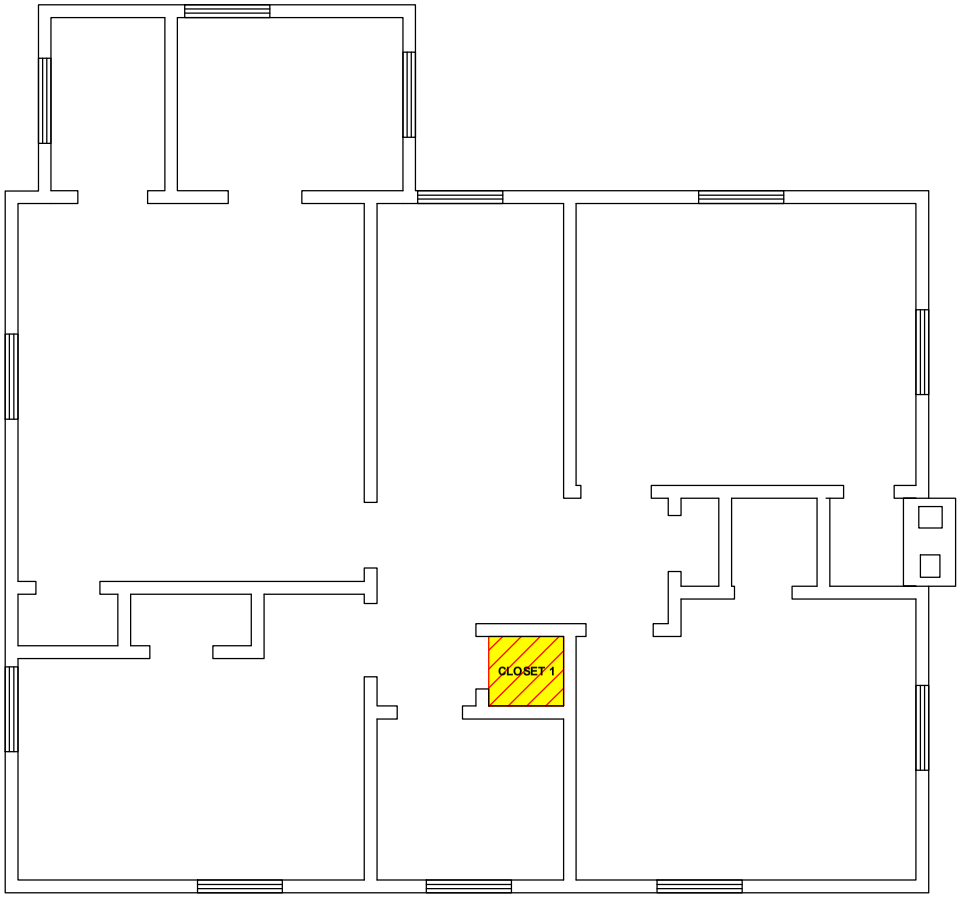
LEGEND

HMA-18-B-TSI - STEAM PIPES
2,620 LIN FT

HMA-18-B-TSI - WATER PIPES
195 LIN FT

USFin

PROJECT NO.	SCALE
17001	1" = 5'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17



TITLE

BUILDING 18 - SECOND FLOOR
PIPING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

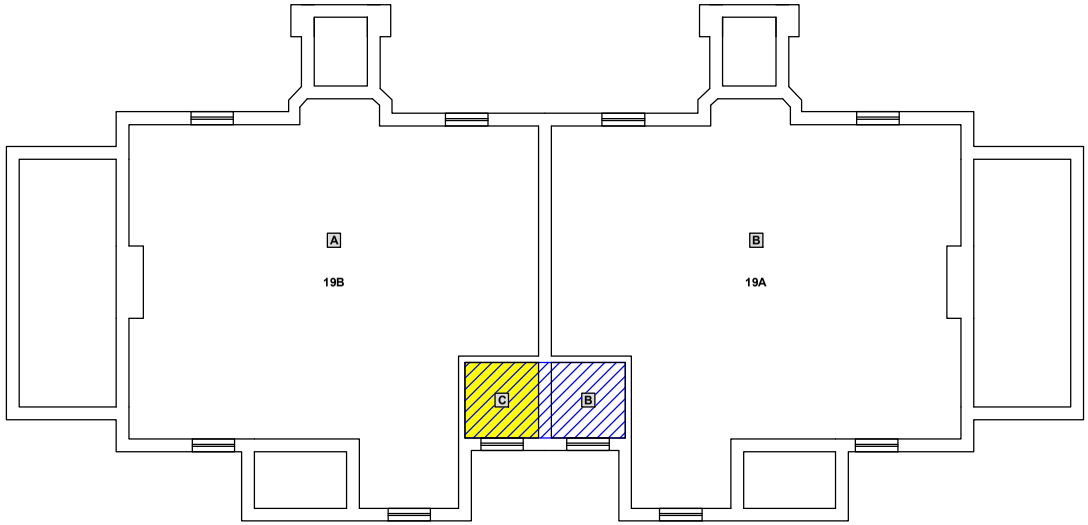
HMA-18-2-TSI BLACK MASTIC WRAP

AREA UPDATED AS OF
2013 REINSPECTION

USFin

PROJECT NO.	SCALE
17001	1" = 5'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17

Building 19



TITLE

BUILDING 19 - BASEMENT
FLOORING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

ABATED AREAS - ABATEMENT DATE & COMPANY UNKNOWN

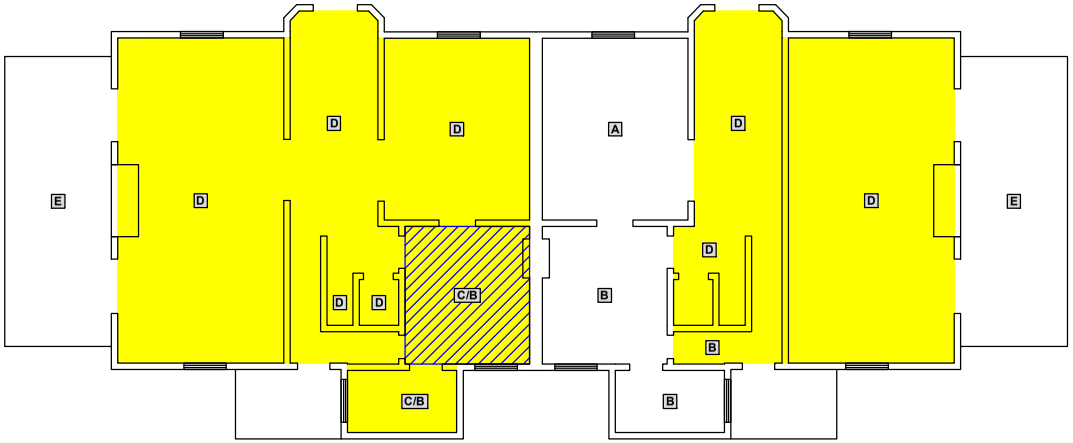
AREA UPDATED AS OF 2013 REINSPECTION

FLOORING LEGEND

A CONCRETE
B LINOLEUM
C CERAMIC

USFin

PROJECT NO.	SCALE
17001	1" = 10'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17



TITLE

BUILDING 19 - FIRST FLOOR
FLOORING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

ABATED AREAS - ABATEMENT DATE & COMPANY UNKNOWN

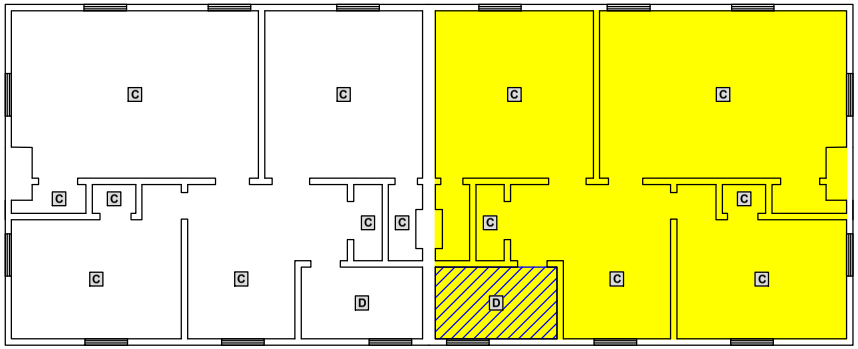
AREA UPDATED AS OF 2013 REINSPECTION

FLOORING LEGEND

- A CARPET OVER WOOD
- B TAN LINOLEUM
- C BROWN 12" X 12" PEEL & STICK
- D WOOD
- E CERAMIC

USFin

PROJECT NO.	SCALE
17001	1" = 10'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17



TITLE

BUILDING 19 - SECOND FLOOR
FLOORING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

ABATED AREAS - ABATEMENT DATE & COMPANY UNKNOWN

AREA UPDATED AS OF 2013 REINSPECTION

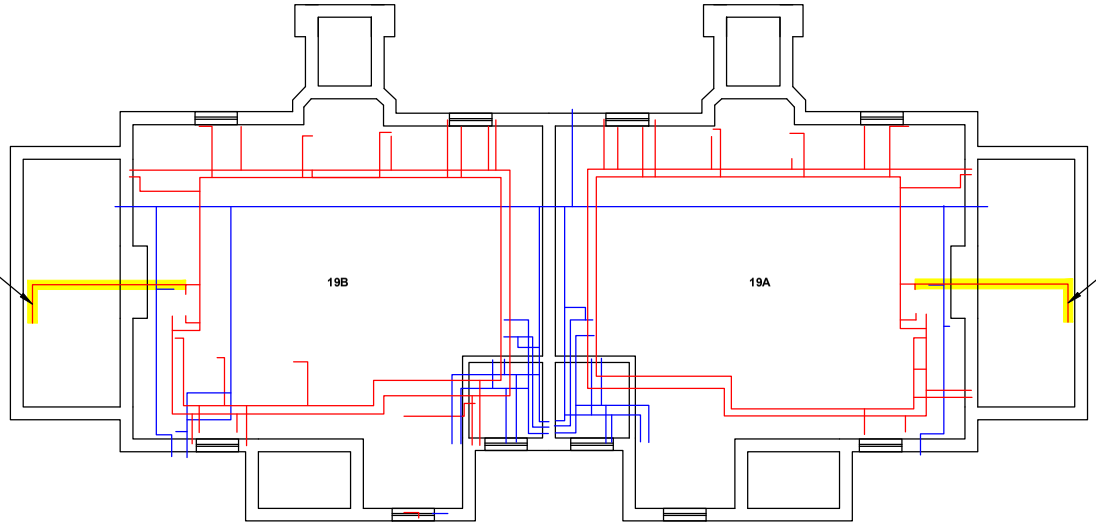
FLOORING LEGEND

A CARPET OVER WOOD
B GRAY W/ MAROON 12" X 12"
C WOOD
D CERAMIC

USFin

PROJECT NO.	SCALE
17001	1" = 10'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17

NOTE: 15 LINEAR FEET OF PIPING FOUND IN THIS AREA AS OF 2013 REINSPECTION.



NOTE: 15 LINEAR FEET OF PIPING FOUND IN THIS AREA AS OF 2013 REINSPECTION.

TITLE

BUILDING 19 - BASEMENT
PIPING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

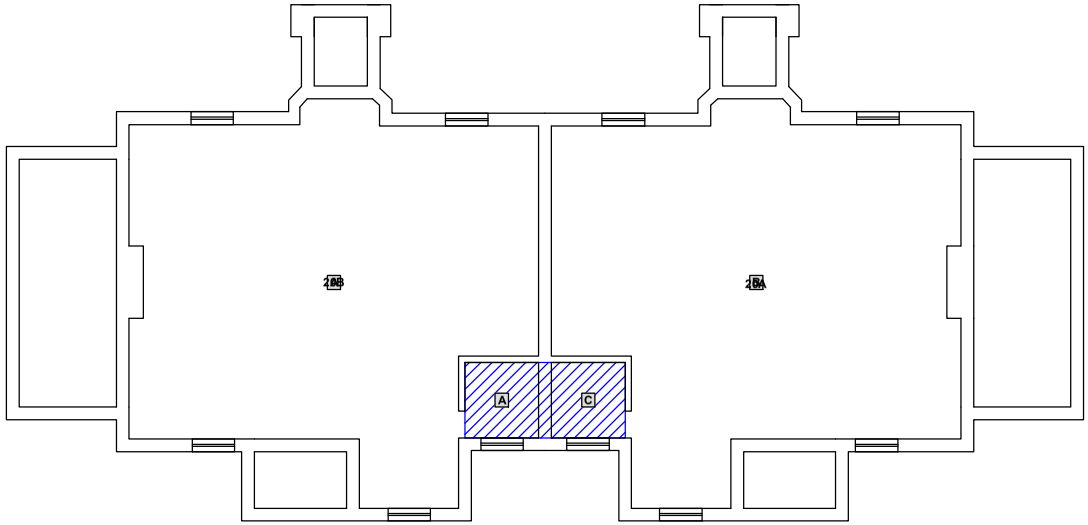
LEGEND

- HMA-19-B-TSI - STEAM PIPES 490 LIN FT
- HMA-19-B-TSI - WATER PIPES 300 LIN FT
- AREA UPDATED AS OF 2013 REINSPECTION

USFin

PROJECT NO.	SCALE
17001	1" = 10'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17

Building 20



TITLE

BUILDING 20 - BASEMENT
FLOORING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

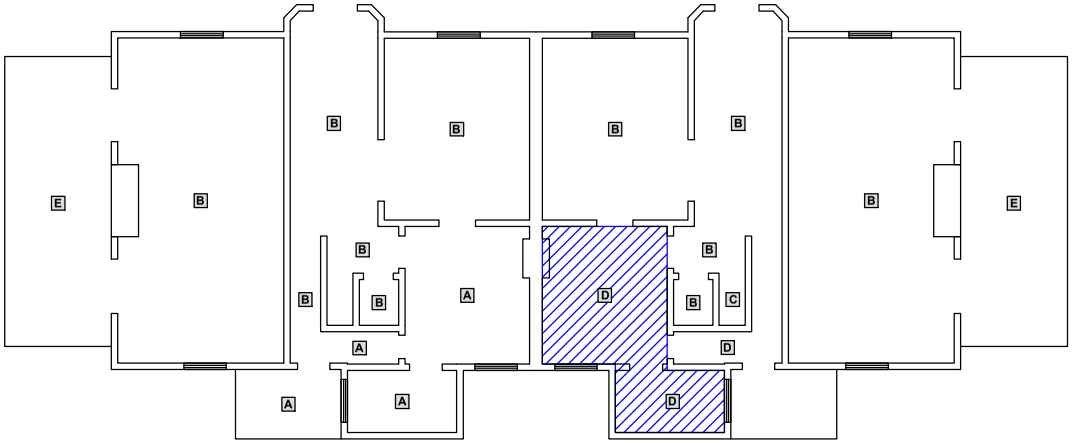
ABATED AREAS - 1997
ABATEMENT COMPANY UNKNOWN

FLOORING LEGEND

A BLUE 12" LINOLEUM SQUARES
B CONCRETE
C CREAM / BROWN 12" X 12"

USFin

PROJECT NO.	SCALE
17001	1" = 10'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17



TITLE

BUILDING 20 - FIRST FLOOR
FLOORING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

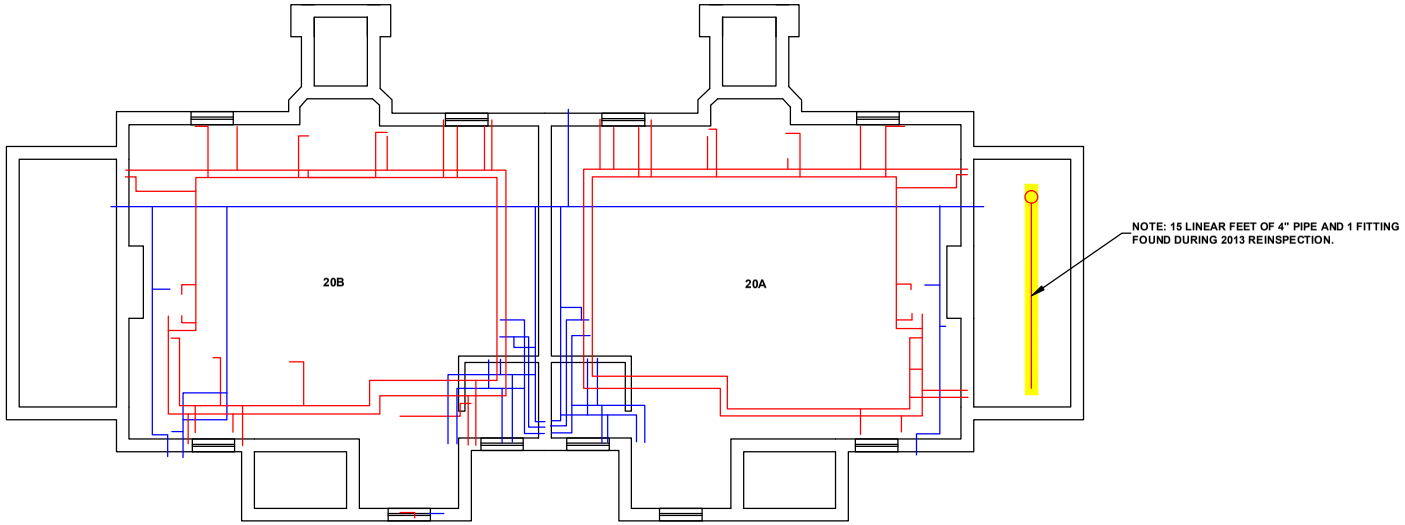
ABATED AREAS - 1997
ABATEMENT COMPANY UNKNOWN

FLOORING LEGEND

- A GRAYISH BLUE / YELLOW LINOLEUM SQUARES
- B WOOD
- C CARPET OVER WOOD
- D TAN LINOLEUM SQUARES
- E CERAMIC

USFin

PROJECT NO.	SCALE
17001	1" = 10'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17



TITLE

BUILDING 20 - BASEMENT
PIPING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

HMA-19-B-TSI - STEAM PIPES
490 LIN FT

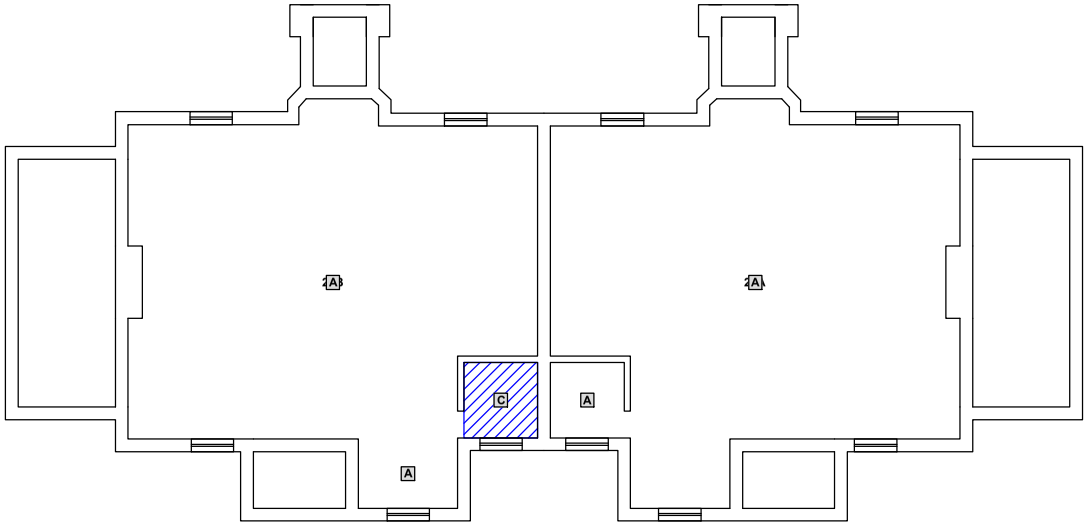
HMA-19-B-TSI - WATER PIPES
300 LIN FT

AREA UPDATED AS OF
2013 REINSPECTION

USFin

PROJECT NO.	SCALE
17001	1" = 10'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17

Building 21



TITLE

BUILDING 21 - BASEMENT
FLOORING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

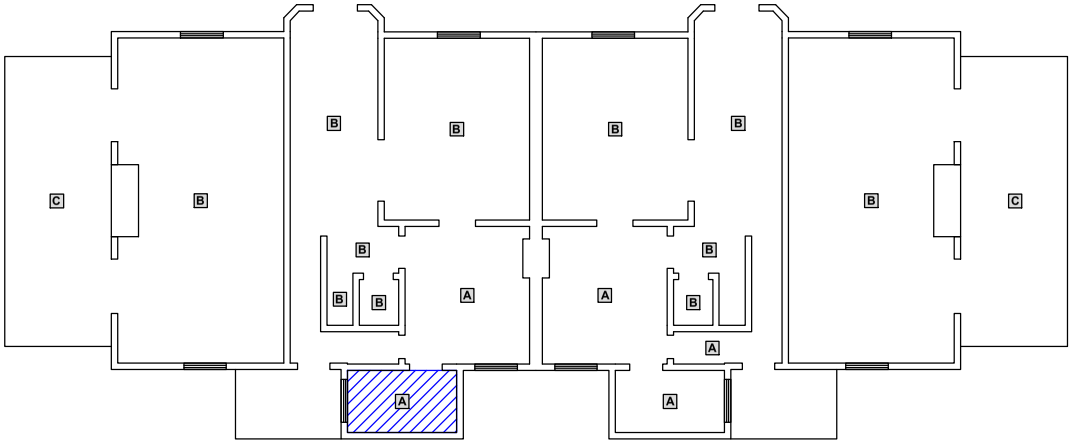
ABATED AREAS - 1997
ABATEMENT COMPANY UNKNOWN

FLOORING LEGEND

A CONCRETE
B CARPET OVER CONCRETE
C OFF WHITE / CINNAMON 12" X 12"

USFin

PROJECT NO.	SCALE
17001	1" = 10'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17



TITLE

BUILDING 21 - FIRST FLOOR
FLOORING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

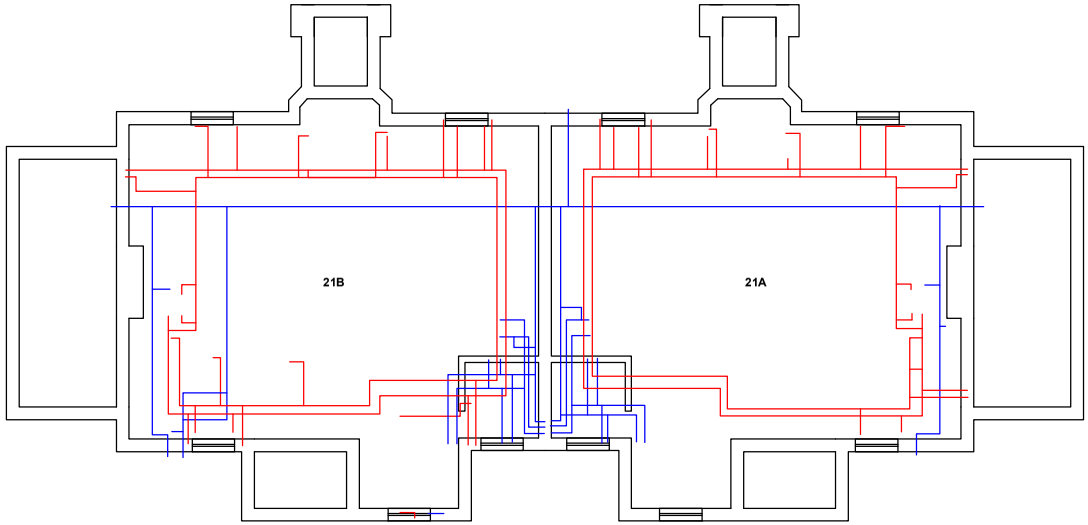
ABATED AREAS - 1997
ABATEMENT COMPANY UNKNOWN

FLOORING LEGEND

A TAN LINOLEUM
B WOOD
C CERAMIC

USFin

PROJECT NO.	SCALE
17001	1" = 10'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17



TITLE

BUILDING 21 - BASEMENT
PIPING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

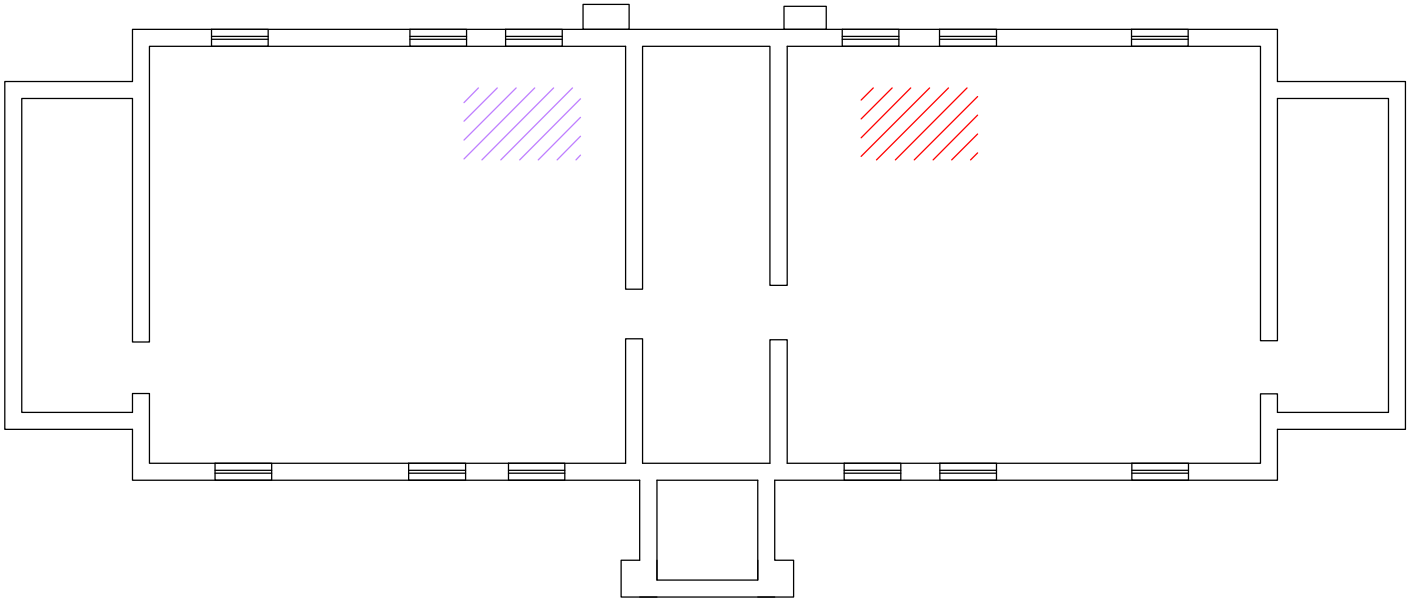
HMA-19-B-TSI - STEAM PIPES
490 LIN FT

HMA-19-B-TSI - WATER PIPES
300 LIN FT

USFin

PROJECT NO.	SCALE
17001	1" = 10'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17

Building 22



TITLE

BUILDING 22 - BASEMENT
MISCELLANEOUS ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

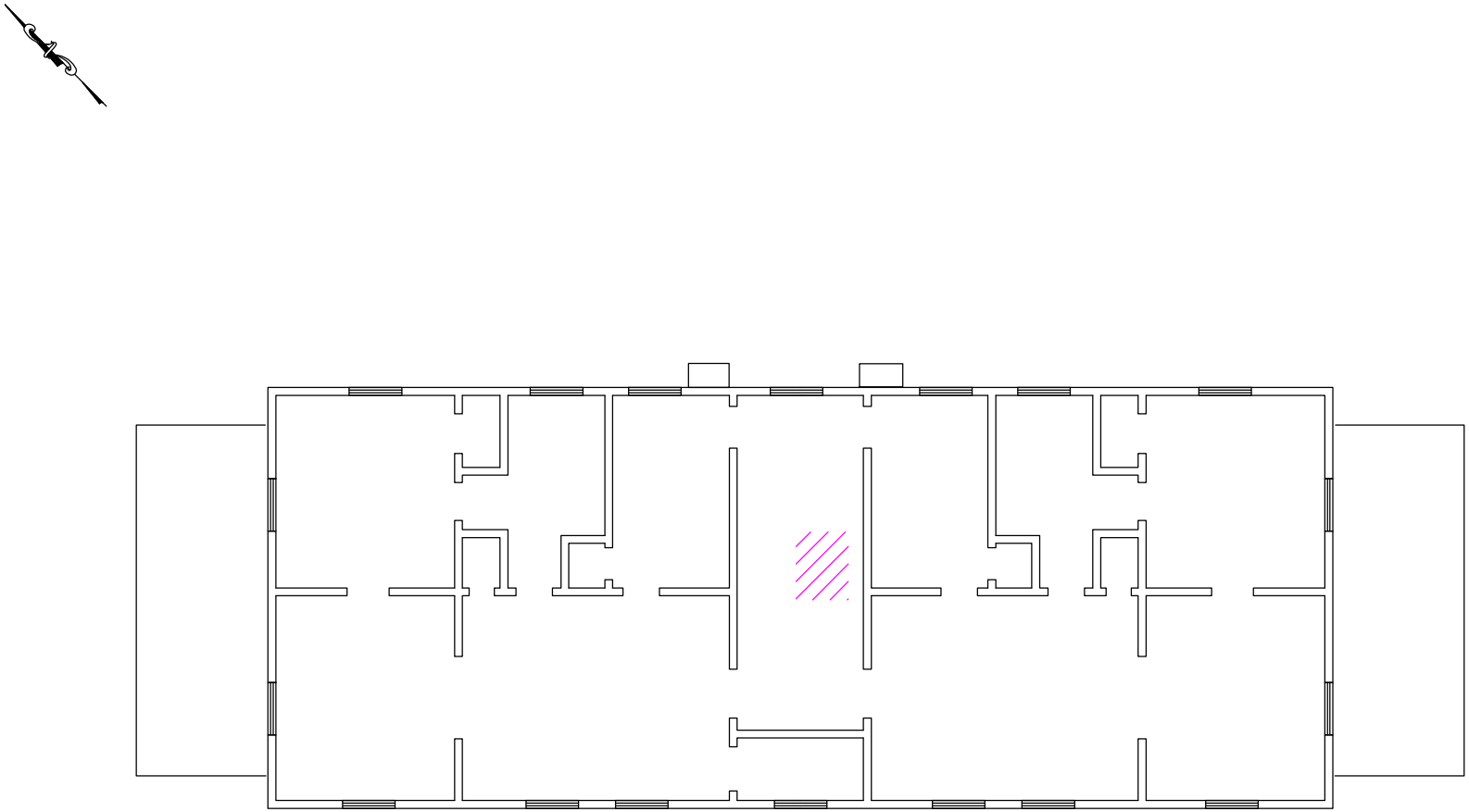
LEGEND

HMA-22-B-M THERMAL SYSTEM
INSULATION DEBRIS FROM PIPING

YELLOW SURFACING MATERIAL ON CINDER
BLOCK WALLS CONTAIN ASBESTOS

USFin

PROJECT NO.	SCALE
17001	1" = 15'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17



TITLE

BUILDING 22 - SECOND FLOOR
MISCELLANEOUS ASBESTOS
HOMOGENEOUS AREAS

LOCATION

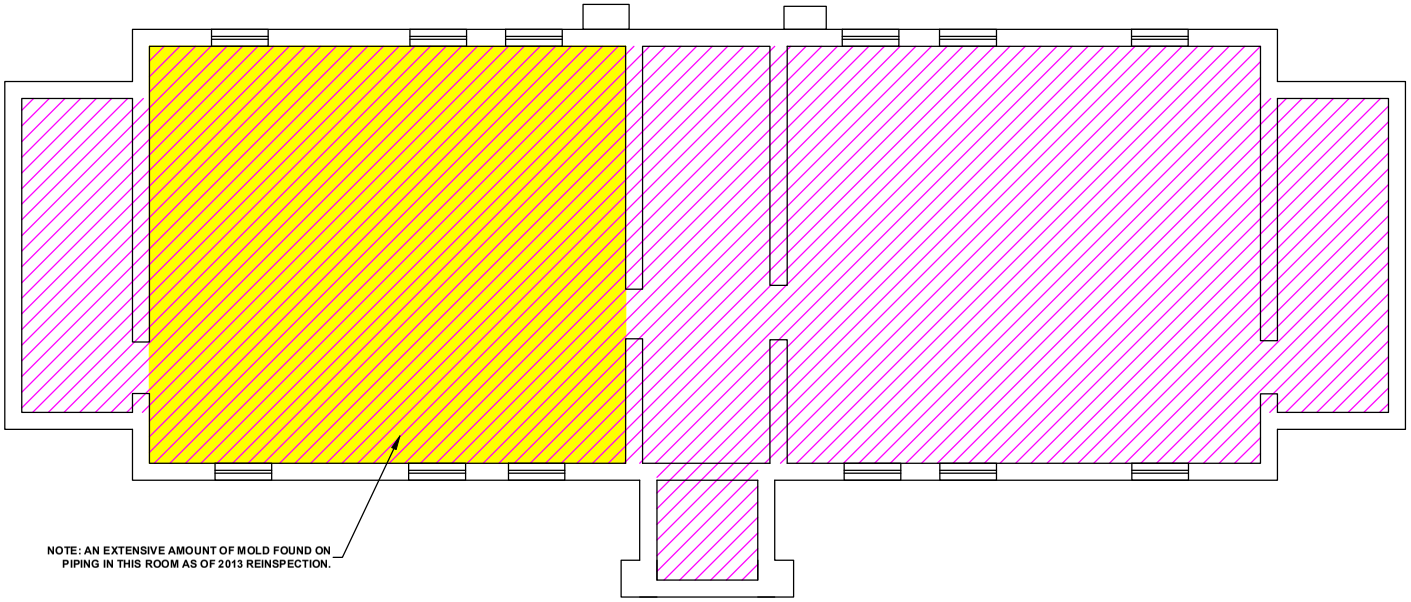
VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

HMA-22-2-M - PAPER BACKING IN LIGHTING FIXTURES

USFin

PROJECT NO.	SCALE
17001	1" = 15'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17



TITLE

BUILDING 22 - BASEMENT
PIPING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

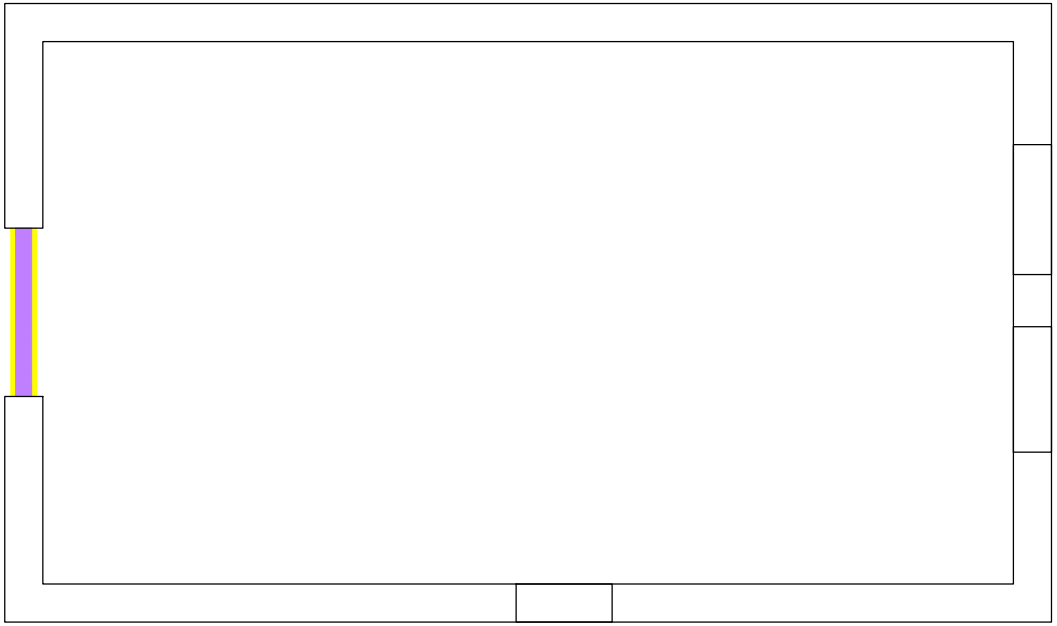
HMA-22-B-TSI - ALL WHITE BLOCK INSULATION ON ENTIRE FLOOR CONTAINS ASBESTOS

AREA UPDATED AS OF 2013 REINSPECTION

USFin

PROJECT NO.	SCALE
17001	1" = 15'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17

Building 38



TITLE

BUILDING 38
MISCELLANEOUS ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

HMA-01 FIRE DOORS
1 DOOR

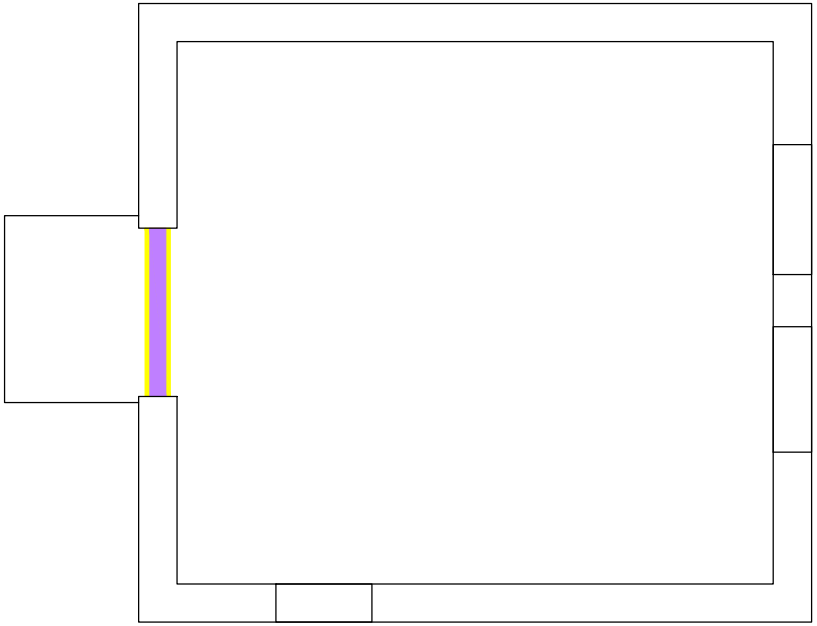
AREA UPDATED AS OF
2013 REINSPECTION

NOTE: FIRE DOORS FOUND DURING
2013 REINSPECTION.

USFin

PROJECT NO.	SCALE
17001	1" = 10'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17

Building 39



TITLE

BUILDING 39
MISCELLANEOUS ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

HMA-01 FIRE DOORS
1 DOOR

AREA UPDATED AS OF
2013 REINSPECTION

NOTE: FIRE DOORS FOUND DURING
2013 REINSPECTION.

USFin

PROJECT NO.	SCALE
17001	1" = 10'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17

Building 42

TITLE

BUILDING 42
MISCELLANEOUS ASBESTOS
SAMPLE LOCATIONS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

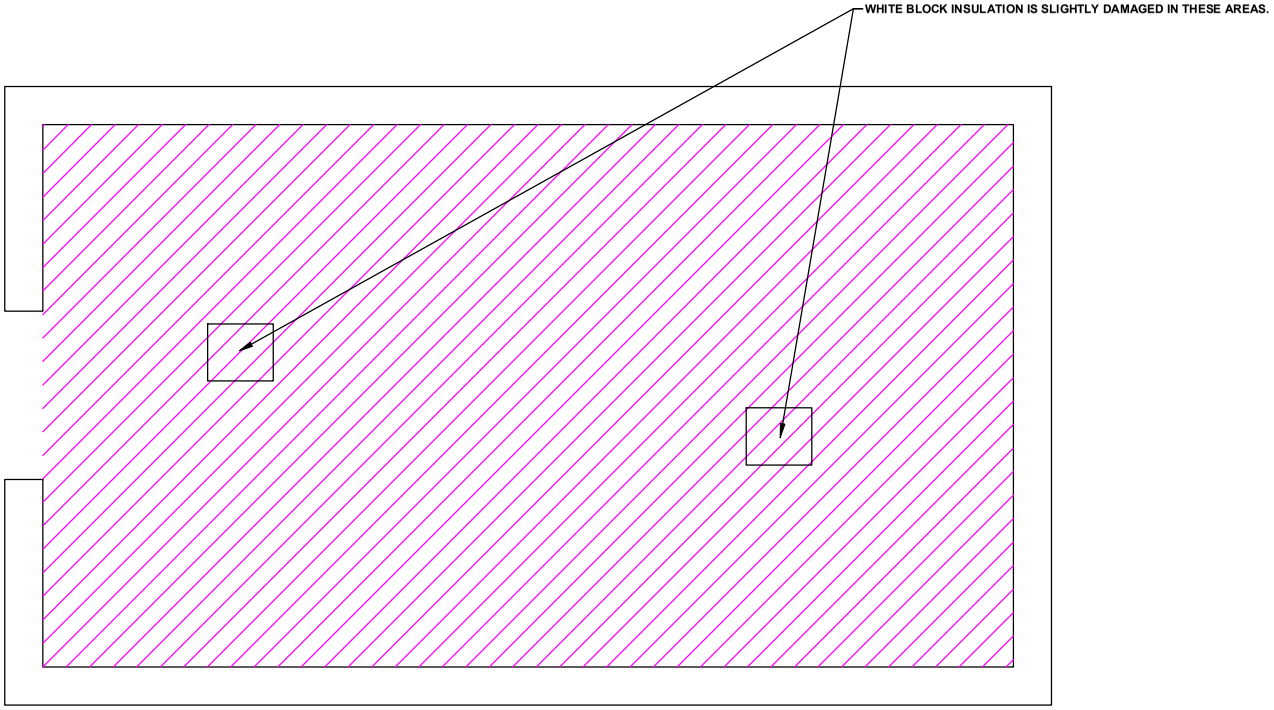
HMA-01 FIRE DOORS
1 DOOR

AREA UPDATED AS OF
2013 REINSPECTION

NOTE: FIRE DOORS FOUND DURING
2013 REINSPECTION.

USFin

PROJECT NO.	SCALE
17001	1" = 10'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17



TITLE

BUILDING 42
PIPING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

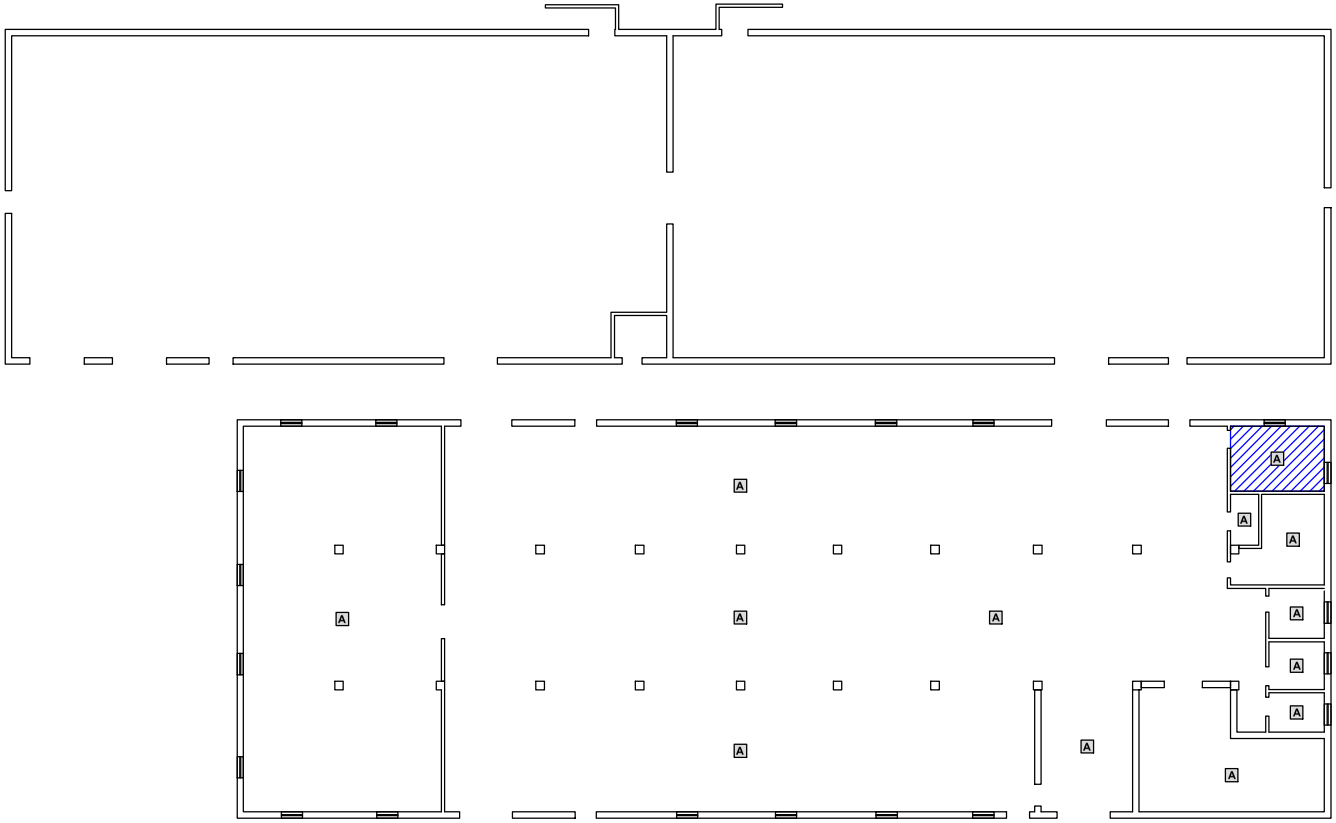
LEGEND

HMA-42-1-TSI - ALL NON-BLOCK WHITE INSULATION (SIMILAR TO VA-05-073-555B) CONTAINS ASBESTOS
100 LIN FT

USFin

PROJECT NO.	SCALE
17001	1" = 10'
PAGE	DRAWN BY
1	BB
SHEET	DATE
B - 11 X 17	2/2/17

Building 136



TITLE

BUILDING 136 - FIRST FLOOR
FLOORING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

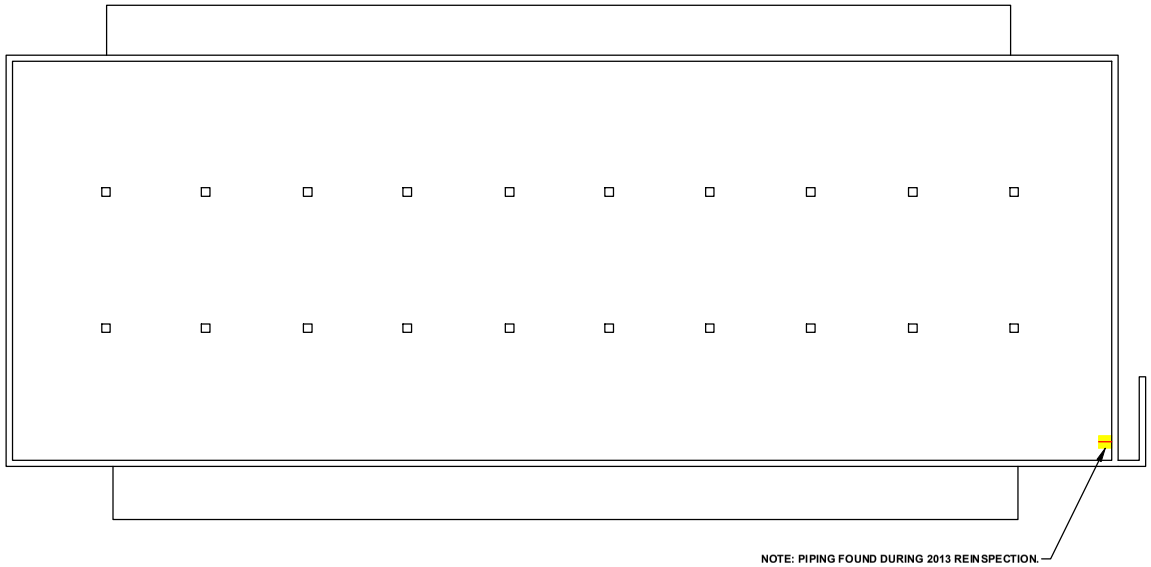
ABATED AREAS - 2003

FLOORING LEGEND

A CONCRETE

USFin

PROJECT NO.	SCALE
17001	1" = 20'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17



TITLE

BUILDING 136 - BASEMENT
PIPING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

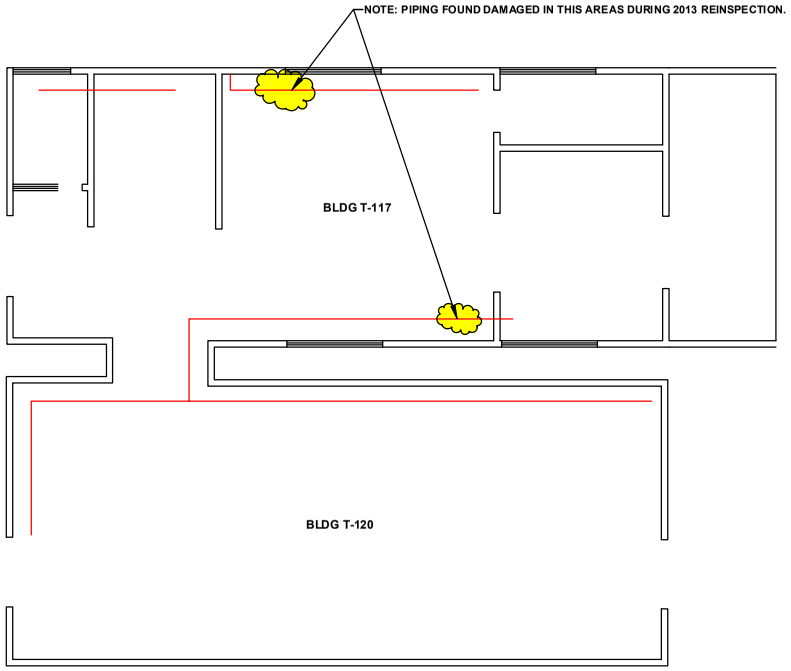
HMA-136-B-TSI PIPING & INSULATION
(QUANTITY TO BE VERIFIED IN THE FIELD)

AREA UPDATED AS OF
2013 REINSPECTION

USFin

PROJECT NO.	SCALE
17001	1" = 20'
PAGE	DRAWN BY
1	BB
SHEET	DATE
B - 11 X 17	2/2/17

Buildings T117 & T120



TITLE

BUILDINGS T-117 & T-120
PIPING ASBESTOS
HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

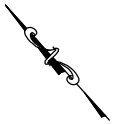
HMA-117-1-TSI - THERMAL SYSTEM INSULATION
HMA-120-1-TSI - THERMAL SYSTEM INSULATION - 125 LIN FT

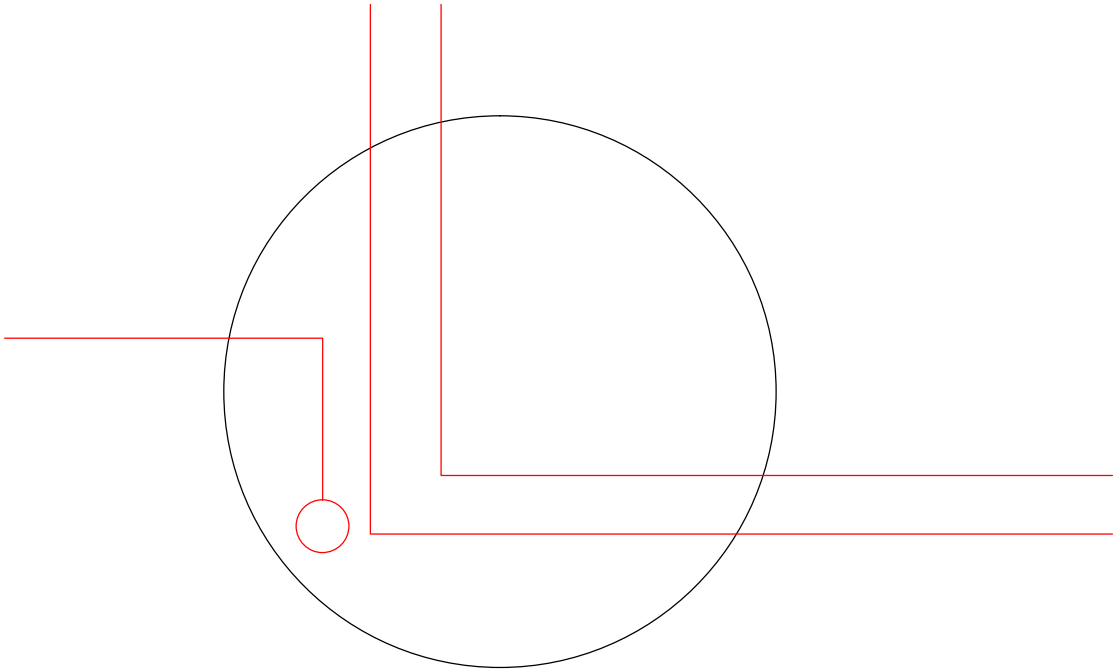
AREA UPDATED AS OF 2013 REINSPECTION

USFin

PROJECT NO.	SCALE
17001	1" = 10'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17

Manholes





TITLE

MANHOLE A
ASBESTOS HOMOGENEOUS AREAS

LOCATION

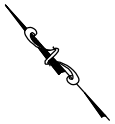
VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

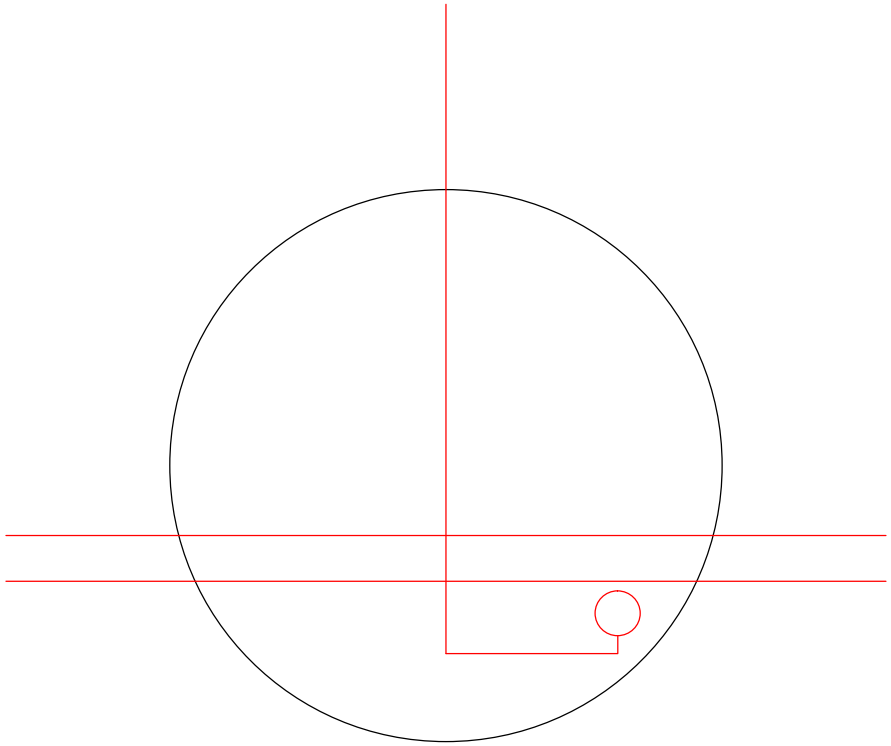
LEGEND

HMA-MANHOLE-A-TSI - ALL WHITE WRAP FIBERGLASS INSULATION CONTAINS ASBESTOS
115 LIN FT
(1) FITTING

USFin

PROJECT NO.	SCALE
17001	1" = 5'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17





TITLE

MANHOLE C
ASBESTOS HOMOGENEOUS AREAS

LOCATION

VETERANS AFFAIRS MEDICAL CENTER
ALEXANDRIA, LOUISIANA
2017 ASBESTOS REINSPECTION

LEGEND

HMA-MANHOLE-C-TSI - ALL WHITE WRAP FIBERGLASS INSULATION CONTAINS ASBESTOS
185 LIN FT
(1) FITTING

USFin

PROJECT NO.	SCALE
17001	1" = 5'
PAGE	**DRAWN BY**
1	BB
SHEET	**DATE**
B - 11 X 17	2/2/17

APPENDIX E

Inspector Certifications

USFin

DEQ
LOUISIANA

STATE OF LOUISIANA
DEPARTMENT OF ENVIRONMENTAL QUALITY
Permit Support Services -- Asbestos

NAME: Jeremiah A Garms
CERT: Inspector
ACCREDITATION #:71140570
VALID: 10/20/2016 - 9/24/2017
AI #: 140570
CB

TSI Training Services International

Asbestos Building Inspector Refresher

Certificate

This is to certify

Brett Brumbaugh

XXX-XX-6789

has attended and successfully completed the Asbestos Hazard Emergency Response Act mandatory course for the Asbestos Building Inspector Refresher and has passed an examination in that course with a minimum score of 70% or better. Training was in accordance with 40 CFR Part 763 (AHERA). The above student received the requisite training for asbestos accreditation under Title II of the Toxic Substances Control Act and State of Indiana requirements under 326 IAC 18-2 and Chapter 3701-34 Ohio Administrative Code.

Training Manager	Expiration Date	Date(s) of Course	Examination Date	Course Location
	10/5/17	10/5/16	10/5/16	Columbus, OH

TSI
33150 Lakeland Blvd.
Cleveland, OH 44095
1-866-666-8438

Course Certificate No. **16 TSI 65098 ir**

TSI Training Services International

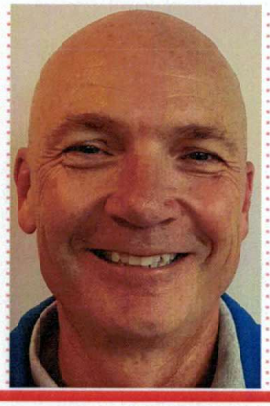
Asbestos Management Planner Refresher

Certificate

This is to certify

Brett Brumbaugh

XXX-XX-6789



has attended and successfully completed the Asbestos Hazard Emergency Response Act mandatory course for the Asbestos Management Planner Refresher and has passed an examination in that course with a minimum score of 70% or better. Training was in accordance with 40 CFR Part 763 (AHERA). The above student received the requisite training for asbestos accreditation under Title II of the Toxic Substances Control Act and State of Indiana requirements under 326 IAC 18-2 and Chapter 3701-34 Ohio Administrative Code.

Training Manager	Expiration Date	Date(s) of Course	Examination Date	Course Location
	10/5/17	10/5/16	10/5/16	Columbus, OH

TSI
33150 Lakeland Blvd.
Cleveland, OH 44095
1-866-666-8438

Course Certificate No. **16 TSI 65101 mpr**

TSI Training Services International

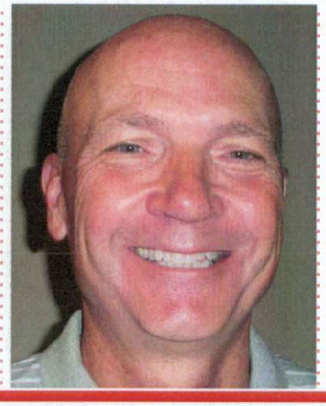
Asbestos Project Designer Refresher

Certificate

This is to certify

Brett Brumbaugh

XXX-XX-6789



has attended and successfully completed the Asbestos Hazard Emergency Response Act mandatory course for the Asbestos Project Designer Refresher and has passed an examination in that course with a minimum score of 70% or better. Training was in accordance with 40 CFR Part 763 (AHERA). The above student received the requisite training for asbestos accreditation under Title II of the Toxic Substances Control Act and State of Indiana requirements under 326 IAC 18-2 and Chapter 3701-34 Ohio Administrative Code.

Robert H Wetter	9/15/17	9/15/16	9/15/16	Cleveland, OH
Training Manager	Expiration Date	Date(s) of Course	Examination Date	Course Location

TSI
33150 Lakeland Blvd.
Cleveland, OH 44095
1-866-666-8438

Course Certificate No. **16 TSI 64940 pdr**

State of Ohio
Department of Health
Asbestos Program

Asbestos Hazard Evaluation Specialist

Brett L Brumbaugh

7920 North Woodbridge Road
Monclova OH 43542

DOB: 09/06/1962

Certification Number: ES3488
Expiration Date: 03/28/2017

This certification is issued pursuant to Chapter 3710 of the Revised Code and 3701-34 of the Ohio Administrative Code

Certification Card is not valid if altered

State of Ohio
Department of Health
Asbestos Program

Asbestos Hazard Abatement Project Designer

Brett L BRUMBAUGH
Brumbaugh-Herrick, Inc.
7920 N. Woodbridge Road
Monclova OH 43542

DOB: 09/06/1962

Certification Number: PD60095
Expiration Date: 10/30/2017

This certification is issued pursuant to Chapter 3710 of the Revised Code and 3701-34 of the Ohio Administrative Code

Certification Card is not valid if altered

IDEM

Indiana Dept. of Environmental Management

Brett L. Brumbaugh

Asbestos Inspector License #: 192916010

Effective: **04/28/2016** Expiration: **04/28/2017**
Birth Date: **09/06/1962** Gender: **M**
Height: **5-10** Eye Color: **BLU**
Weight: **175** Hair Color: **BRO**

IDEM

Indiana Dept. of Environmental Management

Brett L. Brumbaugh

Asbestos Management Planner License #: 192916010

Effective: **04/28/2016** Expiration: **04/28/2017**
Birth Date: **09/06/1962** Gender: **M**
Height: **5-10** Eye Color: **BLU**
Weight: **175** Hair Color: **BRO**

IDEM

Indiana Dept. of Environmental Management

Brett L. Brumbaugh

Asbestos Project Designer License #: 192916010

Effective: **04/28/2016** Expiration: **04/28/2017**
Birth Date: **09/06/1962** Gender: **M**
Height: **5-10** Eye Color: **BLU**
Weight: **175** Hair Color: **BRO**

State of Michigan
Department of Licensing and Regulatory Affairs
Michigan Occupational Safety & Health Administration - Asbestos Program

Asbestos Inspector

Brett L. Brumbaugh
c/o Brumbaugh-Herrick, Inc.
7920 North Woodbridge Road
Monclova, OH 43542

Accreditation Number A3686
Expiration Date 02/25/2018

DOB: 09/06/1962

This individual has satisfactorily met or exceeded the requirements of Michigan Public Act 440 of 1988, as amended, to be accredited as an Asbestos Inspector.

Accreditation card is not valid if altered.

125809

State of Michigan
Department of Licensing and Regulatory Affairs
Michigan Occupational Safety & Health Administration - Asbestos Program

Asbestos Management Planner

Brett L. Brumbaugh
c/o Brumbaugh-Herrick, Inc.
7920 North Woodbridge Road
Monclova, OH 43542

Accreditation Number A3686
Expiration Date 02/25/2018

DOB: 09/06/1962

This individual has satisfactorily met or exceeded the requirements of Section 206 of the Toxic Substances Control Act to be accredited in the above discipline.

Accreditation card is not valid if altered.

125810

State of Michigan
Department of Licensing and Regulatory Affairs
Michigan Occupational Safety & Health Administration - Asbestos Program

Asbestos Project Designer

Brett L. Brumbaugh
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Accreditation Number A3686
Expiration Date 02/25/2018

DOB: 09/06/1962

This individual has satisfactorily met or exceeded the requirements of Section 206 of the Toxic Substances Control Act to be accredited in the above discipline.

Accreditation card is not valid if altered.

125808

State of Ohio
Department of Health
Lead Program

Lead Risk Assessor

License Number
LA000535

Expiration Date
01/26/2018

09/06/1962

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Card not valid if altered

fication is issued pursuant of Chapter 3742 of the
Code and 3701-32 of the Ohio Administrative Code

Commonwealth of Kentucky
Department for Environmental Protection
Division for Air Quality

Brett L Brumbaugh

Has met the requirements of 401 KAR 58:005 and is accredited as an:

Asbestos
Management Planner

Accreditation Number: **P16-11-3908**
Issue Date: **11/14/2016**
Expiration Date: 10/5/2017

KENTUCKY DIVISION FOR AIR QUALITY

DPOR COMMONWEALTH of VIRGINIA
Department of Professional and Occupational Regulation

BOARD FOR ASBESTOS, LEAD, AND HOME INSPECTOR
ASBESTOS INSPECTOR LICENSE
NUMBER: 3303004018 EXPIRES: 12-31-2017

BRETT LAYNE BRUMBAUGH
7920 N WOODBRIDGE ROAD
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Status can be verified at http://www.dpor.virginia.gov

Commonwealth of Kentucky
Department for Environmental Protection
Division for Air Quality

Brett L Brumbaugh

Has met the requirements of 401 KAR 58:005 and is accredited as an:

Asbestos
Project Designer

Accreditation Number: **D16-11-3909**
Issue Date: **11/14/2016**
Expiration Date: 9/15/2017

KENTUCKY DIVISION FOR AIR QUALITY

DPOR COMMONWEALTH of VIRGINIA
Department of Professional and Occupational Regulation

BOARD FOR ASBESTOS, LEAD, AND HOME INSPECTORS
ASBESTOS PROJECT DESIGNER LICENSE
NUMBER: 3305001292 EXPIRES: 12-31-2017

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(FOLD)

Status can be verified at http://www.dpor.virginia.gov

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SECTION 06 10 00
ROUGH CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies wood blocking and plywood.

1.2 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings showing framing connection details, fasteners, connections and dimensions.

C. 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.

D. Manufacturer’s certificate for unmarked lumber.

1.3 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.

1.4 QUALITY ASSURANCE:

A. Installer: A firm with a minimum of three (3) years’ experience in the type of work required by this section.

1.5 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.

1.6 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. 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.

C. 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.

D. 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. Mounting of plywood in TR rooms follows ANSI/TIA-569-D F.
D. 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.

PART 3 - EXECUTION

3.1 INSTALLATION OF FRAMING AND MISCELLANEOUS WOOD MEMBERS:

A. Conform to applicable requirements of the following:

1. AFPA WCD1 for nailing and framing unless specified otherwise.
2. APA for installation of plywood or structural use panels.

- - - END - - -

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 07 92 00, JOINT SEALANTS: Sealants and application.

B. Section 23 31 00, HVAC DUCTS AND CASINGS: Fire and smoke damper assemblies in ductwork.

C. 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. Installer qualifications.

C. Inspector qualifications.

D. Manufacturers literature, data, and installation instructions for types of firestopping and smoke stopping used.

E. List of FM, UL, or WH classification number of systems installed.

F. Certified laboratory test reports for ASTM E814 tests for systems not listed by FM, UL, or WH proposed for use.

G. 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):

Annual Issue Approval Guide Building Materials

4991-13.....Approval of Firestop Contractors

D. Underwriters Laboratories, Inc. (UL):

Annual Issue Building Materials Directory

E. 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

F. Intertek Testing Services - Warnock Hersey (ITS-WH):

Annual Issue Certification Listings

G. 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. All firestop sealants and devices must be red.
2. Contain no flammable or toxic solvents.
3. Release no dangerous or flammable out gassing during the drying or curing of products.
4. Water-resistant after drying or curing and unaffected by high humidity, condensation or transient water exposure.
5. When installed in exposed areas, capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.
6. 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. Firestopping Penetrations: Section 07 84 00, FIRESTOPPING.

B. Sound Rated Gypsum Partitions/Sound Sealants: Section 09 29 00, GYPSUM BOARD.

C. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING

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.

F. Mockups: Before installing joint sealants, apply elastomeric sealants as follows to verify selections and to demonstrate aesthetic effects and qualities of materials and execution:
   1. Joints in mockups of assemblies that are indicated to receive elastomeric joint sealants.

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. Installer qualifications.

C. Contractor certification.

D. Manufacturer's installation instructions for each product used.

E. Cured samples of exposed sealants for each color.

F. Manufacturer's Literature and Data:

1. Primers
2. Sealing compound, each type, including compatibility when different sealants are in contact with each other.

G. 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).
The Professionals' Guide

D. 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,
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. 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. 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 bathtubs and ceramic tile; 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 non-staining; 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 joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field adhesion test log.

C. 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.

D. 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.

E. 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.

F. 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 at interior and exterior locations.
2. Hollow metal door frames for wood doors and at interior locations.

1.2 RELATED WORK

A. Section 08 71 00, DOOR HARDWARE: Door Hardware

B. Card Readers and Biometric Devices: Section 28 13 00, PHYSICAL ACCESS CONTROL SYSTEM.

C. 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):

A250.8-2014.....Standard Steel Doors and Frames

C. ASTM International (ASTM):

A240/A240M-15b.....Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

A653/A653M-15.....Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip

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

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, Profiles, and Tubes

B221M-13.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)

D3656/D3656M-13.....Insect Screening and Louver Cloth Woven from Vinyl Coated Glass Yarns

E90-09.....Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

D. Federal Specifications (Fed. Spec.):

L-S-125B.....Screening, Insect, Nonmetallic

E. Master Painters Institute (MPI):

No. 18.....Primer, Zinc Rich, Organic

F. National Association of Architectural Metal Manufacturers (NAAMM):

AMP 500-06.....Metal Finishes Manual

G. National Fire Protection Association (NFPA):

80-16.....Fire Doors and Other Opening Protectives

H. UL LLC (UL):

10C-09.....Positive Pressure Fire Tests of Door Assemblies

1784-15.....Air Leakage Tests of Door Assemblies and Other Opening Protectives

I. Department of Veterans Affairs

VA Physical Security and Resiliency Design Manual October 1, 2020

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 products comply with specifications.

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.

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. 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 45 sound transmission class (STC) when tested according to ASTM E90.

2.2 MATERIALS

A. Sheet Steel: ASTM A1008/A1008M, cold-rolled.

B. Galvanized Sheet Steel: ASTM A653.

C. Insect Screening: ASTM D3656/D3656M, 18 by 18 aluminum wire mesh.

2.3 PRODUCTS - GENERAL

A. Basis of Design: Steelcraft or equal

B. Provide hollow metal doors and frames from one manufacturer.

2.4 HOLLOW METAL DOORS

A. Hollow Metal Doors: ANSI A250.8; 44 mm (1-3/4 inches) thick. See drawings for sizes and designs.

B. Door Faces:

1. Interior Doors: Sheet steel Z120 or ZF120 (G40 or A40).
2. Exterior Doors: Galvanized sheet steel minimum Z120 or ZF120 (G40 or A40)

C. Door Cores:

1. Interior Doors: Kraft paper honeycomb or vertical steel stiffeners.
2. Exterior Doors: Polystyrene.
3. Fire Doors: Manufacturer's standard complying with specified fire rating performance.

2.5 HOLLOW METAL FRAMES

A. Hollow Metal Frames: ANSI A250.8;

1. Interior Frames:
   a. Level 1 Hollow Metal Doors: 1.0 mm (0.042 inch) thick.
   b. Level 2 and Level 3 Hollow Metal Doors: 1.3 mm (0.053 inch) thick.
   c. Level 1 Hollow Metal Doors: 1.0 mm (0.042 inch) thick.
   d. Wood Doors thick.
2. Interior Borrowed Light Frames: 1.3 mm (0.051 inch) thick.

B. Frame Materials:

1. Interior Frames: Sheet steel Z120 or ZF120 (G40 or A40)
2. Exterior Frames: Galvanized sheet steel minimum Z120 or ZF120 (G40 or A40)

2.6 LOUVERS

A. If louvers are provided in blast resistant doors both the louver and the door must meet the blast resistance requirements noted in this specification.

B. Louver Style: Sight-proof permitting free ventilation.

1. Provide insect screen and wire guards at exterior doors.

C. Louver Construction: Sheet metal matching door faces.

1. Interior Door Louvers: 0.8 mm (0.032 inch) thick.
2. Exterior Door Louvers: 1.3 mm (0.053 inch) inch thick.
3. both directions.

2.7 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 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. Fire 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. Transom Panel Fabrication:

1. Fabricate panels as specified for doors.
2. Fabricate bottom edge with rabbet stop where no transom bar occurs.

F. 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. 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.

G. Sound Rated Door Frames:
   1. Seals: Integral continuous gaskets on frames.
H. Louver Fabrication:
   1. Fabricate louvers as complete units.
   2. Weld stationary blades to frames.
   3. Factory install louvers in door cutouts, welded to door.
I. Louver Screen Fabrication:
   1. Fabricate frame to hold wire fabric in channel with retaining bar anchor and to mount on surface of door with screws.
   2. Do not lap frame over louver opening.
   3. Miter frame corners and join by concealed mechanical fastenings extending about 57 mm (2-1/4 inches) into ends of each member.
   4. Drill frame and doors for screw attachment:
   5. Space screws 50 mm (2 inches) from end of each leg of frame and maximum 300 mm (12 inches) on center.
   6. Insect Screens: Fasten insect screens to interior side of doors with retaining bar against door and not exposed to view.
   7. Wire Guards: Fasten wire guard to exterior side of door with retaining bar against door and not exposed to view.

2.8 FINISHES

A. Steel and 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.

2.9 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: stainless steel

1. Metal Framing: Steel drill screws.
2. Masonry and Concrete: Expansion bolts and power actuated drive pins.

F. Anchors: stainless 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.

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.

1.2 RELATED REQUIREMENTS

A. Door Hardware including hardware location (height): Section 08 71 00, DOOR HARDWARE.

B. Installation of Doors and Hardware: Section 08 11 13, HOLLOW METAL DOORS AND FRAMES, Section 08 71 00, DOOR HARDWARE.

APPLICABLE PUBLICATIONS

C. Comply with references to extent specified in this section.

D. 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.

E. ASTM International (ASTM):

1. E90-09 - Laboratory Measurements of Airborne Sound Transmission Loss of Building Partitions and Elements.

F. National Fire Protection Association (NFPA):

1. 80-16 - Fire Doors and Other Opening Protectives.
2. 252-12 - Fire Tests of Door Assemblies.

G. UL LLC (UL):

1. 10C-09 - Positive Pressure Fire Tests of Door Assemblies.

H. 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.

1.3 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. 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. 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. Test Reports: Indicate each product complies with specifications.
   1. Screw Holding Capacity Test.
   2. Cycle-Slam Test.
   3. Hinge-Loading Test.
F. Operation and Maintenance Data:
   1. Care instructions for each exposed finish product.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Regularly and presently manufactures specified products. Manufactures specified products with satisfactory service on five similar installations for minimum five years.

1.5 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.

1.6 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.

1.7 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.
   a. Comply with door manufacturer's instructions for relative humidity.

1.8 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."
B. Manufacturer's Warranty: Warrant interior factory finished flush wood doors against material and manufacturing defects.
   1. Warranty Period: Lifetime of original installation.

PART 2 - PRODUCTS

2.1 PRODUCTS - GENERAL

A. Basis of Design: VT Industries, Heritage series or equal
B. Provide each product from one manufacturer.

2.2 FLUSH WOOD DOORS

A. General:
   1. ANSI/WDMA I.S. 1A, 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.
   5. ANSI/WDMA I.S. 1A.
   6. One species throughout project unless scheduled or otherwise shown.
   7. Transparent Finished Faces: Premium Grade, match adjacent wood species – verify with COR per location , match existing veneer cut type, match existing veneer match type, match existing door color.
      a. AA 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.

8. Factory sand doors for finishing.

B. Fire-Rated Wood Doors:

1. Fire Resistance Ratings: See Door Schedule
2. 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.
3. 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.
4. Hardware Reinforcement:
   a. Provide fire 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.
5. Other Core Components: Manufacturer's standard as allowed by labeling requirements.
6. Astragal: Steel type for pairs of doors.

C. 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.

D. 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. Finish surfaces, including both faces, top and bottom and edges of the doors smooth to touch.
F. 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 to match existing doors, samples required.

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.

- - E N D - -

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: Section 08 14 00, WOOD DOORS, Section 08 11 13, HOLLOW METAL DOORS AND FRAMES

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. 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

C. 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.

D. 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 Sets listed at the end of this section.

B. Keying: All cylinders shall be keyed, coordinate with VA COR

1. Keying information will be furnished to the Contractor by the COR.
2. Supply information regarding key control of cylinder locks to manufacturers of equipment having cylinder type locks. Notify COR immediately when and to whom keys or keying information is supplied. Return all such keys to 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):

80-10.....Fire Doors and Other Opening Protectives

101-09.....Life Safety Code

E. Underwriters Laboratories, Inc. (UL):

Building Materials Directory (2008)

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: Stainless steel.
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.

2.3 DOOR CLOSING DEVICES

A. Closing devices shall be products of one manufacturer.

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 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 cylindrical locks with turn pieces or pushbuttons occur, equip wall bumpers (rubber pads having concave face) to receive turn piece or button.

D. Provide floor stops in office areas 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.

F. Provide stop 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 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.

J. Where the specified wall or floor stop cannot be used, provide concealed overhead stops (surface-mounted where concealed cannot be used).

2.6 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.

2.7 FLOOR DOOR HOLDERS

A. Conform to ANSI Standard A156.16. Provide extension strikes for Types L01301 and L01311 holders where necessary.

2.8 LOCKS AND LATCHES

A. 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 removable core type. 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 of 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.

B. 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 2.
2. Cylindrical Lock and Latch Sets: levers shall meet ADA (Americans with Disabilities Act) requirements. Cylindrical locksets shall be series 4000 Grade I. 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. Provide lever design to match design selected by Architect or to match existing lever design. Where two turn pieces are specified for lock F76, turn piece on inside knob shall lock and unlock inside knob, and turn piece on outside knob shall unlock outside knob when inside knob is in the locked position. (This function is intended to allow emergency entry into these rooms without an emergency key or any special tool.)

3. Auxiliary locks shall be as specified under hardware sets and conform to ANSI A156.36.
4. Locks on designated doors in Psychiatric (Mental Health) areas shall be paddle type with arrow projection covers and be UL Listed. Provide these locks with paddle in the down position on both sides of the door. Locks shall be fabricated of wrought stainless steel.

2.9 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)

2.10 ELECTRIC STRIKES

A. ANSI/ BHMA A156.31 Grade 1.
B. General: Use fail-secure electric strikes at fire-rated doors.

2.11 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

B. Psychiatric keys shall be cut so that first two bittings closest to the key shoulder are shallow to provide greater strength at point of greatest torque.

2.12 ARMOR PLATES, KICK PLATES, MOP PLATES AND DOOR EDGING

A. Conform to ANSI Standard A156.6.

B. Provide protective plates 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 254 mm (10 inches) or 305 mm (12 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.

2.13 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.

2.14 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.

2.15 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.

2.16 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).

2.17 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 except where otherwise specified.

E. Special Finish: Exposed surfaces of hardware for dark bronze anodized aluminum doors shall have oxidized oil rubbed bronze finish (dark bronze) finish on door closers shall closely match doors.

F. 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.

2.18 BASE METALS

A. Apply specified U.S. Standard finishes on different base metals as following:

Finish	**Base Metal**
652	Steel
626	Brass or bronze
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 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
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 sets listed in the door schedule shown on drawings. Hardware sets are listed as basis of design.

Manufacturer's Abbreviations:

1. PE - Pemko
2. YA - Yale
3. SA - SARGENT
4. HS - HES
5. NO - Norton
6. RO - Rockwood
7. OT - Other
8. MK - McKinney
9. SU - Securitron

Set: 1.0

Doors: 001-D103, 001-D202, 002-D133, 002-D256, 002-D359, 002-D424, 003-D105, 003-D205, 003-D305, 004-D102E, 005-D110A, 005-D212C, 005-DG06A, 006-D008, 006-D101, 006-D201, 006-D310, 007-D042, 007-D045, 007-D184A, 007-D2M4, 007-D3M4, 007-D402, 007-D471A, 007-DD33, 009-D218, 013-D6, 014-D1A107, 016-D110B, 045-D170, 045-D173, 045-D272, 049-D166, 136-D32, 142-D13

Description: INT NEW STOREROOM ML - ES - ACCESS CONTROL - GASKET

1 Continuous Hinge (A31031G)	CFM (height) HD1		PE
1 Storeroom Lock (F07)	AUR 8805FL Temp Core - Match Existing		
626	YA		
1 Permanent Core	Match Existing		
1 Electric Strike (E09391)	1600-CDB	630	HS
1 SMART Pac Bridge Rectifier	2005M3		HS

1 Surface Closer (C02011 / C02021)		R 8501 M / PR	
8501 M	626	NO	
1 Kick Plate (J102)	K1050 10" BEV CSK	US32D	RO
1 Floor Stop (L02121)	470	US26D	RO
1 Adhesive Gasketing (R0Y154)	S88BL		PE
1 Frame Harness	QC-C1500P		MK
1 Position Switch (E08)	DPS-M-BK		SU
1 Card Reader	BY SECURITY INTEGRATOR		
1 Power Supply	BPS-24-_		SU

Notes: Doors are normally closed and secure. Valid credential at reader will allow entry by energizing electric strike. Upon loss of power, door will remain secure. At existing doors and frames, verify all existing conditions and modify hardware as required prior to purchase.

Set: 2.0

Doors: 009-D315

Description: INT NEW STOREROOM ML BH- ES - ACCESS CONTROL - GASKET

1 Continuous Hinge	HT CFM (height) HD1		PE
1 Storeroom Lock (F07) BH	72 8204 ALP	US32D	SA
1 Permanent Core	Match Existing		
1 Electric Strike (E09391)	1600-CDB	630	HS
1 SMART Pac Bridge Rectifier	2005M3		HS
1 Surface Closer (C02011 / C02021)		R 8501 M / PR	
8501 M	626	NO	
1 Kick Plate (J102)	K1050 10" BEV CSK	US32D	RO
1 Floor Stop (L02121)	470	US26D	RO
1 Gasketing - BH - Perforated	P88BL		PE
1 Frame Harness	QC-C1500P		MK
1 Position Switch (E08)	DPS-M-BK		SU
1 Card Reader	BY SECURITY INTEGRATOR		
1 Power Supply	BPS-24-_		SU

Notes: Doors are normally closed and secure. Valid credential at reader will allow entry by energizing electric strike. Upon loss of power, door will

remain secure. Closer inside TR room.

Set: 3.0

Doors: 007-D017, 007-D045A, 007-D1A-117, 007-D267A, 007-D373D, 008-D305D, 015-D7F, 046-D302, 147-D102, 171-D108

Description: INT NEW STOREROOM ML - ES - ACCESS CONTROL - CLOSER/STOP GASKET

1 Continuous Hinge (A31031G)	CFM (height) HD1		PE
1 Storeroom Lock (F07)	AUR 8805FL Temp Core - Match Existing		
626	YA		
1 Permanent Core	Match Existing		
1 Electric Strike (E09391)	1600-CDB	630	HS
1 SMART Pac Bridge Rectifier	2005M3		HS
1 Surface Closer (C02021-Spg Stop)		CPS8501	689
NO			
1 Kick Plate (J102)	K1050 10" BEV CSK	US32D	RO
1 Adhesive Gasketing (R0Y154)	S88BL		PE
1 Frame Harness	QC-C1500P		MK
1 Position Switch (E08)	DPS-M-BK		SU
1 Card Reader	BY SECURITY INTEGRATOR		
1 Power Supply	BPS-24-_		SU

Notes: Doors are normally closed and secure. Valid credential at reader will allow entry by energizing electric strike. Upon loss of power, door will remain secure.

Set: 4.0

Doors: 008-D105C, 009-D135, 045-D270

Description: NOT FOUND

1 Opening	Not found		OT

----END----

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SECTION 08 87 00
WINDOW FILM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Safety and Security Window Film:

a. Combination safety / solar control window film.

1.2 REFERENCES

A. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.

B. ASHRAE - American Society for Heating, Refrigeration, and Air Conditioning Engineers; Handbook of Fundamentals.

C. ASTM International (ASTM):

a. ASTM D 882 - Standard Test Method for Tensile Properties of Thin Plastic Sheeting.

b. ASTM D 412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers -- Tension.

c. ASTM D 624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers

d. ASTM D 1004 - Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting.

e. ASTM D 1044 - Standard Method of Test for Resistance of Transparent Plastics to Surface Abrasion (Taber Abrader Test).

f. ASTM D 2240 - Standard Method for Rubber Property - Durometer Hardness.

g. ASTM D 2582 - Standard Test Method for Puncture-Propagation Tear Resistance of Plastic Film and Thin Sheeting.

h. ASTM D 5895 - Standard Test Methods for Evaluating Drying or Curing During Film Formation of Organic Coatings Using Mechanical Recorders.

i. ASTM E 84 - Standard Method of Test for Surface Burning Characteristics of Building Materials.

j. ASTM E 308 - Standard Recommended Practice for Spectrophotometry and Description of Color in CIE 1931 System.

k. ASTM E 903 - Standard Methods of Test for Solar Absorbance, Reflectance and Transmittance of Materials Using Integrating Spheres.

l. ASTM E 1886 - 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.

m. ASTM E 1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes.

n. ASTM F1642 - Standard Method of Test for Glazing and Glazing Systems Subject to Airblast Loadings

o. ASTM F2912 - Standard Specification for Glazing and Glazing Systems Subject to Airblast Loadings.

D. Consumer Products Safety Commission 16 CFR, Part 1201 - Safety Standard for Architectural Glazing Materials.

E. GSA-TS01 - Standard Test for Glazing and Glazing Systems Subject to Airblast Loadings.

F. NFRC 100/200 (Formerly ASTM E903) - Standard Methods of Test for Solar Absorbance, Reflectance and Transmittance of Materials Using Integrating Spheres.

G. IES LM-83-12: IES Spatial Daylight Autonomy (sDA) and Annual Sunlight Exposure.

H. ISO 16933, International Standard for Glass in Building: Explosion-resistant security glazing - Test and classification for arena air-blast testing.

I. Underwriters Laboratories Inc. (UL): UL 972 - Burglary Resisting Glazing Material.

J. Window 6.3 - A Computer Tool for Analyzing Window Thermal Performance; Lawrence Berkeley Laboratory.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 33 23.

B. Product Data: Manufacturer's current technical literature on each product to be used, including:

a. Manufacturer's Data Sheets.

b. Preparation instructions and recommendations.

c. Storage and handling requirements and recommendations.

d. Installation methods.

C. Samples: For each film specified, three samples representing actual film color and pattern.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: All primary products specified in this section will be supplied by a single manufacturer with a minimum of ten years' experience.

a. Provide documentation that the adhesive used on the specified films is a Pressure Sensitive Adhesive (PSA).

B. Installer Qualifications: All products listed in this section are to be installed by a single installer with a minimum of five years demonstrated experience in installing products of the same type and scope as specified.

a. Provide documentation that the installer is authorized by the Manufacturer to perform Work specified in this section.

b. Provide a commercial building reference list of 5 properties where the installer has applied window film. This list will include the following information:

1. Name of building.
2. The name and telephone number of a management contact.
3. Type of glass.
4. Type of film and/or film attachment system.
5. Amount of film and/or film attachment system installed.
6. Date of completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Follow Manufacturer's instructions for storage and handling.

B. Store products in manufacturer's unopened packaging until ready for installation.

C. Store and dispose of hazardous materials, and materials contaminated by hazardous 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 recommended limits.

1.7 WARRANTY

A. At project closeout, provide to Owner or COR an executed current copy of the manufacturer's standard limited warranty against manufacturing defect, outlining its terms, conditions, and exclusions from coverage.

B. In order to validate warranty, installation must be performed by an Authorized 3M dealer and according to Manufacturer's installation instructions. Verification of Authorized 3M dealer can be confirmed by submission of active 3M dealer code number.

PART 2 PRODUCTS

2.1 SAFETY AND SECURITY FILM

A. Optical Performance: safety / solar control window film

1. Meets ASTM E84, Class A.
2. Film Type Polyester
3. Adhesive Type Pressure-Sensitive
4. Usage Interior
5. Available Width(s) 60”
6. Full Roll Length 100 linear feet (30.5m)
7. Thickness 8 mil
8. Total Solar Reflectance 8%
9. Total Solar Absorbance 17%
10. Tensile Strength psi 28,500 (MD)/26,000 psi (TD)
11. Yield Strength psi 16,000
12. Break Strength 230 lbs/in
13. Longitude Elongation at Break 145% (MD)/140% (TD)
14. Peel Strength 4.21 lb/in
15. Puncture Strength 207 lbf
16. TSER varies on glass type

PART 3 EXECUTION

3.1 EXAMINATION

A. Film Examination:

a. If preparation of glass surfaces is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.

b. Glass surfaces receiving new film should first be examined to verify that they are free from defects and imperfections, which will affect the final appearance.

c. Do not proceed with installation until glass surfaces have been properly prepared and deviations from manufacturer's recommended tolerances are corrected. Prepare surfaces using the methods

recommended by the manufacturer for achieving the best result under the project conditions.

d. Commencement of installation constitutes acceptance of conditions.

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.

C. Refer to Manufacturer's installation instructions for methods of preparation for Impact Protection Adhesive or Impact Protection Profile film attachment systems.

3.3 INSTALLATION

A. Film Installation, General:

a. Install in accordance with manufacturer's instructions.

b. Cut film edges neatly and square at a uniform distance of 1/8 inch (3 mm) to 1/16 inch (1.5 mm) of window sealant. Use new blade tips after 3 to 4 cuts.

c. Spray the slip solution, composed of one capful of baby shampoo or dishwashing liquid to 1 gallon of water, on window glass and adhesive to facilitate proper positioning of film.

d. Apply film to glass and lightly spray film with slip solution.

e. Squeegee from top to bottom of window. Spray slip solution to film and squeegee a second time.

f. Bump film edge with lint-free towel wrapped around edge of a 5-way tool.

g. Upon completion of film application, allow 30 days for moisture from film installation to dry thoroughly, and to allow film to dry flat with no moisture dimples when viewed under normal viewing conditions.

h. If completing an exterior application, check with the manufacturer as to whether edge sealing is required.

3.4 CLEANING AND PROTECTION

A. Remove left over material and debris from Work area. Use necessary means to protect film before, during, and after installation.

B. Touch-up, repair or replace damaged products before Substantial Completion.

C. After application of film, wash film using common window cleaning

solutions, including ammonia solutions, 30 days after application. Do not use abrasive type cleaning agents and bristle brushes to avoid scratching film. Use synthetic sponges or soft cloths.

---END---

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
B. 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 or warranty holding manufacturer’s technical representative.

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

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.

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

2.2 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.

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.
   d. All puddles shall be removed, and material shall be allowed to dry, 1-2 hours at 70F/21C.
   e. 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.

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

J. Property	Test	Value
Bond Strength	ASTM D7234	100% bond to concrete failure

2.3 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

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. Ceiling suspension systems for acoustical tile or panels and lay in gypsum board panels: Section 09 51 00, ACOUSTICAL CEILINGS: 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

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. ASTM International

A641-2019.....Zinc-Coated (Galvanized) Carbon Steel Wire

A653/653M-2020.....Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.

C11-2018.....Terminology Relating to Gypsum and Related Building Materials and Systems

C635-2017.....Manufacture, Performance, and Testing of Metal Suspension System for Acoustical Tile and Lay-in Panel Ceilings

C636-2019.....Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels

C645-2018.....Non-Structural Steel Framing Members

C754-2020.....Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products

C841-03(R2018).....Installation of Interior Lathing and Furring

C954-2018.....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

E580-2020.....Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions.

PART 2 - PRODUCTS

2.1 PROTECTIVE COATING

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).
   2. Runners same thickness as studs.
   3. Exception: Members that can show certified third party testing with gypsum board in accordance with ICC ES AC86 (Approved May 2012) need not meet the minimum thickness limitation or minimum section properties set forth in ASTM C 645. The submission of an evaluation report is acceptable to show conformance to this requirement. Use C 645 steel, 0.48mm (0.019 inch) minimum base-metal (19 mil).

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.
I. Web stiffener track clip:
   1. Mill certified steel, ASTM A653/A653M, 68 mil.
   2. Secure to wall stud framing to prevent web crippling.

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.

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 and insulated exterior wall furring.

G. 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.

H. 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. Do not fasten studs to top runner track when studs extend to underside of structure overhead.

I. 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).

J. 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.

K. Form control joint, with double studs spaced 13 mm (1/2-inch) apart.

3.3 INSTALLING WALL FURRING FOR FINISH APPLIED TO ONE SIDE ONLY

A. In accordance with ASTM C754, or ASTM C841 except as otherwise specified or shown.

B. 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.

C. 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.

D. Installing Wall Furring-Bracket System: Space furring channels not more than 400 mm (16 inches) on center.

3.4 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.

3.5 INSTALLING SHAFT WALL SYSTEM

A. Conform to UL Design No. U438 for two-hour fire rating.

B. Position J runners at floor and ceiling with the short leg toward finish side of wall. Securely attach runners to structural supports with power driven fasteners at both ends and 600 mm (24 inches) on center.

C. After liner panels have been erected, cut C-H studs and E studs, from 9 mm (3/8-inch) to not more than 13 mm (1/2-inch) less than floor-to-ceiling height. Install C-H studs between liner panels with liner panels inserted in the groove.

D. Install full-length steel E studs over shaft wall line at intersections, corners, hinged door jambs, columns, and both sides of closure panels.

E. Suitably frame all openings to maintain structural support for wall:
1. Provide necessary liner fillers and shims to conform to label frame requirements.
2. Frame openings cut within a liner panel with E studs around perimeter.

3. Frame openings with vertical E studs at jambs, horizontal J runner at head and sill.

3.6 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 cannot 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 overhead 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.

3.7 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

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. 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. Test Results:

1. Fire rating test, each fire rating required for each assembly.
2. Sound rating test.

D. 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

In accordance with the requirements of ASTM C840.

1.6 ENVIRONMENTAL CONDITIONS

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):

C11-2018.....Terminology Relating to Gypsum and Related Building Materials and Systems

C475-2017.....Joint Compound and Joint Tape for Finishing Gypsum Board

C840-2020.....Application and Finishing of Gypsum Board

C919-2019.....Sealants in Acoustical Applications

C954-2018.....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

C1002-2018.....Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs

C1047-2019.....Accessories for Gypsum Wallboard and Gypsum Veneer Base

C1177-2017.....Glass Mat Gypsum Substrate for Use as Sheathing

C1658-2019.....Glass Mat Gypsum Panels

C1396-2017.....Gypsum Board

E84-2020.....Surface Burning Characteristics of Building Materials

C. Underwriters Laboratories Inc. (UL):

Latest Edition.....Fire Resistance Directory

D. Inchcape Testing Services (ITS):

Latest Editions.....Certification Listings

PART 2 - PRODUCTS

2.1 GYPSUM BOARD

A. Gypsum Board: ASTM C1396, Type X, 16 mm (5/8 inch) thick unless shown otherwise.

B. Coreboard or Shaft Wall Liner Panels.

1. ASTM C1396, Type X.
2. ASTM C1658: Glass Mat Gypsum Panels,

3. Coreboard for shaft walls 300, 400, 600 mm (12, 16, or 24 inches) wide by required lengths 25 mm (one inch) thick with paper faces treated to resist moisture and mold.

C. Water and Mold Resistant Gypsum Backing Board Assemblies: ASTM C1396/C620, Type X, 16 mm (5/8 inch) thick.

D. Paper facings shall contain 100 percent post-consumer recycled paper content.

2.2 GYPSUM SHEATHING BOARD

A. ASTM C1396, Type X, water-resistant core, 16 mm (5/8 inch) thick.

B. ASTM C1177, Type X.

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.

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

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.

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:

1. Two sides of partitions:
   a. Fire rated partitions.
   b. Smoke partitions.
   c. Sound rated partitions.

d. Full height partitions shown (FHP).

e. Corridor partitions.

2. One side of partitions or furring:

a. Inside of exterior wall furring or stud construction.

b. Room side of room without suspended ceilings.

c. 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 and in locations which might be subject to moisture exposure during construction.

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. Installing Two Layer Assembly Over Sound Deadening Board:
   a. Apply face layer of wallboard vertically with joints staggered from joints in sound deadening board over framing members.
   b. Fasten face layer with screw, of sufficient length to secure to framing, spaced 300 mm (12 inches) on center around perimeter, and 400 mm (16 inches) on center in the field.
9. 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.

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 INSTALLING GYPSUM SHEATHING

A. Install in accordance with ASTM C840, except as otherwise specified or shown.

B. Use screws of sufficient length to secure sheathing to framing.

C. Space screws 9 mm (3/8 inch) from ends and edges of sheathing and 200 mm (8 inches) on center. Space screws a maximum of 200 mm (8 inches) on center on intermediate framing members.

D. Apply 600 mm by 2400 mm (2 foot by 8 foot) sheathing boards horizontally with tongue edge up.

E. Apply 1200 mm by 2400 mm or 2700 mm (4 ft. by 8 ft. or 9 foot) gypsum sheathing boards vertically with edges over framing.

3.4 CAVITY SHAFT WALL

A. Coordinate assembly with Section 09 22 16, NON-STRUCTURAL METAL FRAMING, for erection of framing and gypsum board. Drywall shall be cut to within 1/4" of floor to allow fillet to stay in place through life of flooring.

B. Conform to UL Design No. U438 or FM WALL CONSTRUCTION 12-2/HR (Nonbearing for two-hour fire rating. Conform to FM WALL CONSTRUCTION 25-1/HR (Non-loadbearing) for one-hour fire rating where shown.

C. 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.

D. 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.

E. Treat joints, corners, and fasteners in face layer as specified for finishing of gypsum board.

F. 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.

3.5 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.

B. 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.

C. 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.

3.6 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 and fire protection equivalent to the fire rated construction.

3.7 UNACCESSIBLE CEILINGS

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 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. Color, pattern, and location of each type of acoustical unit: on drawings.

B. Ceiling Suspension System: Section 09 22 16, NON-STRUCTURAL METAL FRAMING.

C. Lay in gypsum board ceiling panels: Section 09 29 00, GYPSUM BOARD.

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. Architect/Engineer. and Interior Designer.
   c. VA Interior Designer.
   d. Inspection and Testing Agency.
   e. Contractor.
   f. Installer.
   g. Manufacturer's field representative.
   h. 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 products comply 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 concealed grid suspension systems.

2.2 SYSTEM PERFORMANCE

A. Design product complying with specified performance:

1. Maximum Deflection: 1/360of span, maximum.

B. Fire Resistance: ASTM E119; as component of 2 hour rated floor-ceiling roof-ceiling assembly.

C. 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: on drawings Provide acoustical units from one manufacturer.

1. Provide each product exposed to view from one production run.

B. Provide suspension system from same manufacturer.

C. Sustainable Construction Requirements:

1. Mineral Base Recycled Content: 65 percent, post-consumer total recycled content, minimum. Select products with recycled content to achieve overall Project recycled content requirement.
2. Steel Recycled Content: 30 percent total recycled content, minimum.

3. Aluminum Recycled Content: 50 percent total recycled content, minimum.
4. Biobased Content: 37 percent by weight biobased material, minimum.
   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. NRC (Noise Reduction Coefficient): ASTM C423, minimum 0.55 unless specified otherwise.
   c. CAC (Ceiling Attenuation Class): ASTM E413, 40-44 range unless specified otherwise.
   d. LR (Light Reflectance): Minimum 0.75.
3. Lay-in panels: Sizes as indicated on Drawings, with square edges
   a. Sizes:
      1) Concealed Grid Upward Access System: 600 by 600 mm (24 by 24 inch) .
      2) Cross Score: 300 by 600 mm (12 by 24 inch) tile to simulate 300 by 300 mm (12 by 12 inch) tile edges.
      3) Edge and Joint Detail: Square edges and joints as required to suit suspension and access system.

2.5 METAL SUSPENSION SYSTEM

A. General: ASTM C635, intermediate-duty heavy-duty system, except as otherwise specified.
1. Suspension System: Provide the following:
   a. Galvanized cold-rolled steel, bonderized.
   b. Fire resistant plastic (glass fiber).
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 on drawings..

C. 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.

D. Clips: Galvanized steel, designed to secure framing member in place. When required by manufacturer.

E. 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. Retain existing acoustical panels suspension system for reuse.
2. Dispose of other 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. 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 to Ensure 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.

D. Fire-Rated System:
   1. Total assembly, consisting of the ceiling suspension system, acoustical units, penetrations, structural components and floor or roof construction above, shall have a 1 hour 2 hour 3 hour fire rating based on tests conducted in conformance with ASTM E119.
   2. Provide concealed fire protection around penetrations in ceilings for electric and mechanical work, and other penetrations as required to maintain the integrity of the fire-rated assembly.
   3. Install fire rated ceiling systems to conform to tested assembly.

3.6 CLEANING

A. Remove excess adhesive before adhesive sets.

B. Clean exposed surfaces. Remove contaminants and stains.

---END---

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.

1.2 RELATED REQUIREMENTS

A. Rubber Tile Flooring: 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):

F1861-16.....Resilient Wall Base.

D4259-18.....Preparation of Concrete by Abrasion Prior to Coating Application.

C. International Concrete Repair Institute (ICRI):

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.

D. Sustainable Construction Submittals:

1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.

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. Provide each product from one manufacturer and from one production run.

B. Provide resilient stair treads and sheet rubber flooring from same manufacturer.

2.2 RESILIENT BASE

A. Resilient Base: 3 mm (1/8 inch) thick, 100 mm (4 inches) high.

1. Type: Rubber; use one type throughout.
2. ASTM F1861, Type TP thermoplastic rubber or Type TV thermoplastic vinyl, Group 2 - layered.

B. Applications:

1. Other Locations: Style B - Cove.

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.
   1. Dispose of removed materials.
D. Correct substrate deficiencies.
   1. Fill cracks, pits, and depressions with leveling compound.
   2. Remove protrusions; grind high spots.
   3. Apply leveling compound to achieve 3 mm (1/8 inch) in 3 m (10 feet) maximum surface variation.
E. Clean substrates. Remove contaminants capable of affecting subsequently installed product's performance.
   1. Mechanically clean concrete floor substrate according to ASTM D4259.
   2. Surface Profile: ICRI Guideline No. 310.2R.
F. Allow substrate to dry and cure.
G. Perform flooring manufacturer’s recommended bond, substrate moisture content, and pH tests.

3.2 INSTALLATION GENERAL

A. Install products according to manufacturer's instructions.
   1. When instructions deviate from specifications, submit proposed resolution for Contracting Officer consideration.

3.3 RESILIENT BASE INSTALLATION

A. Applications:
   1. Install resilient base in rooms scheduled on Drawings.
   2. Install resilient base on casework and locker toe spaces , and other curb supported fixed equipment.
   3. Extend resilient base into closets, alcoves, and cabinet knee spaces, and around columns within scheduled room.
B. Lay out resilient base with minimum number of joints.
   1. Length: 600 mm (24 inches) minimum, each piece.
   2. Locate joints 150 mm (6 inches) minimum from corners and intersection of adjacent materials.
C. Installation:
   1. Apply adhesive uniformly for full contact between resilient base and substrate.
   2. Set resilient base with hairline butted joints aligned along top edge.
D. Field Factory form corners and end stops.
   1. V-groove back of outside corner.
   2. V-groove face of inside corner and notch cove for miter joint.
E. Roll resilient base ensuring complete adhesion.

3.4 CLEANING

A. Remove excess adhesive before adhesive sets.

B. Clean exposed resilient base, resilient stair treads, and sheet rubber flooring surfaces. Remove contaminants and stains.

1. Clean with mild detergent. Leave surfaces free of detergent residue.

C. Polish exposed resilient base to gloss sheen.

3.5 PROTECTION

A. Protect products from construction traffic and operations.

1. Maintain protection until directed by Contracting Officer's Representative.

B. Replace damaged products and re-clean.

1. Damaged Products include cut, gouged, scraped, torn, and unbonded products.

- - E N D - -

SECTION 09 65 19
RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies the installation of solid electro vinyl tile flooring, and accessories required for a complete installation.

1.2 RELATED WORK:

A. Resilient Base: Section 09 65 13, RESILIENT BASE AND ACCESSORIES.

B. Subfloor Testing and Preparation: Section 09 05 16, SUBSURFACE PREPARATION FOR FLOOR FINISHES.

C. Color, Pattern and Texture for Resilient Tile Flooring and Accessories: on drawings .

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 pre-consumer 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.

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 shall 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):

D2047-2017.....Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine

D2240-2015.....Test Method for Rubber Property—Durometer Hardness

D4078-2015.....Water Emulsion Floor Finish

E648-2019.....Critical Radiant Flux of Floor Covering Systems Using a Radiant Energy Source

E662-2019.....Specific Optical Density of Smoke Generated by Solid Materials

E1155/E1155M-14.....Determining Floor Flatness and Floor Levelness Numbers

F510/F510M-2020.....Resistance to Abrasion of Resilient Floor Coverings Using an Abrader with a Grit Feed Method

F710-2019.....Preparing Concrete Floors to Receive Resilient Flooring

F925-13.....Test Method for Resistance to Chemicals of Resilient Flooring

F1344-2015.....Rubber Floor Tile

F1700-2020.....Solid Vinyl Floor Tile

F1869-2016.....Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride

F2170-2019.....Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in Situ Probes

F2195-2018.....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 ELECTROTILE SOLID VINYL-TILE:

A. Tile Standard: ASTM F1700.

1. Complies with ASTM F 1700, Class 1, type A requirements

B. Thickness: 3.2 mm (0.125 inch)

C. Size: 610 x 610 mm (24 x 24 inches)

D. Static dissipative tile. Complies with EOS/EDS 7.1S (ASTM-F150) requirements.

2.5 ADHESIVE AND CONDUCTIVE TAPE:

A. Provide manufacturer’s recommended adhesive; it is specially formulated for static dissipative flooring. It covers 18.6 sq. m/3.79 liters (200 sq. ft./gallon) when applied with the recommended notched trowel on porous subfloor.

B. Supply the required amount of self-adhesive copper tape to be used for the project.

2.6 PRIMER FOR CONCRETE SUBFLOORS:

A. Provide in accordance with Section 09 05 16, SUBSURFACE PREPARATION FOR FLOOR FINISHES.

2.7 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.

2.8 POLISH AND CLEANERS:

A. Cleaners: As recommended in writing by floor tile manufacturer.

B. Polish: ASTM D4078.

2.9 FLOOR TRANSITIONS:

A. Metal edge protection and transition profile for floors, provide between all disalike materials with anchoring leg. Finish to be satin anodized aluminum with type, style and width as required for selected material.

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. Match tile installation to approved mockup.

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 SCHLUTER:
   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.
G. Installation of Copper Tape:
   1. The copper tape is fragile, and care must be taken during its installation.
   2. Grounding copper tape must be installed on the subfloor prior to spreading the adhesive.
   3. The copper tape adhesive must make good contact with the subfloor to ensure it does not move.
   4. Take care not to break the copper tape when applying the grounding strips to the floor. If the copper tape is broken, there is no need to replace it entirely but simply join the broken tape with a piece of copper tape.
   5. Using lengths of copper tape 9.5 mm (3/8”) x 1.8 m (6 ft.) long x 0.003” thick, apply the first 1 m (3 ft.) to the floor out from the wall into the floor area. Take the remainder of the tape and attach

it to the wall ready for installation to the permanent grounding service or bus bar.

6. This procedure should be repeated ideally every 4.9 m (16 ft.) around the room's perimeter.
7. All extremities of the copper tape on the walls should be temporarily protected with masking tape until installation is completed.
8. The copper tape shall be free of stress at the intersection of floor and walls.
9. Care must be taken not to damage copper tape while walking in the room or when spreading the adhesive.

3.4 ELECTRICAL TESTING PROCEDURE:

A. Tests and/or approval by static dissipative tile representative are required in order for the warranty to be valid.

B. The electrical resistance of Electrotile flooring must be measured in accordance with the latest versions of ANSI/ESD STM7.1 or ASTM F150 test method. NOTE: Testing can only be performed on a clean floor .

C. Surface-to-surface testing. The surface resistance must be measured using two 2.27 kg ± 28 g (5 lbs ± 1 oz.) electrodes placed 91.5 cm (36") apart connected to a megohmmeter with 10 or 100 volts open circuit voltage. Both electrodes must be at least 91.5 cm (36") from any grounded object or wall.

D. For Static Dissipative Tile (SDT), apply 100 volts and record the reading after 15 seconds.

E. Do 3 measurements at different locations within a 1,000 sq. ft. (92.9 sq. m) area; then, one per thousand square feet. For 1,000 sq. ft. and less take 5 measurements.

F. Surface-to-ground testing. The ground resistance must also be measured between an electrode placed 91.5 cm (36") from the wall and the permanent grounding service or bus bar.

G. For Static Dissipative Tile (SDT), apply 100 volts and record the reading after 15 seconds. For Conductive Tile (CVT), apply 10 volts and record the reading after 15 seconds. If the reading is higher than 1 x 106 Ohms (1 MOhms), change the voltage to 100 volts and record the reading after 15 seconds.

H. Do 3 ground-resistance measurements at different locations within a 1,000 sq. ft. (92.9 sq. m) area; then, one per thousand square feet. For 1,000 sq. ft. and less take 5 measurements.

I. After each reading, make sure to clean the surface of the electrode with a clean rag and a solution of Isopropyl alcohol 70% then, let the electrode surface dry out (few seconds) and follow to the next reading.

J. Static dissipative tile (SDT): an average reading of between 1 x 106 Ohms and 1 x 109 Ohms (1 MOhms and 1,000 MOhms). Note: 1 MOhms = 1 MegOhms = 1 MΩ = 1,000 kΩ.

3.5 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.

3.6 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.

- - -END- - -

SECTION 09 69 00
ACCESS FLOORING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Access flooring is to consist of a series of modular, removable, interchangeable panels on an elevated support system forming an accessible underfloor cavity to accommodate electrical and mechanical services. System is to be gravity-held panels.

1.2 RELATED WORK

A. Schedule for Finishes and Basis of Design: on DRAWINGS

B. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Connection of access flooring systems to building ground.

C. Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS Section 28 05 26, GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY.

D. Underfloor Fire Suppression System: Refer to applicable construction documents.

E. Electrical distribution components: Refer to applicable construction documents.

1.3 DESIGN CRITERIA

A. Structural Performance per CISCA A/F: Provide access flooring systems capable of withstanding the following loads and stresses within limits and under conditions indicated, as determined by testing manufacturer's current standard products according to referenced procedures in CISCA:

1. Ultimate-Load Performance: Provide access flooring systems capable of withstanding a minimum ultimate concentrated load equal to value obtained by multiplying specified concentrated floor panel design load by a factor of 2.5, without failing, according to CISCA A/F, Section II, "Ultimate Loading." Failure is defined as the point at which access flooring system will not take any additional load.
2. Rolling-Load Performance: Provide access flooring systems capable of withstanding rolling loads of the following magnitude applied to non-perforated panels, with a combination of local and overall deformation not to exceed 1.02 mm (0.040 inch) after exposure to rolling load over CISCA A/F Path A or B, whichever path produces the greatest top-surface deformation, according to CISCA A/F, Section III, "Rolling Loads."

B. Panels:
  1. All panels are to be interchangeable except those altered to meet special conditions. Panels are to match existing HPL panels in style, color and weight.
  2. Concentrated-Load Performance: Provide floor panels, including those with cutouts, capable of withstanding a concentrated design load of the following magnitude, with a top-surface deflection under load and a permanent set not to exceed, respectively, 2.03 and 0.25 mm (0.080 inch and 0.010 inch), according to CISCA A/F, Section I, “Concentrated Loads."
C. Installed access floor is to be level within plus or minus 1.59 mm in 3.05 m (1/16 inch in 10 feet), and plus or minus 3.18 mm (1/8 inch) over the entire area. Floor assembly to be rigid, free of vibration, rocking panels, rattles and squeaks.
D. Leakage: Air leakage through the joints between panels and around the perimeter of the floor system not to exceed .057 cubic meters (2 cubic feet) of air per minute per linear 305 mm (1 foot) of joint subjected to 125 Pa (0.5 inch, water gauge) positive pressure in the plenum.
E. Grounding: Components to be in direct positive contact for safe continuous electrical grounding of the entire floor system.
  1. Panel to Understructure Resistance: Not more than 10 ohms.
F. Static Electricity Control: The acceptable resistance range is from not less than mega ohms minimum to not more than mega ohms maximum. Maximum electrical resistance is to be measured from the top of the panel to the grounded subfloor. Exposed metal will not be allowed at the wearing surface of the floor.
G. Flame Spread Rating: Provide assembly flame spread of 25 or less using ASTM E84 test method.
H. Electromagnetic Shielding:
  1. Radio frequency shielding.
  2. Equipment inductance shielding.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
  1. For composite wood products, documentation indicating product contains no urea formaldehyde.
B. Samples: HPL color chip.

C. Shop Drawings:
  1. Floor panel layout.
  2. Detail components of assembly, anchoring methods and edge details, including cut-out details, method of grounding.
D. Manufacturer's Literature and Data: Access floor.
E. Manufacturer's Certificates: Flame spread rating.
F. Floor System Test Reports: Submit certified test reports, from a testing laboratory satisfactory to the COR, attesting that the floor system proposed for installation meets all specified requirements. Submit test reports with shop drawings.
G. Manufacturer's Qualifications.
H. Installer's Qualifications.

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Manufacturer with three (3) years' experience in providing items of type specified.
B. Installer's Qualifications: Installers who are trained and approved by manufacturer and have a minimum of three (3) years' experience installation of units required for this project.
C. Obtain access flooring from single manufacturer.

1.6 DELIVERY, STORAGE AND HANDLING

A. Delivery:
  1. Deliver materials to site in undamaged condition, in original containers or packages, complete with accessories and instructions. Label packages with manufacturer's name and brand designations. Package materials covered by specific references bearing specification number, type, and class as applicable.
B. Storage:
  1. Store all materials in original protective packaging in a safe, dry, and clean location. Store panels at temperatures between 4 and 32 degrees C (40 and 90 degrees F) and between 20 and 70 percent humidity. Replace defective or damaged materials.
C. Handling:
  1. Handle and protect materials in a manner to prevent damage during the entire construction period.

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. American Association of Textile Chemists and Colorists (AATCC):

134-11.....Electrostatic Propensity of Carpets

C. Architectural Aluminum Manufacturers Association (AAMA):

2604-10.....High Performance Organic Coatings on Aluminum Extrusions and Panels.

D. ASTM International (ASTM):

E84-20.....Surface Burning Characteristics of Building Materials

E648-19ae1.....Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source

F150-06(2018).....Electrical Resistance of Conductive and Static Resilient Flooring

F1066-04(2018).....Vinyl Composition Floor Tile

F1700-20.....Solid Vinyl Floor Tile

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. National Association of Architectural Metal Manufacturers (NAAMM):

AMP 500 Series.....Metal Finishes Manual

G. National Electrical Manufacturers Association (NEMA):

LD-3.1-05.....Application, Fabrication, and Installation of High-Pressure Decorative Laminates

H. Ceilings and Interior Systems Construction Association (CISCA):

CISCA 2004.....Recommended Test Procedures for Access Floors

I. National Fire Protection Association (NFPA):

75-13.....Fire Protection of Information Technology Equipment

J. Underwriters Laboratory (UL):

94-06(R2014).....Tests for Flammability of Plastic Materials for Parts in Devices and Appliances

PART 2 - PRODUCTS

2.1 FLOOR COVERING

A. Conductive Plastic Laminate: NEMA LD3, High-Wear type, Grade HW-62 HW-120 fabricated in one (1) piece to cover each panel face within perimeter plastic edging or with integral trim serving as edging. Static decay of 5000 to 0 V in less than 0.5 seconds per FS 101C/4046 at 15 percent relative humidity.

2.2 FLOOR PANELS

A. Construct panels to be uniform in face dimensions, within a tolerance of plus or minus 0.38 mm (0.015 inches) of required size and be square within a tolerance of plus or minus 0.38 mm (0.015 inches), and flatness within a tolerance of plus or minus 0.5 mm (0.02 inches). Design individual floor panels to be easily placed and removed, without disturbing adjacent panels or understructure, by one (1) person using a tool furnished by the access floor manufacturer. Provide panels 610 by 610 mm (24 by 24 inches)in size.

B. Filled Formed-Steel Panels: Contractor option of panel construction described below:

1. Resin core panels not less than 25 mm (1.07 inch) thick laminated to top and bottom face sheets of galvanized steel not less than 0.45 mm (0.0179 inches) thick. Enclose edges of core with upturned, die formed edge of bottom sheet with perimeter channel welded to top and bottom sheets. The completed panels will have a flame spread rating of 25 or less when tested in accordance with ASTM E84.
2. Resin Fiber Core Panels: Steel clad resin fiber core panels covered with factory applied high pressure laminate over Galvanized steel material construction with a high pressure laminate top suitable to withstand a minimum of 1250 lbs. design concentrated Load (1” x 1”) Block.

C. Provide perimeter of panels with continuous extruded conductive PVC edge strips. Top edge of strip to be flush with panel floor finish. Mechanically lock edge strips and fasten in place with adhesive.

2.3 CUT-OUTS

A. Fabricate cut-outs in floor panels to accommodate cable penetrations and service outlets where shown on construction documents or specified. Provide reinforcement or additional support to make panels with cut-outs perform the same as solid uncut panels. Fit cut-outs

with manufacturer’s standard grommet. For cut-outs larger than maximum size grommet, trim edge of cut-outs with plastic trim, molding and/or gaskets having tapered top flange. Provide removable twist close covers for grommets.

1. Provide foam-rubber pads for sealing annular space formed in cutouts by cables and trim edge of cutout with molding having flange and ledge for capturing and supporting pads.

2.4 ACCESSORIES

A. Provide manufacturer's standard registers, grilles and plenum dividers. Design registers and grilles exposed to foot traffic, or the weight of equipment, to support the same load as the floor panel.

B. Plastic Floor Grilles with Dampers: Standard load-bearing grilles molded from polycarbonate plastic to produce removable one (1) piece unit precisely fitted in factory prepared openings of standard field panels, with adjustable/removable damper blades and complying with requirements indicated below:

1. Air-Distribution Characteristics: Refer to mechanical construction documents.
2. Structural Performance: Capable of supporting a 4448 N (1000 pound force) concentrated load.
3. Flammability Characteristics: Classified 94V 0 per UL 94.

C. Vertical Closures (Fascia): Where under floor cavity is not enclosed by abutting walls or other construction, provide manufacturer's standard metal closure plates with factory applied finish.

D. Panel Lifting Device: Manufacturer's standard portable lifting device of type required for lifting panels with floor covering provided. Provide four (4) lifting devices of each type required.

E. Perimeter Support: Where indicated on construction documents, provide manufacturer's standard method for supporting panel edge and form transition between access flooring and adjoining floor covering at same level as access flooring.

F. Floor Cleaner: Type recommended by the floor covering manufacturer.

2.5 PEDESTALS

A. Provide manufacturer's standard pedestal assembly including base, column with provisions for adjustment, locking device, head and pad.

1. Base: Provide pedestal base with not less than 101 by 101 mm (4 by 4 inches) of bearing area.

2. Column: Hollow shaft of appropriate length fitted with threaded rod and leveling nut.
3. Provide vibration proof mechanism for making and holding fine adjustments in heights for leveling purposes over a range of not less than 50 mm (2 inches). Include means of locking mechanism at a selected height.
4. Heads: Provide heads designed to hold panels in place in a freestanding stringer-less understructure.
5. Pads: Provide sound dampening pad for each pedestal head.
6. Fabricate units of sufficient height to provide required under floor clearance indicated in construction documents.

2.6 FINISHES:

A. General: Apply finishes in factory after products are fabricated. Protect finishes on exposed surfaces with protective covering before shipment.

B. Pre-cast Resin Fiber Core Panels set in Galvanized steel shell:

1. Exposed face is to be high pressure laminated.

2.7 FLOOR TRANSITIONS:

A. Provide aluminum trim edge protection and transition profile for all flooring, provide between all disalike adjacent materials with straight embedded anchoring leg. Profile to be selected by flooring installer for appropriate materials.

B. Set aluminum trim edge protection and transition profile to line and level centered under doors or in openings.

C. Finish to be anodized aluminum with type, style and width as required for selected materials.

D. Height as required to coordinate with flooring systems and setting systems as applicable.

E. Finish: Clear anodic coating unless specified otherwise on Basis of Design on Drawings.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prior to installation, subfloor is to be dry and free of any surface irregularities that will adversely affect access flooring system appearance or performance.

B. Clear the area in which the floor system is to be installed of debris. Clean floor surfaces and remove dust before the work is started.

3.2 INSTALLATION

A. Layout floor panel installation to keep the number of cut panels at the floor perimeter to a minimum and to sizes not less than 1/2 half width to the greatest extent possible. Scribe panel assemblies at perimeter and around column to provide a close fit with no voids greater than 6 mm (1/4 inch) where panels abut vertical surface.

B. Construct floor panels to lie flat without warp or twist and bear uniformly on supports without rocking, and without edges projecting above the floor plane. Panels to interlock with supports in a manner that will preclude lateral movement.

C. Provide free ends of floor with positive anchorage and rigid support where floor system does not abut wall or other construction.

D. Cover exposed ends of floor system with aluminum closures. Closures to consist of complete trim and fascia assemblies.

3.3 REPAIR OR WELDED GALVANIZED SURFACES:

A. Use galvanized repair compound where galvanized surfaces are scheduled to receive field or shop coatings, and apply in accordance with manufacturers printed instructions.

3.4 CLEANING

A. Remove debris accumulated during installation from beneath the raised floor system. Immediately after completion of the floor installation, apply floor cleaner in accordance with the floor covering manufacturer's instruction. Do not allow any cleaner to remain between individual panels.

3.5 PROTECTION

A. Cover cleaned floors with clean building paper before construction traffic is permitted. Remove protective covering at completion of Work.

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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. Division 05 METALS: Shop prime painting of steel and ferrous metals.

C. Division 08 OPENINGS: Shop prime painting of steel and ferrous metals.

D. Section 08 14 00, INTERIOR WOOD DOORS: Prefinished flush doors with transparent finishes.

E. Division 10 SPECIALTIES: Shop prime painting of steel and ferrous metals.

F. Division 22 PLUMBING: Shop prime painting of steel and ferrous metals.

G. Division 27 COMMUNICATIONS: Shop prime painting of steel and ferrous metals.

H. Division 28 ELECTRONIC SAFETY AND SECURITY: Shop prime painting of steel and ferrous metals.

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. Product type and color
   c. Name of project.

F. 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.
   4. Intumescent clear coating or fire-retardant paint.
   5. 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
64.....Fire Retardant Coating, Latex, Interior Flat (ULC Approved)

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
   1. 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. Pressure sensitive adhesive back.

B. Snap on coil plastic markers.

C. Widths as shown on construction documents.

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.
8. Fire Retardant paint on plywood has additional processes noted on drawings. One stamp to remain exposed.

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). Where high temperature aluminum paint is used, prepare surface in accordance with paint manufacturer's instructions.
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. Zinc-Coated (Galvanized) Metal, Aluminum, Copper and Copper Alloys Surfaces Specified Painted:

1. Clean surfaces to remove grease, oil and other deterrents to paint adhesion in accordance with SSPC-SP 1 (Solvent Cleaning).
2. Spot coat abraded and damaged areas of zinc-coating which expose base metal on hot-dip zinc-coated items with MPI 18 (Organic Zinc Rich Coating). Prime or spot prime with MPI 134 (Waterborne Galvanized Primer) or MPI 135 (Non-Cementitious Galvanized Primer) depending on finish coat compatibility.

E. Masonry, Concrete, Cement Board, Cement Plaster and Stucco:

1. Clean and remove dust, dirt, oil, grease efflorescence, form release agents, laitance, and other deterrents to paint adhesion.
2. Use emulsion type cleaning agents to remove oil, grease, paint and similar products. Use of solvents, acid, or steam is not permitted.
3. Remove loose mortar in masonry work.
4. Neutralize Concrete floors to be painted by washing with a solution of 1.4 Kg (3 pounds) of zinc sulfate crystals to 3.8 L (1 gallon) of water, allow to dry three (3) days and brush thoroughly free of crystals.
5. Repair broken and spalled concrete edges with concrete patching compound to match adjacent surfaces as specified in Division 03, CONCRETE Sections. Remove projections to level of adjacent surface by grinding or similar methods.

F. 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. Wood and Wood Particleboard:

1. Apply MPI 67 Interior Latex Fire Retardant, Under Coat (UL Approved) with two coats of Semi-Gloss Fire Retardant, Top Coat (UL Approved) to wood for fire retardant finish. .

F. Metals except boilers, incinerator stacks, and engine exhaust pipes:

1. Steel and iron: MPI 79 (Marine Alkyd Metal Primer), MPI 95 (Fast Drying Metal Primer) . Use MPI 101 (Cold Curing Epoxy Primer) where MPI 77 (Epoxy Cold Cured, Gloss , MPI 98 (High Build Epoxy Coating), MPI 108 (High Build Epoxy Marine Coating finish is specified.
2. Zinc-coated steel and iron: MPI 134 (Waterborne Galvanized Primer), MPI 135 (Non-Cementitious Galvanized Primer) .
3. Aluminum scheduled to be painted: MPI 95 (Fast Drying Metal Primer).
4. Terne Metal: MPI 79 (Marine Alkyd Metal Primer), MPI 95 (Fast Drying Metal Primer) .
5. Copper and copper alloys scheduled to be painted: MPI 95 (Fast Drying Metal Primer).
6. Machinery not factory finished: MPI 9 (Exterior Alkyd Enamel).
7. Asphalt coated metal: MPI 1 (Aluminum Paint).

8. Metal over 94 degrees C (201 degrees F), Boilers, Incinerator Stacks, and Engine Exhaust Pipes: MPI 22 (High Heat Resistant Coating).

G. Gypsum Board
1. Surfaces scheduled to have MPI 52 (Interior Latex, MPI Gloss Level 3),
2. Primer: MPI 50 (Interior Latex Primer Sealer) except use MPI 45 (Interior Primer Sealer),

3.8 INTERIOR FINISHES:

A. Apply following finish coats over prime coats in spaces or on surfaces specified on drawings.

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 one (1) coats of MPI 134 (Acrylic Gloss Primer) unless specified otherwise.
   b. Two (2) coats of MPI 114 (Interior Acrylic Gloss)

C. Gypsum Board:
1. One (1) coat of MPI 50 (Interior Latex Primer Sealer)
2. Two (2) coats of MPI 52 (Interior Latex, MPI Gloss Level 3).

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. In existing rooms and areas where alterations occur, clean existing stained and natural finished wood retouch abraded surfaces and then give entire surface one (1) coat of MPI 31 (Polyurethane, Moisture Cured, Clear Gloss) MPI 71 (Polyurethane, Moisture Cured, Clear Flat) .

G. Refinish areas as specified for new work to match adjoining work unless specified or scheduled otherwise.

H. Coat knots and pitch streaks showing through old finish with MPI 36 (Knot Sealer) before refinishing.

I. Sand or dull glossy surfaces prior to painting.

J. 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 on drawings.

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 on drawings 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 on drawings to match surrounding surfaces.
2. Paint colors as specified on drawings 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. 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) MPI 11 (Exterior Latex Semi-Gloss MPI 119 (Exterior Latex, High Gloss (acrylic)).

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 existing work including colors and gloss of finish selected is specified on drawings.
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
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
Fuel Oil - Grade		Brown	White	Fuel Oil-Grade
(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
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
Hot Water Supply Dom./ Solar Water		Green	White	H.W. Sup Dom/SW
Hot Water Return Dom./ Solar Water		Green	White	H.W. Ret Dom/SW

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. Regular compressed air lines: Section 22 15 00, GENERAL SERVICE COMPRESSED-AIR SYSTEMS.
   b. 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 10 14 00
SIGNAGE

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies interior signage for room numbers, code required signs and temporary signs.

1.2 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.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 00, 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. 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.

E. Sign Location Plan, showing location, type and total number of signs required.

F. Shop Drawings: Scaled for manufacture and fabrication of sign types. Identify materials, show joints, welds, anchorage, accessory items, mounting and finishes.

G. Full size layout patterns for dimensional letters.

H. Manufacturer’s qualifications.

I. Installer’s qualifications.

1.4 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.

1.5 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.....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):
70-14.....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 50 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 sliding rail , frame , insert and frame,curved 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.
b. Provide sign system comprised of following primary components: Rail Back: Horizontal rails, spaced to allow for uniform, modular sizing of sign types.
   1) Rail Insert: Mount to back of Copy Panels to allow for attachment to Rail Back.
   2) Copy Panels: Fabricate of ABS , phopolymer , acrylic , aluminum , stainless steel materials to allow for different graphic needs.
   3) End Caps: Interlock to Rail Back to enclose and secure changeable Copy Panels.
   4) Joiners and Accent Joiners: To connect separate Rail Backs together.
   5) Top Accent Bars: To provide decorative trim cap that encloses the top of sign.
c. Provide rail back, rail insert and end caps in anodized extruded aluminum.
d. 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.
e. 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) 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.

4) 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.

5) 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.

5. 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.

6. Joiners: Extruded using 6063T5 aluminum with a black anodized finish. Rail joiners connect rail backs together blindly, providing a butt joint between copy inserts.

7. 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.

8. 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.

9. 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 , Aluminum 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. 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 , Sign Location Plans .
B. Where not otherwise indicated conform to the VA Signage Design Manual 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 26 00
WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies handrail, corner guards and crash rail.

1.2 RELATED WORK

A. Section 08 71 00, DOOR HARDWARE: Armor plates and kick plates not specified in this section.

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. 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.
   2. Crash Rail.
   3. Corner Guards.

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. Provide aluminum alloy used for colored anodizing coating as required to produce specified color.

C. Solid Wood

1. 1.Solid Wood Components: Shall be manufactured from plain sawn, FAS grade hardwood, kiln dried to a moisture content of 6% to 10%.
2. Aluminum: Extruded aluminum should be 6063-T6 alloy with nominal .090" or 10CQLV or 6105-T5 alloy with nominal .075" (1.90mm) thickness. Minimum strength and durability properties as specified in ASTM B221.
3. Fasteners: All fasteners to be non-corrosive and compatible with aluminum retainers. All necessary fasteners to be supplied by the manufacturer.

D. 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. Surface mounted guards consisting of continuous retainer with snap-on cover formed from *Engineered PETG* 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. Minimum strength and durability properties as specified in ASTM B221 Retainer used for flush mounted type to act as a stop for adjacent wall finish material. 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: Match existing heights.
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.

2.3 HANDRAILS AND CRASH RAILS

A. Handrails:
1. Wood Handrails: Surface mounted assembly consisting of a continuous extruded aluminum retainer with removable wood face and handrail. Color matched mounting brackets to be spaced as indicated on installation instructions. All wooden components shall be removable

without removing aluminum retainer from wall to allow repair and refinishing with minimum disruption to facility. Attachment hardware shall be appropriate for wall construction.

a. All wood components shall be factory finished. Wood components to be final coated with water based, high solids, clear lacquer using a two-coat process. Finish shall be in accordance with specified AWI finish system. Coverage shall be a minimum of 3-5 mils. Gloss shall be measured on 60° gloss meter as per ASTM D523.

2. Wood Chair Rail and Crash Rail: Shall be manufactured from plain sawn, FAS grade hardwood, kiln dried to a moisture content of 6% to 10%.

   a. All wood components shall be factory finished. Wood components to be final coated with water based, high solids, clear lacquer using a two-coat process. Finish shall be in accordance with specified AWI finish system. Coverage shall be a minimum of 3-5 mils. Gloss shall be measured on 60° gloss meter as per ASTM D523.

3. Engineered PETG Handrails: Surface mounted assembly consisting of a continuous extruded aluminum retainer, minimum 1.82 mm (0.072-inch) thick with snap-on cover, minimum 2mm (0.078-inch) thick and integral shock absorbing cushions where indicated. Color matched mounting brackets to be spaced as indicated on installation instructions. Color matched end caps and corners shall be attached to allow post installation adjustment. Attachment hardware shall be appropriate for wall construction.

   1) Anchor to wall at maximum 762 mm (30 inches) on center.

4. Engineered PETG Crash Rail:

   a. Snap-on covers of resilient material, minimum 1.98mm (.078”) thickness. Free-floating over aluminum retainer clips. Extruded aluminum should be 6063-T6 alloy, nominal .072" (1.83mm) thickness. Minimum strength and durability properties as specified in ASTM B221 anchored to wall per manufacturer’s

5. Provide handrails, bumper rails and crash rails 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, bumper rails and crash rails. Screw or bolt closure caps to aluminum retainer in a concealed manner.

2.4 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.

2.5 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. AAMA 611 AA-M12C22A32 chemically etched medium matte with integrally colored 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 RESILIENT HANDRAILS AND CRASH RAILS

A. Secure guards to walls with mounting cushions brackets and fasteners in accordance with manufacturer's details and instructions.

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SECTION 10 44 13
FIRE EXTINGUISHER CABINETS

PART 1 - GENERAL

1.1 DESCRIPTION

This section covers semi-recessed and surface mounted fire extinguisher cabinets.

1.2 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.

1.3 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 Acrylic Plastic Sheet

PART 2 - PRODUCTS

2.1 FIRE EXTINGUISHER CABINET

A. Semi-recessed type with flat trim of size and design shown.
Basis of Design: Kidde, semi recessed cabinet, 468044 or equal.

B. Surface mounted type with flat trim of size and shown.
Basis of Design: Kidde, 5 lb surface mounted cabinet, 468071 or equal.

B. Provide rated cabinet where installed in rated walls.

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.

PART 3 - EXECUTION

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.

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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 A&E 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. The 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. Contractors 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.

---END---

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 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.

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.

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 the following:

1. Qualifications:
   a. Provide a copy of the installing contractors fire sprinkler 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.
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) 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 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 OHIO 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):

13-2018(AMD 2020).....Installation of Sprinkler Systems

25-2020.....Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems

101-2021.....Life Safety Code

170-2021.....Fire Safety Symbols

C. Underwriters Laboratories, Inc. (UL):
Fire Protection Equipment Directory

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 suites.
   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.

2.3 SPRINKLERS

A. All sprinklers shall be FM approved quick response. Provide FM approved quick response sprinklers in all areas, except provide standard response sprinklers Telecommunications 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.

2.4 PIPE HANGERS, SUPPORTS AND RESTRAINT OF SYSTEM PIPING

A. Pipe hangers, supports, and restraint of system piping shall be in accordance with NFPA 13.

B. The contractor shall provide wire guard for all sprinkler heads in telecommunications, security and bio medical rooms.

2.5 WALL, FLOOR AND CEILING PLATES

A. Provide chrome plated steel escutcheon plates.

2.6 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. Pipe hangers, supports and accessories in MRI suites shall be made of non-ferrous material.

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. 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.

E. 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.

F. Provide escutcheon plates for exposed piping passing through walls, floors or ceilings.

G. 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.

H. Firestopping shall be provided for all penetrations of fire resistance rated construction. Firestopping shall comply with Section 07 84 00, FIRESTOPPING.

I. 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.

J. 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.

K. Interruption of Service: There shall be no interruption of the existing sprinkler protection, water, electric, or fire alarm services without prior permission of the ’s Representative (COR). 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 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 shall 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 07 84 00, FIRESTOPPING.

E. Section 07 92 00, JOINT SEALANTS.

F. Section 09 91 00, PAINTING.

G. Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT.

H. Section 22 07 11, PLUMBING INSULATION.

I. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

J. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

K. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below shall 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):

B31.1-2020.....Power Piping

ASME Boiler and Pressure Vessel Code -

BPVC Section IX-2021.... Welding, Brazing, and Fusing Qualifications

C. American Society for Testing and Materials (ASTM):

A36/A36M-2019.....Standard Specification for Carbon Structural Steel

A575-2020.....Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades

E84-2021.....Standard Test Method for Surface Burning Characteristics of Building Materials

E119-2020.....Standard Test Methods for Fire Tests of Building Construction and Materials

D. International Code Council, (ICC):

IBC-2021.....International Building Code

IPC-2021.....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(2021).....Paint High Zinc Dust Content, Galvanizing Repair (Metric)

G. National Electrical Manufacturers Association (NEMA):
MG 1-2016(2018).....Motors and Generators

H. National Fire Protection Association (NFPA):
51B-2019.....Standard for Fire Prevention During Welding, Cutting and Other Hot Work
54-2021.....National Fuel Gas Code
70-2020.....National Electrical Code (NEC)
99-2021-AMD1.....Healthcare Facilities Code

I. NSF International (NSF):
5-2019.....Water Heaters, Hot Water Supply Boilers, and Heat Recovery Equipment
14-2020.....Plastic Piping System Components and Related Materials
61-2020.....Drinking Water System Components – Health Effects
372-2020.....Drinking Water System Components – Lead Content

J. Department of Veterans Affairs (VA):
PG-18-102014(R21).....Plumbing Design Manual
PG-18-13-2017(R18).....Barrier Free Design Guide

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 11, COMMON WORK RESULTS FOR PLUMBING", with applicable paragraph identification.

C. 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.

D. 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.

E. Prior to submitting shop drawings for approval, Contractor shall 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.

F. Submittals and shop drawings for interdependent items, containing applicable descriptive information, shall 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.

G. Manufacturer's Literature and Data including: Manufacturer’s literature shall be submitted under the pertinent section rather than under this section.

   1. Electric motor data and variable speed drive data shall 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.

H. 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.

I. 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 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 belts for equipment: Belt manufacturer, model number, size and style, and distinguished whether of multiple belt sets.

J. Provide copies of approved plumbing equipment submittals to the TAB Subcontractor.

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 plumbing.

B. Products Criteria:
   1. Standard Products: Material and equipment shall 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, shall 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 shall be permanent service organizations, authorized and trained by manufacturers of the equipment supplied, located within 160 km (100 miles) of the project. These organizations shall 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 shall be submitted for project record and inserted into the operations and maintenance manual.
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 22 shall conform to the referenced codes and standards as required by the specifications. Local codes and amendments enforced by the local code official shall be enforced, if required by local authorities such as the natural gas supplier. If the local codes are more stringent, then the local code shall apply. Any conflicts shall 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 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. 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 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, "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 shall 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 shall 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 shall be applied and installed in accordance with manufacturer's written instructions. Conflicts between the manufacturer's instructions and the contract documents shall be referred to the COR for resolution. Printed copies or electronic files of manufacturer's installation instructions shall 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, 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, 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. Installer Qualifications: Installer shall be licensed and shall 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.
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.

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 shall be considered mandatory, the word “should” shall be interpreted as “shall”. Reference to the “code official” or “owner” shall be interpreted to mean the COR.

I. Cleanliness of Piping and Equipment Systems:
1. Care shall 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 shall be removed.
2. Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.

3. The interior of all tanks shall be cleaned prior to delivery and beneficial use by the Government. All piping shall be tested in accordance with the specifications and the International Plumbing Code (IPC). All filters, strainers, fixture faucets shall be flushed of debris prior to final acceptance.
4. Contractor shall 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 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. Damaged equipment shall be replaced with an identical unit as determined and directed by the COR. Such replacement shall be at no additional cost or additional time to the Government.
3. Interiors of new equipment and piping systems shall be protected against entry of foreign matter. Both inside and outside shall be cleaned before painting or placing equipment in operation.
4. 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.
5. Protect plastic piping and tanks from ultraviolet light (sunlight) while in pre-construction. Plastic piping and tanks shall 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 shall be in electronic version on CD or DVD with a copy 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.

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. 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.

D. 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.

E. 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.

PART 2 - PRODUCTS

2.1 MATERIALS FOR VARIOUS SERVICES

A. Non-pressure PVC pipe shall contain a minimum of 25 percent recycled content. Steel pipe shall contain a minimum of 25 percent recycled content.

B. Plastic pipe, fittings and solvent cement shall meet NSF 14 and shall bear the NSF seal “NSF-PW”. Polypropylene pipe and fittings shall

comply with NSF 14 and NSF 61. Solder or flux containing lead shall not be used with copper pipe.

C. Material or equipment containing a weighted average of greater than 0.25 percent lead shall not be used in any potable water system intended for human consumption and shall 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 shall 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 shall be maximized to reduce spare part requirements.

B. Manufacturers of equipment assemblies that include components made by others shall 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 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 at no additional cost or time to the Government.

C. Components of equipment shall 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, shall be the same make and model.

2.3 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 system that conforms to contract requirements.

2.4 LIFTING ATTACHMENTS

A. Equipment shall be provided 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.

2.5 EQUIPMENT AND MATERIALS IDENTIFICATION

A. Use symbols, nomenclature and equipment numbers specified, shown in the drawings, or shown in the maintenance manuals. Coordinate equipment and valve identification with local VAMC shops. In addition, provide bar code identification nameplate for all equipment which will allow the equipment identification code to be scanned into the system for maintenance and inventory tracking. Identification for piping is specified in Section 09 91 00, PAINTING.

B. Control Items: All temperature, pressure, and controllers shall be labeled, and the component’s function identified. Identify and label each item as they appear on the control diagrams.

C. Valve Tags and Lists:

1. Plumbing: All valves shall 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 shall 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) shall show valve tag number, valve function and area of control for each service or system. The valve list shall be in a punched 3-ring binder notebook. An additional copy of the valve

list shall be mounted in picture frames for mounting to a wall. COR shall instruct Contractor where frames shall be mounted.

4. A detailed plan for each floor of the building indicating the location and valve number for each valve shall be provided in the 3-ring binder notebook. Each valve location shall be identified with a color-coded sticker or thumb tack in ceiling or access door.

2.6 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.

2.7 GALVANIZED REPAIR COMPOUND

A. Mil. Spec. DOD-P-21035B, paint.

2.8 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. Submittals based on the International Building Code (IBCrequirements, or the following paragraphs of this Section shall 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) shall 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.

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 shall 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 shall 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.

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.

2.9 PIPE PENETRATIONS

A. Pipe penetration sleeves shall be installed for all pipe other than rectangular blocked out floor openings for risers in mechanical bays.
B. Pipe penetration sleeve materials shall 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 shall 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 shall be provided for pipe passing through exterior walls below grade. The space between the sleeve and pipe shall be made watertight with a modular or link rubber seal. The link seal shall be applied at both ends of the sleeve.

G. Galvanized steel or an alternate black iron pipe with asphalt coating sleeves shall be for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. A galvanized steel sleeve shall be provided for pipe passing through floor of mechanical rooms, laundry work rooms, and animal rooms above basement. Except in mechanical rooms, sleeves shall be connected with a floor plate.

H. Brass Pipe Sleeves shall be provided for pipe passing through quarry tile, terrazzo or ceramic tile floors. The sleeve shall be connected with a floor plate.

I. Sleeve clearance through floors, walls, partitions, and beam flanges shall be 25 mm (1 inch) greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to accommodate the insulation plus 25 mm (1 inch) in diameter. Interior openings shall be caulked tight with firestopping material and sealant to prevent the spread of fire, smoke, water and gases.

J. Sealant and Adhesives: Shall be as specified in Section 07 92 00, JOINT SEALANTS. Bio-based materials shall be utilized when possible.

2.10 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 shall be utilized when possible.

2.11 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 shall be used where insulation ends on exposed water supply pipe drop from overhead. A watertight joint shall be provided in spaces where brass or steel pipe sleeves are specified.

2.12 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 shall be coordinated with the work of all trades. Piping, sleeves, inserts, hangers, and equipment shall be located clear of windows, doors, openings, light outlets, and other services and utilities. Equipment layout drawings shall be prepared to coordinate proper location and personnel access of all facilities. The drawings shall be submitted for review.

B. Manufacturer's published recommendations shall be followed for installation methods not otherwise specified.

C. Operating Personnel Access and Observation Provisions: All equipment and systems shall 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 shall 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 shall not be changed nor reduced.

D. Structural systems necessary for pipe and equipment support shall be coordinated to permit proper installation.

E. Location of pipe sleeves, trenches and chases shall be accurately coordinated with equipment and piping locations.

F. Cutting Holes:

1. Holes shall be located to avoid interference with structural members such as beams or grade beams. 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.
2. Waterproof membrane shall not be penetrated. Pipe floor penetration block outs shall be provided outside the extents of the waterproof membrane.
3. Holes through concrete and masonry shall 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 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 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 shall be tightly covered against dirt or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.

I. Gauges, thermometers, valves and other devices shall be installed with due regard for ease in reading or operating and maintaining said devices. Thermometers and gauges shall be located and positioned to be

easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.

J. Interconnection of Controls and Instruments: Electrical interconnection is generally not shown but shall be provided. This includes interconnections of sensors, transmitters, transducers, control devices, control and instrumentation panels, alarms, instruments and computer workstations. Comply with NFPA 70.

K. 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.

L. Work in bathrooms, restrooms, housekeeping closets: All pipe penetrations behind escutcheons shall be sealed with plumbers’ putty.

M. Switchgear Drip Protection: Every effort shall 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 shall be provided in low point of casement pipe.

N. Inaccessible Equipment:

1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall 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 RIGGING

A. Openings in building structures shall 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 shall be closed 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.

E. Contractor shall check all clearances, weight limitations and shall provide 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. Rigging plan and methods shall be referred to COR for evaluation prior to actual work.

3.3 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 shall 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 shall not be permitted. Rusty products shall be replaced.

C. Hanger rods shall 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 shall 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 shall be supported in channel troughs.

3.4 LUBRICATION

A. All equipment and devices requiring lubrication shall be lubricated prior to initial operation. All devices and equipment shall be field checked for proper lubrication.

B. All devices and equipment shall 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 shall be provided. All materials shall be delivered to COR in unopened containers that are properly identified as to application.

C. A separate grease gun with attachments for applicable fittings shall be provided for each type of grease applied.

D. All lubrication points shall be accessible without disassembling equipment, except to remove access plates.

E. All lubrication points shall be extended to one side of the equipment.

3.5 PLUMBING SYSTEMS DEMOLITION

A. Rigging access, other than indicated in the drawings, shall be provided after approval for structural integrity by the COR. Such access shall be provided at no additional cost or time to the Government. Where work is in an operating plant, approved protection from dust and debris shall 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 shall be maintained. The plant shall 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 shall be confined to the immediate area concerned; maintain cleanliness and wet down demolished materials to eliminate dust. Dust and debris shall not be permitted to accumulate in the area to the detriment of plant

operation. All flame cutting shall be performed to maintain the fire safety integrity of this plant. Adequate fire extinguishing facilities shall be available at all times. All work shall be performed in accordance with recognized fire protection standards including NFPA 51B. Inspections will be made by personnel of the VAMC, and the 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 equipment 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 plans and specifications where specifically covered. Structural integrity of the building system shall be maintained. Reference shall 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 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 plans and specifications. Such material shall be removed from Government property expeditiously and shall not be allowed to accumulate. Coordinate with the COR and Infection Control.

3.6 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. Scratches, scuffs, and abrasions shall be repaired 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. Name plates.
3. The final result shall be a smooth, even-colored, even-textured factory finish on all items. The entire piece of equipment shall be repainted, if necessary, to achieve this. Lead based paints shall not be used.

3.7 IDENTIFICATION SIGNS

A. Laminated plastic signs, with engraved lettering not less than 7 mm (3/16 inch) high, shall be provided that designates equipment function, 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, and performance data shall be placed on factory-built equipment.

C. Pipe Identification: Refer to COR

3.8 OPERATING AND PERFORMANCE TESTS

A. Prior to the final inspection, all required tests shall 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 shall be requested in writing to COR for approval.

3.9 OPERATION AND MAINTENANCE MANUALS

A. All new and temporary equipment and all elements of each assembly shall be included.

B. Data sheet on each device listing model, size, capacity, pressure, speed, horsepower, impeller size, and other information shall be included.

C. Manufacturer’s installation, maintenance, repair, and operation instructions for each device shall be included. Assembly drawings and parts lists shall also be included. A summary of operating precautions and reasons for precautions shall be included in the Operations and Maintenance Manual.

D. Lubrication instructions, type and quantity of lubricant shall be included.

E. Emergency procedures for shutdown and startup of equipment and 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 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

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(R2013).....Thermometers, Direct Reading and Remote Reading

C. American Water Works Association (AWWA):

C700-2020.....Cold Water Meters, Displacement Type, Bronze Main Case

C701-2019.....Cold Water Meters-Turbine Type, for Customer Service

C702-2019.....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(2020).....National Electrical Safety Code (NESC)

E. International Code Council (ICC):

IPC-2021.....International Plumbing Code

F. National Fire Protection Association (NFPA):

70-2020(2020e).....National Electrical Code (NEC)

G. NSF International (NSF):

61-2020.....Drinking Water System Components - Health Effects

372-2020.....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. Pressure Gauges.
2. Thermometers.
3. Product certificates for each type of meter and gauge.

D. Complete operating and maintenance manual shall including wiring diagrams, technical data sheets, information for ordering replaceable parts, and troubleshooting guide:

1. Include complete list indicating all components of the system.
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. As-Built Documentation ; Comply with requirements in Paragraph "AS-BUILT DOCUMENTATION" of Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

PART 2 - PRODUCTS

2.1 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.

2.2 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. 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.
F. 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 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.

3.4 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative for 2 hours to instruct each VA personnel responsible in operation and maintenance of the system.

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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 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

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(R2017)...Backwater Valves

C. American Society of Sanitary Engineering (ASSE):
1001-2017.....Performance Requirements for Atmospheric Type Vacuum Breakers
1003-2020.....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

1020-2020.....Performance Requirements for Pressure Vacuum Breaker Assembly

1035-2020.....Performance Requirements for Laboratory Faucet Backflow Preventers

1069-2020.....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-2021.....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(2017e).....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(2010e).....Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

G. National Environmental Balancing Bureau (NEBB):

9th Edition 2019 Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems

H. NSF International (NSF):

61-2020.....Drinking Water System Components – Health Effects

372-2020.....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. Backflow Preventers.

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.

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.

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.

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.

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. Direct acting to maintain return hot water temperature at 45 degrees C (120 degrees F) 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.

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.

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. 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.

F. 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.

G. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no additional cost or time to the Government.

H. 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.

3.6 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative for 2 hours to instruct each VA personnel responsible in operation and maintenance of the system.

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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, 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, 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.
D. Section 07 84 00, FIRESTOPPING: Mineral fiber and bond breaker behind sealant.
E. 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.
F. Section 22 05 19, METERS AND GAGES FOR PLUMBING PIPING: Hot and cold water piping.
G. Section 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING: Hot and cold water 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 basic designation only.
B. ASTM International:

B209-2014..... Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

C411-2019 Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation

C449-2007 (R2019).....Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement

C450-2018.....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.

C533-2017..... Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation

C534/C534M-2020a..... Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form

C547-2019..... Standard Specification for Mineral Fiber Pipe Insulation

C552-2021..... Standard Specification for Cellular Glass Thermal Insulation

C553-2013(R2019)..... Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications

C591-2021..... Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation

C680-2019..... 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(R2019)..... Standard Specification for Mineral Fiber Block and Board Thermal Insulation

C1126-2019.....Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation

C1136-2021..... Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation

C1710-2021..... 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

E84-2021..... Standard Test Method for Surface Burning Characteristics of Building Materials

E2231-2019..... 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(2012)..... Plastic Sheet (Sheeting): Plastic Strip; Poly (Vinyl Chloride) and Poly (Vinyl Chloride - Vinyl Acetate), Rigid.

D. International Code Council, (ICC):

IMC-2021..... International Mechanical Code

E. Military Specifications (Mil. Spec.):

MIL-DTL-3316D2020..... Adhesives, Fire-Resistant, Thermal Insulation

MIL-A-24179A (2)-2020... Adhesive, Flexible Unicellular-Plastic Thermal Insulation

MIL-PRF-19565D (1)-2021.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-2021..... Standard for the Installation of Air-Conditioning and Ventilating Systems

G. Underwriters Laboratories, Inc (UL):

723-2018..... Standard for Test for Surface Burning Characteristics of Building Materials

1887-2017.....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; http://www.pipeinsulation.org

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.

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 with a copy 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 2020 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 C547 (Pipe Fitting Insulation and Preformed Pipe Insulation), Class 1, 0.23 at 75 degrees F, for use at temperatures up to 450 degrees F with an all service vapor retarder jacket with polyvinyl

chloride premolded fitting covering with mineral fiber insulation inserts.

2.2 FLEXIBLE ELASTOMERIC CELLULAR THERMAL

A. ASTM C534/C534M, k = 0.245 at 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.

2.3 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 conveying fluids below ambient temperature or exposed to outdoor air (i.e.; in ventilated attics, piping in ventilated (not air conditioned) spaces, etc.)in high humidity locations . 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 conveying fluids below ambient temperature or exposed to outdoor air (i.e.; in ventilated attics, piping in ventilated (not air conditioned) spaces, etc.) in high humidity locations . 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.

2.4 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

Nominal Pipe Size and Accessories Material (Insert Blocks)	
Nominal Pipe Size mm (inches)	**Insert Blocks mm (inches)**
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).

2.5 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.

2.6 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.

2.7 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.

2.8 FIRESTOPPING MATERIAL

A. Other than pipe insulation, refer to Section 07 84 00, FIRESTOPPING.

2.9 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 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 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. 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.

H. 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.

I. 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.

J. 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.

K. 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

L. Provide vapor barrier systems as follows:

1. All piping exposed to outdoor weather.
2. All interior piping conveying fluids below ambient air temperature that are exposed to outdoor air (i.e. in attics, ventilated (not air conditioned) spaces, etc.

3.2 INSULATION INSTALLATION

A. 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.

B. 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.

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) (Domestic Cold Water Supply and Return)	Flexible Elastomeric Cellular Thermal (Above ground piping only)	25 (1.0)	25 (1.0)	25 (1.0)	25 (1.0)

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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 A&E 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.

1.3SUMMARY

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

3.1CONSTRUCTION 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 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 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.

D. Section 07 84 00, FIRESTOPPING.

E. Section 07 92 00, JOINT SEALANTS.

F. Section 09 91 00, PAINTING.

G. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

H. Section 22 07 11, PLUMBING INSULATION.

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):

A13.1-2020.....Scheme for Identification of Piping Systems

B16.3-2016.....Malleable Iron Threaded Fittings: Classes 150 and 300

B16.9-2018.....Factory-Made Wrought Buttwelding Fittings

B16.11-2016(2017e).....Forged Fittings, Socket-Welding and Threaded

B16.12-2019.....Cast Iron Threaded Drainage Fittings

B16.15-2018 .....Cast Copper Alloy Threaded Fittings: Classes 125 and 250

B16.18-2018.....Cast Copper Alloy Solder Joint Pressure Fittings

B16.22-2018.....Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings

B16.24-2016.....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-2021....Welding, Brazing, and Fusing Qualifications

C. American Society of Sanitary Engineers (ASSE):

1010-2004.....Performance Requirements for Water Hammer Arresters

D. American Society for Testing and Materials (ASTM):

A47/A47M-1999 (R2018)e1.Standard Specification for Ferritic Malleable Iron Castings

A53/A53M-2020.....Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

A183-2014(R2020).....Standard Specification for Carbon Steel Track Bolts and Nuts

A269/A269M-2015A(R2019).Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service

A312/A312M-2019.....Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes

A403/A403M-2020.....Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings

A536-1984 (R2019)e1.....Standard Specification for Ductile Iron Castings

A733-2016.....Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples

B32-2020.....Standard Specification for Solder Metal

B43-2020.....Standard Specification for Seamless Red Brass Pipe, Standard Sizes

B61-2015.....Standard Specification for Steam or Valve Bronze Castings

B62-2017.....Standard Specification for Composition Bronze or Ounce Metal Castings

B75/B75M-2020.....Standard Specification for Seamless Copper Tube

B88-2020.....Standard Specification for Seamless Copper Water Tube

B584-2014.....Standard Specification for Copper Alloy Sand Castings for General Applications

B687-1999 (R2016).....Standard Specification for Brass, Copper, and Chromium-Plated Pipe Nipples

C919-2019.....Standard Practice for Use of Sealants in Acoustical Applications

D1785-2015e1.....Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120

D2000-2018.....Standard Classification System for Rubber Products in Automotive Applications

D2564-2020.....Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems

D2657-2007(R2015).....Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings

D2855-2020.....Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings

D4101-2017e1.....Standard Specification and Basis for Specification for Polypropylene Injection and Extrusion Materials

E1120-2016.....Standard Specification for Liquid Chlorine

E1229-2016.....Standard Specification for Calcium Hypochlorite

F2389-2019.....Standard Specification for Pressure-rated Polypropylene (PP) Piping Systems

F2620-2020.....Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings

F2769-2018.....Standard Specification for Polyethylene of Raised Temperature (PE-RT) Plastic Hot and Cold-Water Tubing and Distribution Systems

E. American Water Works Association (AWWA):

C110-2012.....Ductile-Iron and Gray-Iron Fittings

C151-2017(2018e).....Ductile Iron Pipe, Centrifugally Cast

C153-2019.....Ductile-Iron Compact Fittings

C203-2020.....Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied

C213-2015.....Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines

C651-2014(2020).....Disinfecting Water Mains

F. American Welding Society (AWS):

A5.8M/A5.8-2019.....Specification for Filler Metals for Brazing and Braze Welding

G. International Code Council (ICC):

IPC-2021.....International Plumbing Code

H. Manufacturers Specification Society (MSS):

SP-58-2018-AMD1.....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(ETRA 2010)..Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

I. NSF International (NSF):

14-2020.....Plastics Piping System Components and Related Materials

61-2020.....Drinking Water System Components – Health Effects

372-2020.....Drinking Water System Components – Lead Content

J. Plumbing and Drainage Institute (PDI):

PDI-WH 201-2010.....Water Hammer Arrestors

K. Department of Veterans Affairs:

H-18-8-2019(R2020).....Seismic Design Handbook

H-18-10-2021.....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.

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 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 with a copy 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 2019 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 ABOVE GROUND (INTERIOR) WATER PIPING

A. Pipe: Copper tube, ASTM B88, Type K or L, drawn.

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. Flanged fittings, bronze, class 150, solder-joint ends conforming to ASME B16.24.

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.

2.3 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.

2.4 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.

2.5 DIELECTRIC FITTINGS

A. Provide dielectric couplings or unions between pipe of dissimilar metals.

2.6 STERILIZATION CHEMICALS

A. Hypochlorite: ASTM E1229.

B. Liquid Chlorine: ASTM E1120.

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.

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. 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.

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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 07 84 00, FIRESTOPPING: Penetrations in rated enclosures.

D. Section 07 92 00, JOINT SEALANTS: Sealant products.

E. Section 09 91 00, PAINTING: Preparation and finish painting and identification of piping systems.

F. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING: Pipe Hangers and Supports, Materials Identification.

G. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

H. 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):

A13.1-2020.....Identification of Piping Systems

A112.36.2M-1991(R2017)..Cleanouts

A112.6.3-2019.....Floor and Trench Drains

B1.20.1-2013(R2018).....Pipe Threads, General Purpose (Inch)

B16.1-2020.....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

B16.39-2019.....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(R2021).....Performance Requirements for Trap Seal Primer Valves - Potable Water Supplied

1044-2015(R2020).....Performance Requirements for Trap Seal Primer Devices - Drainage Types and Electronic Design Types

1079-2012(R2021).....Performance Requirements for Dielectric Pipe Unions

D. American Society for Testing and Materials (ASTM):

A53/A53M-2020.....Standard Specification for Pipe, Steel, Black And Hot-Dipped, Zinc-coated, Welded and Seamless

A74-2021.....Standard Specification for Cast Iron Soil Pipe and Fittings

A888-2021.....Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

B32-2020.....Standard Specification for Solder Metal

B43-2020.....Standard Specification for Seamless Red Brass Pipe, Standard Sizes

B88-2020.....Standard Specification for Seamless Copper Water Tube

B306-2020.....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

C564-2020a.....Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings

D2321-2020.....Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

D2564-2020.....Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems

D2665-2020.....Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings

D2855-2020.....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(R2020).....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

F1545-2015a.....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

301-2018.....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):

A4015-14/20.....Copper Tube Handbook

G. International Code Council (ICC):

IPC-2021.....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):

508-2018.....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. Cleanouts.
3. Trap Seal Protection.
4. Penetration Sleeves.

5. Pipe Fittings.
6. Traps.
7. 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.

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.

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.

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 .
   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 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.

2.6 PRIMER VALVES AND TRAP SEAL PRIMER SYSTEMS

A. The trap seal primer valve shall be hydraulic, supply type with a pressure rating of 861 kPa (125 psig) and conforming to standard ASSE 1018.

1. The inlet and outlet connections shall be 15 mm or DN15 (NPS 1/2 inch)
2. The trap seal primer valve shall be fully automatic with an all brass or bronze body.
3. The trap seal primer valve shall be activated by a drop in building water pressure, no adjustment required.

4. The trap seal primer valve shall include a manifold when serving two, three, or four traps.
5. The manifold shall be omitted when serving only one trap.

2.7 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. 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.

I. 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"

J. 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. Plumbing vents shall be extended separately through roof. Sanitary vents shall not connect to plumbing vents.

3.5 TESTS

A. Sanitary waste and drain systems shall be tested either in its entirety or in sections.

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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.

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 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC and STEAM GENERATION

M. Section 23 05 41, NOISE AND VIBRATION CONTROL FOR HVAC PIPING and EQUIPMENT.

N. Section 23 05 93, TESTING, ADJUSTING, AND BALANCING FOR HVAC.

O. Section 23 07 11, HVAC AND BOILER PLANT INSULATION.

P. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

Q. Section 23 36 00, AIR TERMINAL UNITS.

R. Section 23 82 00, CONVECTION HEATING AND COOLING UNITS.

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 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. Air Movement and Control Association (AMCA):

410-1996.....Recommended Safety Practices for Users and Installers of Industrial and Commercial Fans

C. American Society of Mechanical Engineers (ASME):

B31.1-2020.....Power Piping

B31.9-2020.....Building Services Piping

ASME Boiler and Pressure Vessel Code:

BPVC Section IX-2019Welding, Brazing, and Fusing Qualifications

D. American Society for Testing and Materials (ASTM):

A36/A36M-2019.....Standard Specification for Carbon Structural Steel

A575-2020.....Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades

E. Association for Rubber Products Manufacturers (ARPM):

IP-20-2015.....Specifications for Drives Using Classical V-Belts and Sheaves

IP-21-2016.....Specifications for Drives Using Double-V (Hexagonal) Belts

IP-24-2016.....Specifications for Drives Using Synchronous Belts

IP-27-2015.....Specifications for Drives Using Curvilinear Toothed Synchronous Belts

F. Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry, Inc.:

SP-58-2018(AMD 2019)....Pipe Hangers and Supports-Materials, Design, Manufacture, Selection, Application, and Installation

SP-127-2014a.....Bracing for Piping Systems: Seismic-Wind-Dynamic Design, Selection, and Application

G. Military Specifications (MIL):

MIL-P-21035B-2021.....Paint High Zinc Dust Content, Galvanizing Repair (Metric)

H. National Fire Protection Association (NFPA):

70-2020(2020e).....National Electrical Code (NEC)

101-2021.....Life Safety Code

I. Department of Veterans Affairs (VA):

PG-18-10-2020(R2021)....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. 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: Include 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, 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 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 belts for equipment: 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 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.

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 on site, 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 33 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. Qualify welding processes and operators for piping according to 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 Article, 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.

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. Boilers shall be left clean following final internal inspection by Government insurance representative or inspector.
5. 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 a copy 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. As-built drawings are to be provided, with a copy of them on AutoCAD version 2019 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 must 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 Article, 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, must 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 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. Materials: Sheet steel, expanded metal or wire mesh rigidly secured so as to be removable without disassembling pipe, duct, or electrical connections to equipment.

C. Access for Speed Measurement: 25 mm (1 inch) diameter hole at each shaft center.

2.4 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.

2.5 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.

2.6 EQUIPMENT AND MATERIALS IDENTIFICATION

A. Use symbols, nomenclature and equipment numbers specified, shown on 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 15 mm (1/2 inch) high for number designation, and not less than 6 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: Typed or printed plastic coated card(s), sized 215 mm (8-1/2 inches) by 275 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 15 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.

2.7 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.

2.8 GALVANIZED REPAIR COMPOUND

A. Mil-P-21035B, paint form.

2.9 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 275 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 may be used for individual copper tubing up to 23 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 40 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 mm by 41 mm (1-5/8 inches 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 15 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.

2.10 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 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.

C. Penetrations through beams or ribs are prohibited, but may be installed in concrete beam flanges. Any deviation from these requirements must 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.

2.11 DUCT PENETRATIONS

A. Provide curbs for roof mounted piping, ductwork and equipment. Curbs shall be 450 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.

2.12 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.

2.13 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 80 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.

2.14 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 on 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 must be provided.

G. Electrical Interconnection of Instrumentation or Controls: This generally not shown but must 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 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 least interfere with normal operation of the facility.

M. Work in Animal Research Areas: Seal all pipe and duct penetrations with silicone sealant to prevent entrance of insects.

N. 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).

O. 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 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 Article, 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 15 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, in-line pumps and other heavy components. Provide a support within one foot of each elbow.

E. HVAC Vertical Pipe Supports:

1. Up to 150 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 150 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.

3.6 MECHANICAL DEMOLITION

A. Rigging access, other than indicated on 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. Where work is in an operating plant, provide approved protection from dust and debris at all times for the safety of plant personnel and maintenance of plant operation and environment of the plant.

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, 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 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 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. 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, Article, 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 Article, TESTS, and in

individual Division 23 specification 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 may 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 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 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 standard will govern.

B. American Bearing Manufacturers Association (ABMA):

9-2015.....Load Ratings and Fatigue Life for Ball Bearings

11-2014.....Load Ratings and Fatigue Life for Roller Bearings

C. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):

90.1-2019(2021e).....Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings

D. Institute of Electrical and Electronics Engineers (IEEE):

112-2017.....Standard Test Procedure for Polyphase Induction Motors and Generators

841-2009.....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 1-2016(R2018).....Motors and Generators
MG 2-2014.....Safety Standard for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators
250-2020.....Enclosures for Electrical Equipment (1000 Volts Maximum)

F. National Fire Protection Association (NFPA):
70-2020(2020e).....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 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.

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. 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 with a copy 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. As-built drawings are to be provided, with a copy of them on AutoCAD version 2019 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 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: 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: 208-230/460 volts, dual connection s.
      b. Motors, less than 74.6 kW (100 hp), connected to 240-volt or 480-volt systems: 208-230/460 volts, dual connection.

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 larger: 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 on 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 (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.

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 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.

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%

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 on 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 Commissioning Agent 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 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.

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 one hour 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 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION

A. 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.

B. Definitions:

1. Basic TAB used in this Section: Chapter 39, "Testing, Adjusting and Balancing" of 2019 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 Contractors National Association
7. Hydronic Systems: Includes chilled 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 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

C. Section 23 07 11, HVAC, AND BOILER PLANT INSULATION.

F. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

G. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

H. Section 23 31 00, HVAC DUCTS AND CASINGS.

1.3 QUALITY ASSURANCE

A. Refer to Articles, Quality Assurance and Submittals, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC, Section 23 05 10, COMMON WORK RESULTS FOR BOILER PLANTS and STEAM GENERATION, 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, NEEB, TABB or NEBB 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 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 Resident Engineer 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 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 must be performed by an approved successor.

4. TAB Specialist shall be identified by the General Contractor within 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 would specifically include:
   a. Shall directly supervise all TAB work.
   b. Shall 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. Would follow all TAB work through its satisfactory completion.
   d. Shall provide final markings of settings of all HVAC adjustment devices.
   e. Permanently mark location of duct test ports.
   f. Shall document critical paths from the fan or pump. These critical paths are ones in which are 100% 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 must have done satisfactory work on a minimum of 3 projects comparable in size and complexity to this project. Qualifications must 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 Standards 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.

D. TAB Criteria:
   1. One or more of the applicable AABC, NEBB,TABB or SMACNA publications, supplemented by ASHRAE Handbook "2019 HVAC

Applications" Chapter 39, 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 2011 ASHRAE Handbook "2019 HVAC Applications", Chapter 39, 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 0 percent to plus 10 percent.
   b. Air terminal units (maximum values): Minus 2 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 10 percent except if the air to a space is 100 CFM or less the tolerance would 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 pumps: Minus 0 percent to plus 5 percent.
   h. Chilled water coils: Minus 0 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 Resident Engineer for one air distribution system (including all fans, three terminal units, three rooms randomly selected by the COR one of which shall be a critical path) and one hydronic system (pumps and three 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.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. 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.

C. For use by the Resident Engineer staff, submit one complete set of applicable AABC,NEBB or TABB publications that will be the basis of TAB work.

D. Submit Following for Review and Approval:

1. Design Review Report within 90 days 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% open.

E. Prior to request for Final or Partial Final inspection, submit completed Test and Balance report for the area with noted critical paths.

1.5 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. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE):

Handbook 2019.....HVAC Applications ASHRAE Handbook, Chapter 39, Testing, Adjusting, and Balancing and Chapter 49, Sound and Vibration Control

C. Associated Air Balance Council (AABC):

7th Edition 2016 .....AABC National Standards for Total System Balance

D. National Environmental Balancing Bureau (NEBB):

9th Edition 2019 .....Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems

3rd Edition 2015(2018e) Procedural Standards for the Measurement of Sound and Vibration

2nd Edition 2019 ... Whole Building Technical Commissioning of New Construction

E. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):

3rd Edition 2002 .....HVAC SYSTEMS Testing, Adjusting and Balancing

1st Edition 2003- TAB Procedural Guide

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 Article, 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 Plans and specifications and advise the Resident Engineer 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 is to be done after air distribution equipment is on site and duct 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 check list 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 on drawings. Submit report of findings to resident engineer.

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 Commissioning Agent.

C. Verify that all items such as ductwork piping, dampers, valves, ports, terminals, connectors, etc., that is required for TAB are installed. Provide a report to the COR.

3.6 TAB REPORTS

A. Submit an intermediate report for 25 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 Resident Engineer.

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 one trunk damper shall be 100% open.
   2. At least one branch damper shall be 100%open per trunk.
   3. At least one terminal device duct be 100% open per branch.

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 . Return existing areas outside the work area to pre constructed conditions.

D. Allow 10 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, AND computer room AC units.
   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.
   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 al operating conditions).

c. Adjust operating pressure control setpoint to maintain the design flow to each space with the lowest setpoint.

5. Record final measurements for air handling equipment performance data sheets.

3.8 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 Resident Engineer.

3.9 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.

3.10 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.

3.11 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.

3.12 CRITICAL FLOW PATH

A. Provide a documented critical path for all fluid flows. There shall be at least one terminal device that can be traced back to the fan or pump where there is no damper or valves that are less than 100% open.

- - 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.

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, interstitial space, 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 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. CHR: 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 07 84 00, FIRESTOPPING.

C. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

D. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

E. Section 23 21 13, HYDRONIC PIPING.

F. Section 23 22 13, STEAM and CONDENSATE HEATING PIPING

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:

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*.

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.)*

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.

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

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.

4.3.3.3.1 In no case shall the test temperature be below 121°C (250°F).

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.

4.3.3.5* Air duct linings shall be interrupted at fire dampers to prevent interference with the operation of devices.

4.3.3.6 Air duct coverings shall not be installed to conceal or prevent the use of any service opening.

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.

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.

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.

4.3.10.2.6.6 Supplementary materials for air distribution systems shall be permitted when complying with the provisions of 4.3.3.

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. Refer to applicable specification paragraph numbers for coordination.

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.

B. Federal Specifications (Fed. Spec.):

L-P-535E-1979 (Notice4 2012) Plastic Sheet (Sheeting): Plastic Strip; Poly (Vinyl Chloride) and Poly (Vinyl Chloride - Vinyl Acetate), Rigid

C. Military Specifications (Mil. Spec.):

MIL-A-3316D-2020 Adhesives, Fire-Resistant, Thermal Insulation

MIL-A-24179A-1969(R2020) Adhesive, Flexible Unicellular-Plastic Thermal Insulation

MIL-C-19565C-1980(AMD1 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

D. American Society for Testing and Materials (ASTM):

B209-2014.....Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

C411-2019.....Standard test method for Hot-Surface Performance of High-Temperature Thermal Insulation

C449-2007(R2019).....Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement

C533-2017.....Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation

C534/C534M-2020a.....Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form

C547-2019.....Standard Specification for Mineral Fiber pipe Insulation

C552-2021.....Standard Specification for Cellular Glass Thermal Insulation

C553-2013(R2019).....Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications

C585-2010(R2016).....Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing

C612-2014(R2019).....Standard Specification for Mineral Fiber Block and Board Thermal Insulation

C1126- 2019.....Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation

C1136-2021.....Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation

D1668/D1668M-97a(2014e1) Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing

E84-2021a.....Standard Test Method for Surface Burning Characteristics of Building Materials

E119-2020.....Standard Test Method for Fire Tests of Building Construction and Materials

E136-2019a.....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-2021.....Standard for the Installation of Air Conditioning and Ventilating Systems

96-2021.....Standard~~s~~ for Ventilation Control and Fire Protection of Commercial Cooking Operations

101-2021.....Life Safety Code

F. Underwriters Laboratories, Inc (UL):

723-2018.....UL Standard for Safety Test for Surface Burning Characteristics of Building Materials, 11th Edition

G. Manufacturer’s Standardization Society of the Valve and Fitting Industry (MSS):

SP58-2018(AMD1 2019)....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 = 0.23 at 75 degrees F, external insulation for temperatures up to 204 degrees 400 degrees F with all service jacket (ASJ) facing.

B. ASTM C553 (Blanket, Flexible) Type I, Class B-3, Density 1 pcf, k = 0.27 at 75 degrees F, for use at temperatures up to 400 degrees F with foil scrim (FSK) facing.

C. ASTM C547 (Pipe Fitting Insulation and Preformed Pipe Insulation), Class 1, 0.23 at 75 degrees F, for use at temperatures up to 450 degrees F with an all service vapor retarder jacket with polyvinyl chloride premolded fitting covering with mineral fiber insulation inserts.

2.2 FLEXIBLE ELASTOMERIC CELLULAR THERMAL

ASTM C177, C518, k = 0.245 at 75 degrees F, flame spread not over 25, smoke developed not over 50, for temperatures from 25 degrees F to 200 degrees F. No jacket required.

2.3 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 ductwork exposed to outdoor air temperatures(i.e.; in ventilated attics, piping in ventilated (not air conditioned) spaces, etc.)in high humidity areas 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 if 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.

2.4 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

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).

2.5 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.

2.6 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 monel or 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.

2.7 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.

2.8 FIRESTOPPING MATERIAL

A. Other than pipe and duct insulation, refer to Section 07 84 00 FIRESTOPPING.

2.9 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 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, 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. 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).

D. Install vapor stops at all insulation terminations on either side of valves, pumps and equipment and particularly in straight lengths of pipe insulation.

E. 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.

F. Protect all insulation 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.

G. HVAC work not to be insulated:
   1. Internally insulated ductwork and air handling units.
   2. Double walled ducts.
   3. Relief air ducts (Economizer cycle exhaust air).
   4. Exhaust air ducts and plenums, and ventilation exhaust air shafts.
   4. Equipment: Expansion tanks, flash tanks, hot water pumps,
   5. 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.

H. Ductwork exposed in finished areas shall be double walled insulated duct. See Section 23 31 00, HVAC Ducts and Casings for double walled duct.

I. Apply insulation materials subject to the manufacturer's recommended temperature limits. Apply adhesives, mastic and coatings at the manufacturer's recommended minimum coverage.

J. 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.

K. 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

L. 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 in high humidity areasor exposed to outdoor air temperatures (i.e. in attics, ventilated (not air conditioned) spaces, etc.) .

M. 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,. Provide PVC or Aluminum jackets. 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.

3. Exposed, unlined ductwork and equipment in unfinished areas, mechanical and electrical equipment rooms and attics, and duct work exposed to outdoor weather:

a. Supply air duct, unlined air handling units and after filter housing: 50 mm (2 inch) thick insulation faced with ASJ (white all service jacket):

b. Return air duct, mixed air plenums and prefilter housing: 40 mm (1-1/2 inch) thick insulation faced with ASJ:.

c. Outside air intake ducts: no insulation required 50 mm (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: 25 mm (one inch) thick insulation faced with ASJ.

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.Exposed Supply air duct:

   a. Provide double walled duct in accordance with Section 23 31 00 , HVAC Ducts and Casings.

5. Concealed return air duct:
   a. In attics (where not subject to damage) and where exposed to outdoor weather: 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.
6. Concealed outside air duct: 40 mm (1-1/2 inch) thick insulation faced with FSK.
7. 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. Minimum thickness in millimeters (inches) specified in the schedule at the end of this section.
8. 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.

9. 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. 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 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.

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.
2. Pipe and tubing insulation:
   a. Use proper size material. Do not stretch or strain insulation.
   b. 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.
   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. Make changes from mineral fiber insulation in a straight run of pipe, not at a fitting. Seal joint with tape.
   d. Provide UV rated PVC jacket on duct or piping with flexible elastomeric insulation exposed to outdoors and weather.

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. 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.
6. 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.

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

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)
100-121 degrees C (212-250 degrees F) (HPR, MPR, LPS, vent piping from PRV Safety Valves,	Mineral Fiber (Above ground piping only)	62 (2.5)	62 (2.5)	75 (3.0)	75 (3.0)

Condensate receivers and flash tanks)					
38-94 degrees C (100-200 degrees F) (LPR, PC, HWH, HWHR, GH and GHR)	Mineral Fiber (Above ground piping only)	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 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, CHR, GC, GCR and RS 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 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

PART 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 A&E 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. 23 23 00 Refrigerant Piping

E. 23 81 00 Decentralized Unitary Equipment

SECTION 23 05 11 COMMON 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 it 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 2007.....Mission Critical Facilities - DRAFT

PG 18-10 2007.....Life-Safety Protected Facilities - DRAFT

C. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE):

HANDBOOK 2019.....HVAC Applications ASHRAE Handbook, Chapter 39, Testing, Adjusting, and Balancing, Chapter 44, HVAC Commissioning and Chapter 49, Sound and Vibration Control

HANDBOOK 2021.....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

F. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):

006 2006.....HVAC Duct Construction Standard - Metal and Flexible Duct

3rd Edition 2005 ... HVAC Systems Testing, Adjusting and Balancing

PART 2 - PRODUCTS (NOT USED)

PART 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 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.

----- END -----

SECTION 23 09 23
DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide a workstation for the IT department to access the TR rooms on the BAS. The TR rooms shall be connected to a dedicated Controller in each building such that the IT department can access the TR rooms to monitor the cooling unit operation, room temperature , room humidity, water detection alarms and change room temperature setpoints. BAS access shall be password protected to limit the IT department access to only the TR room points listed above.

B. Provide (a) 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, controls and installation materials, installation labor, commissioning and start-up, training, final project documentation and warranty.

1. The direct-digital control system(s) shall consist of high-speed, peer-to-peer network of DDC controllers, a control system server, and an Engineering Control Center. Provide a remote user using a standard web browser to access the control system graphics and change adjustable setpoints with the proper password.
2. The direct-digital control system(s) shall be native BACnet. All new workstations, controllers, devices and components shall be listed by BACnet Testing Laboratories. All new workstations, controller, devices and components shall be accessible using a Web browser interface and shall communicate exclusively using the ASHRAE Standard 135 BACnet communications protocol without the use of gateways, unless otherwise allowed by this Section of the technical specifications, specifically shown on the design drawings and specifically requested otherwise by the VA.
   a. If used, gateways shall support the ASHRAE Standard 135 BACnet communications protocol.
   b. If used, gateways shall provide all object properties and read/write services shown on VA-approved interoperability schedules.

3. 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 items required for complete and fully functional Controls Systems.
4. The control systems shall be designed such that each mechanical system shall operate under stand-alone mode. 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.
5. The control system shall accommodate 2 Engineering Control Center(s) and the control system shall accommodate 5 web-based Users simultaneously, and the access to the system should be limited only by operator password.

C. 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 contractor’s formal acknowledgements in writing prior to submission the installation of the products. These products include the following:
   1. Control valves.
   2. Flow switches.
   3. Flow meters.
   4. Sensor wells and sockets in piping.
   5. Terminal unit controllers.

D. 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 contractor's formal acknowledgements in writing prior to submission the procurement of the products. These products include the following:

1. Factory-furnished accessory thermostats and sensors furnished with unitary equipment.

E. 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. The contractor administered by this Section of the technical specifications shall formally coordinate in writing and receive from other contractor's formal acknowledgements in writing prior to submission the particulars of the products. These products include 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. Unitary HVAC equipment. These include:
   a. Discharge temperature control.
   b. Flowrate control.
   c. Setpoint reset.
   d. Status alarm.

F. 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

Work/Item/System	**Furnish**	**Install**	**Low Voltage Wiring**	**Line Power**
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
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
Computer Room A/C Unit field-mounted controls	23	23	16	26
Control system interface with CRU A/C controls	23 09 23	23 09 23	23 09 23	26
CRU A/C unit controls interface with control system	23	23 09 23	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
Starters, HOA switches	23	23	N/A	26

G. This facility’s existing direct-digital control system is manufactured by Siemens, and its ECC is located at the main Alexandria VAMC campus. The existing system’s top-end communications is via Ethernet. 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. Leave the existing direct digital control system intact and in place. Connect controls for new equipment into the existing system for full communication and control.
   a. The 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.

H. This campus has standardized on an existing standard ASHRAE Standard 135, BACnet/IP Control System supported by a preselected controls service company. This entity is referred to as the "Control System Integrator" in this Section of the technical specifications. The Control system integrator is responsible for ECC system graphics and expansion. It also prescribes control system-specific commissioning/ verification procedures to the contractor administered by this Section of the technical specification. It lastly provides limited assistance to the contractor administered by this Section of the technical specification in its commissioning/verification work.

1. The General Contractor of this project shall directly hire the Control System Integrator in a contract separate from the contract procuring the controls contractor administered by this Section of the technical specifications.
2. The contractor administered by this Section of the technical specifications shall coordinate all work with the Control System Integrator. The contractor administered by this Section of the technical specifications shall integrate the ASHRAE Standard 135, BACnet/IP control network(s) with the Control System Integrator's area control through an Ethernet connection provided by the Control System Integrator.
3. The contractor administered by this Section of the technical specifications shall provide a peer-to-peer networked, stand-alone, distributed control system. This direct digital control (DDC) system shall include one portable operator terminal - laptop, one digital display unit, microprocessor-based controllers,

instrumentation, end control devices, wiring, piping, software, and related systems. This contractor is responsible for all device mounting and wiring.

4. Responsibility Table:

Item/Task	**Section 23 09 23 contactor**	**Control system integrator**	**VA**
ECC expansion		X	
ECC programming		X	
Devices, controllers, control panels and equipment	X		
Point addressing: all hardware and software points including setpoint, calculated point, data point(analog/ binary), and reset schedule point	X		
Point mapping		X	
Network Programming	X		
ECC Graphics		X	
Controller programming and sequences	X		
Integrity of LAN communications	X		
Electrical wiring	X		
Operator system training		X	
LAN connections to devices	X		
LAN connections to ECC		X	
IP addresses			X
Overall system verification		X	
Controller and LAN system verification	X		

I. 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 by the VA.

1.2 RELATED WORK

A. Section 21 13 13, Wet-Pipe Sprinkler Systems.

B. Section 23 21 13, Hydronic Piping.

C. Section 23 31 00, HVAC Ducts and Casings.

D. Section 23 81 00, Decentralized Unitary HVAC Equipment.

E. Section 26 05 11, Requirements for Electrical Installations.

F. Section 26 05 19, Low-Voltage Electrical Power Conductors and Cables (600 Volts and Below).

G. Section 26 05 26, Grounding and Bonding for Electrical Systems.

H. Section 26 05 33, Raceway and Boxes for Electrical Systems.

I. Section 26 27 26, Wiring Devices.

J. Section 27 15 00, Communications Structured Cabling

K. Section 28 31 00, Fire Detection and Alarm.

1.2 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. ARCNET: ANSI/ATA 878.1 - Attached Resource Computer Network. ARCNET is a deterministic LAN technology; meaning it's possible to determine the maximum delay before a device is able to transmit a message.

C. Analog: A continuously varying signal value (e.g., temperature, current, velocity etc.

D. BACnet: A Data Communication Protocol for Building Automation and Control Networks , ANSI/ASHRAE Standard 135. This communications protocol allows diverse building automation devices to communicate data over and services over a network.

E. 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.

F. BACnet Internetwork: Two or more BACnet networks connected with routers. The two networks may sue different LAN technologies.

G. 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.

H. BACnet Segment: One or more physical segments of BACnet devices on a BACnet network, connected at the physical layer by repeaters.

I. 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.

J. 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.

K. BACnet Testing Laboratories (BTL). The organization responsible for testing products for compliance with the BACnet standard, operated under the direction of BACnet International.

L. 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).

M. 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.

N. 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.

O. Bus Topology: A network topology that physically interconnects workstations and network devices in parallel on a network segment.

P. 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

Q. 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).

R. Device: a control system component that contains a BACnet Device Object and uses BACnet to communicate with other devices.

S. 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.

T. Device Profile: A specific group of services describing BACnet capabilities of a device, as defined in ASHRAE Standard 135-2008, 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.

U. 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.

V. 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.

W. 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.

X. 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.

Y. DXF: An AutoCAD 2-D graphics file format. Many CAD systems import and export the DXF format for graphics interchange.

Z. 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.

AA. 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.

BB. 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.

CC. Ethernet: A trademark for a system for exchanging messages between computers on a local area network using coaxial, fiber optic, or twisted-pair cables.

DD. Firmware: Firmware is software programmed into read only memory (ROM) chips. Software may not be changed without physically altering the chip.

EE. 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.

FF. GIF: Abbreviation of Graphic interchange format.

GG. 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.

HH. Graphic Sequence of Operation: It is a graphical representation of the sequence of operation, showing all inputs and output logical blocks.

II. 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.

JJ. 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.

KK. JPEG: A standardized image compression mechanism stands for Joint Photographic Experts Group, the original name of the committee that wrote the standard.

LL. Local Area Network (LAN): A communication bus that interconnects operator workstation and digital controllers for peer-to-peer communications, sharing resources and exchanging information.

MM. Network Repeater: A device that receives data packet from one network and rebroadcasts to another network. No routing information is added to the protocol.

NN. MS/TP: Master-slave/token-passing (ISO/IEC 8802, Part 3). It is not an acceptable LAN option for VA health-care facilities. It uses

twisted-pair wiring for relatively low speed and low cost communication.

OO. 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.

PP. 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.

QQ. Object: The concept of organizing BACnet information into standard components with various associated properties. Examples include analog input objects and binary output objects.

RR. Object Identifier: An object property used to identify the object, including object type and instance. Object Identifiers must be unique within a device.

SS. 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.

TT. Operating system (OS): Software, which controls the execution of computer application programs.

UU. 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.

VV. Peripheral: Different components that make the control system function as one unit. Peripherals include monitor, printer, and I/O unit.

WW. 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.

XX. PICS: Protocol Implementation Conformance Statement, describing the BACnet capabilities of a device. All BACnet devices have published PICS.

YY. PID: Proportional, integral, and derivative control, used to control modulating equipment to maintain a setpoint.

ZZ. Repeater: A network component that connects two or more physical segments at the physical layer.

AAA. 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.

BBB. Sensors: devices measuring state points or flows, which are then transmitted back to the DDC system.

CCC. 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: The Contractor shall obtain hardware and software supplied under this Section and delegate the responsibility to a single source controls installation subcontractor. The controls subcontractor shall be responsible for the complete design, installation, 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 would observe the control systems in full operation.
4. The controls subcontractor shall have 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’ 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°C (±1°F)
Ducted air temperature	±0.5°C [±1°F]
Outdoor air temperature	±1.0°C [±2°F]
Dew Point	±1.5°C [±3°F]
Water temperature	±0.5°C [±1°F]
Relative humidity	±2% RH
Water flow	±1% of reading
Air flow (terminal)	±10% of reading
Air flow (measuring stations)	±5% of reading
Air pressure (ducts)	±25 Pa [±0.1"w.c.]
Air pressure (space)	±0.3 Pa [±0.001"w.c.]
Water pressure	±2% of full scale *Note 1
Electrical Power	±0.5% 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 in. w.g.)	0–1.5 kPa (0–6 in. w.g.)
Air Pressure	±3 Pa (±0.01 in. w.g.)	-25 to 25 Pa (-0.1 to 0.1 in. w.g.)
Airflow	±10% of full scale	
Space Temperature	±1.0°C (±2.0°F)	
Duct Temperature	±1.5°C (±3°F)	
Humidity	±5% RH	
Fluid Pressure	±10 kPa (±1.5 psi)	0–1 MPa (1–150 psi)
Fluid Pressure	±250 Pa (±1.0 in. w.g.)	0–12.5 kPa (0–50 in. w.g.) 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 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 be extended to 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 24 hours after the problem is reported.

D. Controls and Instrumentation 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. Manufacturer's literature and data for all components including the following:

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 HVAC 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 and all control panels.
12. Scaled 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 are the responsibility of the contractor administered by this Section of the technical specifications.

C. Product Certificates: Compliance with Article, QUALITY ASSURANCE.

D. Licenses: Provide licenses for all software residing on and used by the Controls Systems and transfer these licenses to the Owner prior to completion.

E. 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) stick 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.

F. 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.

G. Submit Performance Report to COR prior to final inspection.

1.8 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°C (65 to 90°F) at a relative humidity of 20 to 80% non-condensing.

B. The CUs used outdoors shall be mounted in NEMA 4 waterproof enclosures, and shall be rated for operation at −40 to 65°C (-40 to 150°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.

1.9 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 Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE):

Standard 135-10.....BACNET Building Automation and Control Networks

C. American Society of Mechanical Engineers (ASME):

B16.18-01.....Cast Copper Alloy Solder Joint Pressure Fittings.
B16.22-01.....Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

D. American Society of Testing Materials (ASTM):

B32-08.....Standard Specification for Solder Metal
B88-09.....Standard Specifications for Seamless Copper Water Tube
B88M-09.....Standard Specification for Seamless Copper Water Tube (Metric)
B280-08.....Standard Specification for Seamless Copper Tube for Air-Conditioning and Refrigeration Field Service
D2737-03.....Standard Specification for Polyethylene (PE) Plastic Tubing

E. Federal Communication Commission (FCC):

Rules and Regulations Title 47 Chapter 1-2001 Part 15: Radio Frequency Devices.

F. Institute of Electrical and Electronic Engineers (IEEE):

802.3-11.....Information Technology-Telecommunications and Information Exchange between Systems-Local and Metropolitan Area Networks- Specific Requirements-Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access method and Physical Layer Specifications

G. National Fire Protection Association (NFPA):

70-11.....National Electric Code

90A-09.....Standard for Installation of Air-Conditioning and Ventilation Systems

H. Underwriter Laboratories Inc (UL):

94-10.....Tests for Flammability of Plastic Materials for Parts and Devices and Appliances
294-10.....Access Control System Units
486A/486B-10.....Wire Connectors
555S-11.....Standard for Smoke Dampers
916-10.....Energy Management Equipment
1076-10.....Proprietary Burglar Alarm Units and Systems

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. Utilize digital wireless technologies as appropriate to the application and if approved by the VA.
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 start-up 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. These server(s) shall utilize IT industry standard data base platforms which utilize a database declarative language designed for managing data in relational database management systems (RDBMS) such as SQL.

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 135-2008, BACnet.
   1. The Data link / physical layer protocol (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 not acceptable 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. Project drawings indicate remote buildings or sites to be connected by a nominal 56,000 baud modem over voice-grade telephone lines. In each remote location a modem and field device connection shall allow communication with each controller on the internetwork as specified in Paragraph D.

D. 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 internetwork 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.

E. 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.

F. 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 PORTABLE OPERATOR'S TERMINAL (POT)

A. Provide a portable operator's terminal (POT) that shall be capable of accessing all system data. POT may be connected to any point on the system network or may be connected directly to any controller for programming, setup, and troubleshooting. POT shall communicate using BACnet protocol. POT may be connected to any point on the system network or it may be connected directly to controllers using the BACnet PTP (Point-To-Point) Data Link/ Physical layer protocol. The terminal shall use the Read (Initiate) and Write (Execute) BACnet Services. POT shall be an IBM-compatible notebook-style PC including all software and hardware required.

B. Hardware: POT shall conform to the BACnet Advanced Workstation (B-AWS) Profile and shall be BTL-Listed as a B-AWS device.

1. POT shall be commercial standard with supporting 32- or 64-bit hardware (as limited by the direct-digital control system software) and software enterprise server. Internet Explorer v6.0 SP1 or higher, Windows Script Hosting version 5.6 or higher, Windows Message Queuing, Windows Internet Information Services (IIS) v5.0 or higher, minimum 2.8 GHz processor, minimum 500 GB 7200 rpm SATA

hard drive with 16 MB cache, minimum 2GB DDR3 SDRAM (minimum 1333 Mhz) memory, 512 MB video card, minimum 16 inch (diagonal) screen, 10-100-1000 Base-TX Ethernet NIC with an RJ45 connector or a 100Base-FX Ethernet NIC with an SC/ST connector, 56,600 bps modem, an ASCII RS-232 interface, and a 16 speed high density DVD-RW+/- optical drive.

C. Software: POT shall include software equal to the software on the ECC.

2.5 BACNET PROTOCOL ANALYZER

A. For ease of troubleshooting and maintenance, provide a BACnet protocol analyzer. Provide its associated fittings, cables and appurtenances, for connection to the communications network. The BACnet protocol analyzer shall be able to, at a minimum: capture and store to a file all data traffic on all network levels; measure bandwidth usage; filter out (ignore) selected traffic.

2.6 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 above 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.

2.7 BACNET DEVICES

A. All BACnet Devices – controllers, gateways, routers, actuators 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 of the Devices through links in the BTL website.

1. BACnet Building Controllers, historically referred to as NACs, 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.

2.8 CONTROLLERS

A. General. Provide an adequate number of BTL-Listed B-BC building controllers and an adequate number of BTL-Listed B-AAC advanced application controllers to achieve the performance specified in the Part 1 Article on "System Performance." Each of these controllers shall meet the following requirements.

1. The controller shall have sufficient memory to support its operating system, database, and programming requirements.
2. The building controller shall share data with the ECC and the other networked building controllers. The advanced application controller shall share data with its building controller and the other networked advanced application controllers.
3. The operating system of the controller shall manage the input and output communication signals to allow distributed controllers to share real and virtual object information and allow for central monitoring and alarms.
4. Controllers that perform scheduling shall have a real-time clock.
5. The controller shall continually check the status of its processor and memory circuits. If an abnormal operation is detected, the controller shall:
   a. assume a predetermined failure mode, and
   b. generate an alarm notification.

6. The controller shall communicate with other BACnet devices on the internetwork using the BACnet Read (Execute and Initiate) and Write (Execute and Initiate) Property services.
7. Communication.
   a. Each controller shall reside on a BACnet network using the ISO 8802-3 (Ethernet) Data Link/Physical layer protocol for its communications. Each building controller also shall perform BACnet routing if connected to a network of custom application and application specific controllers.
   b. The controller shall provide a service communication port using BACnet Data Link/Physical layer protocol for connection to a portable operator’s terminal.
8. 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 shall be available to prevent unauthorized use of the keypad and display.
9. 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.
10. Memory. The controller shall maintain all BIOS and programming information in the event of a power loss for at least 72 hours.
11. The controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage. Controller operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 1 m (3 ft).

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 reside on a BACnet network using the ISO 8802-3 (Ethernet) Data Link/Physical layer protocol for its communications. Each building controller also shall perform BACnet routing if connected to a network of custom application and application specific controllers.
b. 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% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80%. Operation shall be protected against electrical noise of 5-120 Hz and from keyed radios up to 5 W at 1 m (3 ft).
7. Transformer. Power supply for the ASC must be rated at a minimum of 125% of ASC power consumption and shall be of the fused or current limiting type.

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 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 via DDC algorithms. 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.

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 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, when it is necessary, to access directly the programmable unit.
   a. 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.

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.

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 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 ft of sensing element for each sq ft of cooling 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.

c. Space sensors shall be equipped with in-space User set-point adjustment, override switch, numerical temperature display on sensor cover, and 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. Wire: Twisted, shielded-pair cable.

e. Output Signal: 4-20 ma.

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. 4-20 ma continuous output signal.

C. 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.

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, with thermoplastic insulated conductors as specified in Section 26 05 19, Low-Voltage Electrical Power Conductors and Cables.

C. Copper digital communication cable between the ECC and the B-BC and B-AAC controllers shall be 100BASE-TX Ethernet, Category 5e or 6, 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. Optical digital communication fiber, if used, shall be Multimode or Singlemode fiber, 62.5/125 micron for multimode or 10/125 micron for singlemode micron with SC or ST connectors as specified in ANSI/TIA-568.3-D. 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 as accepted by the VA COR., setpoint range and temperature display and external adjustment:

1. Electronic Thermostats: Solid-state, microprocessor based, 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. Battery replacement without program loss.

B. Strap-on thermostats shall be enclosed in a dirt-and-moisture proof housing with fixed temperature switching point and single pole, double throw switch.

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 plum.

A. Electrical Wiring Installation:

1. All wiring 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 Section 26 05 19, Low-Voltage Electrical Power Conductors and Cables. Install digital communication cables in conduit and in accordance with Specification Section 27 15 00, Communications 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.
1. 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.
   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. Flow Switches:
   a. Install flow switch according to manufacturer's written instructions.

b. Mount flow switch a minimum of 5 pipe diameters up stream and 5 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 5e 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 modular in design, 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.

B. Validation

1. Prepare and submit for approval a validation test plan including test procedures for the performance verification tests. Test Plan shall 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 insure 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 or VA's representative on random samples of equipment as dictated by the Architect or VA’s representative. Should random sampling indicate improper commissioning, the owner reserves the right to subsequently witness complete calibration of the system at no addition cost to the VA.
2. Demonstrate to authorities that all required safeties and life safety functions are fully functional and complete.
3. Make accessible, personnel to provide necessary adjustments and corrections to systems as directed by balancing agency.

4. 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.
5. 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 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 arate, alarm archiving, and color banding.

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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.

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 91 00, GENERAL COMMISSIONING REQUIREMENTS.

D. Section 23 05 11, COMMON WORK RESULTS FOR HVAC: General mechanical requirements and items, which are common to more than one section of Division 23.

E. Section 23 07 11, HVAC AND BOILER PLANT INSULATION: Piping insulation.

F. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.

G. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC: Temperature and pressure sensors and valve operators.

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):

B1.20.1- 2013 .....Pipe Threads, General Purpose (Inch)

B16.3- 2016 .....Malleable Iron Threaded Fittings: Classes 150 and 300

B16.4- 2016 .....Gray Iron Threaded Fittings: (Classes 125 and 250)

B16.5- 2017 .....Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard

B16.9- 2018 .....Factory Made Wrought Buttwelding Fittings

B16.11- 2016 .....Forged Fittings, Socket-Welding and Threaded

B16.18- 2018 .....Cast Copper Alloy Solder Joint Pressure Fittings

B16.22- 2018 .....Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings

B16.24- 2016 .....Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500, and 2500

B16.39- 2014 .....Malleable Iron Threaded Pipe Unions: Classes 150, 250, and 300

B16.42- 2016 .....Ductile Iron Pipe Flanges and Flanged Fittings

B31.9- 2014 .....Building Services Piping

B40.100- 2013 .....Pressure Gauges and Gauge Attachments

ASME Boiler and Pressure Vessel Code:

BPVC Section VIII-2015..Rules for Construction of Pressure Vessels

C. American Society for Testing and Materials (ASTM):

A47/A47M- 2018 .....Standard Specification for Ferritic Malleable Iron Castings

A53/A53M- 2018 .....Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

A106/A106M- 2019 .....Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service

A126- 2004(R2019) .....Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings

A183- 2014 .....Standard Specification for Carbon Steel Track Bolts and Nuts

A216/A216M- 2018 .....Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service

A307- 2016 .....Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength

A536- 1984(R2019).....Standard Specification for Ductile Iron Castings

B62- 2017 .....Standard Specification for Composition Bronze or Ounce Metal Castings

B88- 2016 .....Standard Specification for Seamless Copper Water Tube

F439- 2019 .....Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80

F441/F441M- 2015 .....Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80

D. American Welding Society (AWS):

B2.1/B2.1M- 2014 .....Standard for Welding Procedure and Performance Specification

E. Expansion Joint Manufacturer’s Association, Inc. (EJMA):

EJMA 2017 .....Expansion Joint Manufacturer’s Association Standards, Tenth Edition

F. Manufacturers Standardization Society (MSS) of the Valve and Fitting Industry, Inc.:

SP-67- 2017 .....Butterfly Valves

SP-70- 2014 .....Gray Iron Gate Valves, Flanged and Threaded Ends

SP-71- 2014 .....Gray Iron Swing Check Valves, Flanged and Threaded Ends

SP-80- 2014 .....Bronze Gate, Globe, Angle, and Check Valves

SP-85- 2014 .....Gray Iron Globe and Angle Valves, Flanged and Threaded Ends

SP-110- 2014 .....Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

SP-125- 2018 .....Gray Iron and Ductile Iron In-line, Spring-Loaded, Center-Guided Check Valves

G. Tubular Exchanger Manufacturers Association (TEMA):

TEMA Standards 2015 ....9th 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.
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.

D. Manufacturer's certified data report, Form No. U-1, for ASME pressure vessels:

E. Submit the welder’s qualifications in the form of a current (less than one-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 drawing as follows for chilled water, condenser water, and heating hot water system and other piping systems and equipment.

1. One wall-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. One complete set of reproducible drawings.
3. One 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 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.

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. 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 one-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.

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 with a copy 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.

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.

1.7 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 and Heating Hot Water Piping:
   1. Steel: Piping 2-1/2” and larger: ASTM A53/A53M Grade B, seamless or ERW, Schedule 40.
   2. Copper water tube: Piping 2” and under: ASTM B88, Type K or L, hard drawn.

B. Cooling Coil Condensate Drain Piping:
   1. From fan coil units and ductless split systems: Copper water tube, ASTM B88, Type M for runouts and Type L for mains.

C. Pipe supports, including insulation shields, for above ground 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 not acceptable.
4. Unions: ASME B16.39.
5. Water hose connection adapter: Brass, pipe thread to 20 mm (3/4 inch) garden hose thread, with hose cap nut.

B. 65 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 A307, Grade B.

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 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.
2. Pressfit type fittings are not allowed.

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 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. 65 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 or dielectric nipples may be used in lieu of dielectric unions.

2.6 SCREWED JOINTS

A. Pipe Thread: ASME B1.20.1.

B. Lubricant or Sealant: Oil and graphite or other compound approved for the intended service.

2.7 VALVES

A. Asbestos packing is not acceptable.

B. All valves of the same type shall be products of a single manufacturer.

C. 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 4137 kPa (600 psig) working pressure rating. Provide stem extension to allow operation without interfering with pipe insulation.

2.8 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, 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 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.

2.9 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 on the drawings.

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. 90 mm (3-1/2 inch) diameter, one percent accuracy, compound gauge, 101 kPa (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.

2.10 THERMOMETERS

A. Organic liquid filled type, red or blue column, clear plastic window, with 150 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 225 mm (9 inches), range as described below, two-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).

2.11 FIRESTOPPING MATERIAL

A. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

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.

B. The drawings 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 on the drawings 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 on the drawings. 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 on the drawing. 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 on the drawings.

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 on the drawings. 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 65 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 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 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 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 may 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.

3.4 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 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. Adjust red set hand on pressure gauges to normal working pressure.

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 23 00
REFRIGERANT PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Field refrigerant piping for direct expansion HVAC systems. Field refrigerant piping and associated drain and condenser water piping for walk-in coolers and freezers, including required pipe insulation. Field refrigerant piping and associated drain and condenser water piping for laboratory refrigerators, including required pipe insulation.

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. 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 23 05 11, COMMON WORK RESULTS FOR HVAC.

C. Section 23 07 11, HVAC, and BOILER PLANT INSULATION.

D. Section 23 21 13, HYDRONIC PIPING.

E. Section 23 64 00, PACKAGED WATER CHILLERS.

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. 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."

1.4 SUBMITTALS

A. Submit in accordance with specification Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Shop Drawings:

1. Complete information for components noted, including valves and refrigerant piping accessories, clearly presented, shall be included to determine compliance with drawings and specifications 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. Gages
   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.

C. Certification: Copies of certificates for welding procedure, performance qualification record and list of welders' names and symbols.

D. Design Manual: Furnish two copies of design manual of refrigerant valves and accessories.

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. Air Conditioning, Heating, and Refrigeration Institute (ARI/AHRI):

495- 2005 .....Standard for Refrigerant Liquid Receivers

730- 2013 .....Flow Capacity Rating of Suction-Line Filters and Suction-Line Filter-Driers

750- 2016 .....Thermostatic Refrigerant Expansion Valves

760- 202014 .....Performance Rating of Solenoid Valves for Use with Volatile Refrigerants

C. American Society of Heating Refrigerating and Air Conditioning Engineers (ASHRAE):

15- 2019 .....Safety Standard for Refrigeration Systems (ANSI)

17- 2008 .....Method of Testing Capacity of Thermostatic Refrigerant Expansion Valves (ANSI)

63.1- 2001 .....Method of Testing Liquid Line Refrigerant Driers (ANSI)

63.2- 2010 .....Method of Testing Liquid Line Filter Drier Filtration Capability (ANSI)

D. American National Standards Institute (ANSI):

A13.1- 2015 Scheme for Identification of Piping Systems

Z535.1- 2017 .....Safety Color Code

E. American Society of Mechanical Engineers (ASME):

B16.22- 2018 Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings (ANSI)

B16.24- 20016 Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500 (ANSI)

B31.5- 2013 Refrigeration Piping and Heat Transfer Components (ANSI)

B40.100- 2013 .....Pressure Gauges and Gauge Attachments

B40.200- 2008 .....Thermometers, Direct Reading and Remote Reading

F. American Society for Testing and Materials (ASTM)

A126- 2014 .....Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings

B32-08Standard Specification for Solder Metal

B88- 2016 .....Standard Specification for Seamless Copper Water Tube

B88M- 2018 .....Standard Specification for Seamless Copper Water Tube (Metric)

B280- 2019 .....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- 2011 .....Standard Specification for Filler Metals for Brazing and Braze Welding

H. Underwriters Laboratories (U.L.):

U.L.207- 2018 .....Standard for Refrigerant-Containing Components and Accessories, Nonelectrical

U.L.429- 2013 .....Standard for Electrically Operated Valves

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 closed 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. 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 larger 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 on drawings. Conform to ARI Standard 730 and ASHRAE Standard

63.1. Heavy gage 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, Section 23 64 00, PACKAGED WATER CHILLERS and Section 13 21 29, CONSTANT TEMPERATURE ROOM.
10. Oil Separators: Provide for condensing units, as shown. All welded steel construction with capacity to eliminate a minimum of 95 percent of the oil from the hot gas flowing through it. Provide manufacturer's published ratings for minimum and maximum refrigeration tonnage corresponding to this oil separating efficiency. Separator shall be equipped with a float valve to prevent return of the hot gas to crankcase and shall have isolating stop valves so it can be opened and services without pumping out any other part of the system. ASME construction or UL listed.
11. Receivers: Conform to AHRI 495, steel construction, equipped with taps for liquid inlet and outlet valves, pressure relief valve and liquid level indicator.

2.2 GAGES

A. Temperature Gages: Comply with ASME B40.200. Industrial-duty type and in required temperature range for service in which installed. Gages 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 gages 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 gages shall be provided in thermal wells located 1525 to 2135 mm (5 to 7 feet) above the finished floor. Remote element type temperature gages shall be provided in thermal wells located 2135 mm (7 feet) above the finished floor.

B. Vacuum and Pressure Gages: Comply with ASME B40.100 and provide with throttling type needle valve or a pulsation dampener and shut-off valve. Gage 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 gage 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 (gage) (250 psig).
   2. Discharge: 0 to 3445 kPa (gage) (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 ELECTRICAL HEAT TRACING SYSTEM

A. Refer to specification Section 23 21 13, HYDRONIC PIPING. Provide for freezer unit cooler drain piping.

2.6 REFRIGERANTS AND OIL

A. Provide EPA approved refrigerant and oil for proper system operation.

2.7 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/cu.m (3 lb/cu.ft.) 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.

2.8 PIPE INSULATION FOR DX HVAC SYSTEMS

A. Refer to specification Section 23 07 11, HVAC, PLUMBING, and BOILER PLANT INSULATION.

2.9 PIPE INSULATION FOR WALK-IN COOLERS AND FREEZERS AND LABORATORY REFRIGERATORS AND MORTUARY REFRIGERATORS

A. Flexible elastomeric: Refer to specification Section 23 07 11, HVAC, PLUMBING, and BOILER PLANT INSULATION.

B. Insulate refrigerant suction piping from unit cooler to condensing unit. Use 20 mm (3/4-inch) thick insulation on piping inside the refrigerator or freezer and 40 mm (1-1/2 inch) thick insulation (double layer required) on piping outside the refrigerated space.

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 on the drawing.
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 more 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.

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 more 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."

3.4 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 gages, 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 gage 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. 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

psi) gage. 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 gage 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 four 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.

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SECTION 23 31 00
HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Ductwork and accessories for HVAC including the following:
   1. Supply air, return air, outside air, exhaust, make-up air, and relief systems.

B. Definitions:
   1. SMACNA Standards as used in this specification means the HVAC Duct Construction Standards, Metal and Flexible.
   2. 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.
   3. Duct Pressure Classification: SMACNA HVAC Duct Construction Standards, Metal and Flexible.
   4. Exposed Duct: Exposed to view in a finished room, exposed to weather.

1.2 RELATED WORK

A. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Section 07 84 00, FIRESTOPPING: Fire Stopping Material.

C. Section 23 05 11, COMMON WORK RESULTS FOR HVAC: General Mechanical Requirements.

D. Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC: Testing and Balancing of Air Flows.

E. Section 23 07 11, HVAC, and BOILER PLANT INSULATION: Duct Insulation.

F. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC: Duct Mounted Instrumentation.

1.3 QUALITY ASSURANCE

A. Refer to article, QUALITY ASSURANCE, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. Fire Safety Code: Comply with NFPA 90A.

C. Duct System Construction and Installation: Referenced SMACNA Standards are the minimum acceptable quality.

D. 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 on the drawings.

E. 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 the duct or provide at least the same level of corrosion resistance.

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. Rectangular ducts:
   a. Schedules of duct systems, materials and selected SMACNA construction alternatives for joints, sealing, gage and reinforcement.
   b. Sealants and gaskets.
   c. Access doors.
2. Round and flat oval duct construction details:
   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. Flexible ducts and clamps, with manufacturer's installation instructions.
7. Flexible connections.
8. Instrument test fittings.

C. Coordination Drawings: Refer to article, SUBMITTALS, in Section 23 05 11-COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION.

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 Civil Engineers (ASCE):

ASCE7-2017.....Minimum Design Loads for Buildings and Other Structures

C. American Society for Testing and Materials (ASTM):

A167-2009.....Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

A653-2020.....Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy coated (Galvannealed) by the Hot-Dip process

A1011-2018.....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

B209-2014.....Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

C1071-2019.....Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)

E84-2021.....Standard Test Method for Surface Burning Characteristics of Building Materials

D. National Fire Protection Association (NFPA):

90A-2021.....Standard for the Installation of Air Conditioning and Ventilating Systems

96-2021.....Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations

E. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):

3rd Edition –2019.....HVAC Duct Construction Standards, Metal and Flexible

2nd Edition -2012.....HVAC Air Duct Leakage Test Manual

6th Edition – 2016 .....Fibrous Glass Duct Construction Standards

F. Underwriters Laboratories, Inc. (UL):

181-2013.....Factory-Made Air Ducts and Air Connectors

555-2010 .....Standard for Fire Dampers

555S-2014.....Standard for Smoke Dampers

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, coating G90; or, aluminum sheet, ASTM B209, alloy 1100, 3003 or 5052.

C. Joint Sealing: Refer to SMACNA HVAC Duct Construction Standards.

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 not acceptable 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.

D. 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:

0 to 50 mm (2 inch)

> 50 mm to 75 mm (2 inch to 3 inch)

> 75 mm to 100 mm (3 inch to 4 inch)

Show pressure classifications on the floor plans.

C. Seal Class: All ductwork shall receive Class A Seal

D. Round and Flat Oval Ducts: Furnish duct and fittings made by the same manufacturer to insure 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 on the drawings.

1. Elbows: Diameters 80 through 200 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.
3. Ribbed Duct Option: Lighter gage round/oval duct and fittings may be furnished provided certified tests indicating that the rigidity and performance is equivalent to SMACNA standard gage ducts are submitted.
   a. Ducts: Manufacturer's published standard gage, 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 Standard S3.13. Because of high pressure loss, do not use internal tie-rod reinforcement unless approved by the Resident Engineer.

G. Casings and Plenums: Construct in accordance with SMACNA HVAC Duct Construction Standards Section 6, including curbs, access doors, pipe penetrations, eliminators and drain pans. Access doors shall be hollow metal, insulated, with latches and door pulls, 500 mm (20 inches) wide by 1200 - 1350 mm (48 - 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 Figure 2.13 for Multi-blade Volume Dampers.

I. Duct Hangers and Supports: Refer to SMACNA Standards Section IV. Avoid use of trapeze hangers for round duct.

J. Ductwork in excess of 620 cm^2 (96 square inches) shall be protected unless the duct has one dimension less than 150 mm (6 inches) if it passes through the areas listed below. Refer to the Mission Critical Physical Design Manual for VA Facilities. This applies to the following:

1. Perimeter partitions of computer rooms
2. Perimeter partitions of Entrances
3. Security control centers (SCC)

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.

B. Openings shall be as large as feasible in small ducts, 300 mm by 300 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 (Figure 2-12).
   2. For round and flat oval duct: Refer to SMACNA HVAC duct Construction Standards (Figure 2-11).

2.4 FIRE DAMPERS

A. Galvanized steel, interlocking blade type, UL listing and label, 1-1/2-hour rating, 70 degrees C (160 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 gage), 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 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 larger than 200 mm (8 inches) in diameter shall be Class 1. Ducts 200 mm (8 inches) in diameter and smaller may be Class 1 or Class 2.

C. Insulated Flexible Air Duct: Factory made 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 150 mm (6 inch) duct, of 750 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: 1200 m/min (4000 feet per minute).
   3. Minimum working pressure, inches of water gage: 2500 Pa (10 inches) positive, 500 Pa (2 inches) negative.

E. Duct Clamps: 100 percent nylon strap, 80 kg (175 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.

2.6 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 ounce) neoprene coated fiberglass fabric approximately 150 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.

2.7 FIRESTOPPING MATERIAL

A. Refer to Section 07 84 00, FIRESTOPPING.

2.8 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: 3 inch outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

2.9 DUCT MOUNTE DTEMPERATURE SENSOR (AIR)

A. Refer to Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

2.10 INSTRUMENT TEST FITTINGS

A. Manufactured type with a minimum 50 mm (two inch) length for insulated duct, and a minimum 25 mm (one 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.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with provisions of Section 23 05 11, COMMON WORK RESULTS FOR HVAC, particularly regarding coordination with other trades and work in existing buildings.

B. Fabricate and install ductwork and accessories in accordance with referenced SMACNA Standards:

1. Drawings 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 on the drawings 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, Chapter 6. Design casing access doors to swing against air pressure so that pressure helps to maintain a tight seal.

C. Install duct hangers and supports in accordance with SMACNA Standards.

D. Install fire dampers, smoke dampers and combination fire/smoke dampers in accordance with the manufacturer's instructions to conform to the installation used for the rating test. Install fire dampers, smoke dampers and combination fire/smoke dampers at locations indicated and where ducts penetrate fire rated and/or smoke rated walls, shafts and where required by the Resident Engineer. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges per UL and NFPA. Demonstrate re-setting of fire dampers and operation of smoke dampers to the Resident Engineer.

E. Seal openings around duct penetrations of floors and fire rated partitions with fire stop material as required by NFPA 90A.

F. Flexible duct installation: Refer to SMACNA Standards, Chapter 3. Ducts shall be continuous, single pieces not over 1.5 m (5 feet) long (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.

G. 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.

H. 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.

I. 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 Resident Engineer. 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. Based upon satisfactory initial duct leakage test results, the scope of the testing may be reduced by the COR on ductwork constructed to the 500 Pa (2" WG) duct pressure classification. In no

case shall the leakage testing of ductwork constructed above the 500 Pa (2" WG) duct pressure classification or ductwork located in shafts or other inaccessible areas be eliminated.

C. Test procedure, apparatus and report shall conform to SMACNA 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 Resident Engineer 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 Resident Engineer.

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 DUCTWORK EXPOSED TO WIND VELOCITY

A. Provide additional support and bracing to all exposed ductwork installed on the roof or outside the building to withstand wind velocity of 145_km/h (_90_mph).

3.4 TESTING, ADJUSTING AND BALANCING (TAB)

A. Refer to Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC.

3.5 OPERATING AND PERFORMANCE TESTS

A. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

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SECTION 23 37 00
AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Roof Curbs

B. Air Outlets and Inlets: Diffusers, Registers, and Grilles.

1.2 RELATED WORK

A. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Section 08 90 00, LOUVERS and VENTS.

C. Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.

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.

1.3 QUALITY ASSURANCE

A. Refer to Article, QUALITY ASSURANCE, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

B. Fire Safety Code: Comply with NFPA 90A.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Manufacturer's Literature and Data: Include dimensions, weights, performance data, features, materials of construction and all accessories clearly indicated.

1. Air intake/exhaust hoods.
2. Diffusers, registers, grilles and accessories.

C. Coordination Drawings: Refer to article, SUBMITTALS, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

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. Air Diffusion Council Test Code:

1062 GRD- 2015 .....Certification, Rating, and Test Manual 4th Edition

C. American Society of Civil Engineers (ASCE):

ASCE7-2017.....Minimum Design Loads for Buildings and Other Structures

D. American Society for Testing and Materials (ASTM):

A-240/A240M-2019.....Standard Specification for Chromium, and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

B209- 2014.....Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

E. National Fire Protection Association (NFPA):

90A-2018.....Standard for the Installation of Air Conditioning and Ventilating Systems

F. Underwriters Laboratories, Inc. (UL):

181-2013.....UL Standard for Safety Factory-Made Air Ducts and Connectors

PART 2 - PRODUCTS

2.1 GRAVITY INTAKE/EXHAUST VENTILATORS (ROOF MOUNTED)

A. Aluminum, ASTM B209, louvered, spun, or fabricated using panel sections with roll-formed edges, 13 mm (1/2 inch) mesh aluminum welded wire bird screen, with gravity or motorized dampers where shown, accessible interior, designed for wind velocity specified in Paragraph 3.2.

1. Spun Intake/Exhaust Ventilators: Spun aluminum structural components shall be constructed of minimum 1.3 mm (16 Gauge) marine alloy aluminum, bolted to a rigid aluminum support structure. The aluminum base shall have continuously welded curb cap corners for maximum leak protection. The spun aluminum baffle shall have a rolled bead for added strength.
2. Louvered Intake/Exhaust Hoods: Louvered hood constructed from 0.081 Gauge extruded aluminum tiers welded to a minimum 3.3 mm (8 Gauge) aluminum support structure. The aluminum hood shall be constructed of a minimum 0.064 marine alloy aluminum and provided with a layer of anti-condensate coating. The aluminum base shall have continuously welded curb cap corners for maximum leak protection.
3. Low Silhouette Intake/Exhaust Ventilator: The unit shall be of bolted and welded construction utilizing corrosion resistant fasteners. The aluminum hood shall be constructed of minimum 1.60 mm (14 Gauge) marine alloy aluminum, bolted to a minimum 3.25 mm (8 Gauge) aluminum support structure. The aluminum base shall have

continuously welded curb cap corners for maximum leak protection. Birdscreen constructed of 13 mm (1/2 inch) mesh shall be mounted across the relief opening.

B. See ventilator schedule on the drawings. Sizes shown on the drawings designate throat size. Area of ventilator perimeter opening shall be not less than the throat area.

C. Dampers for Gravity Ventilators without Duct Connection: Construct damper of the same material as the ventilator and of the design to completely close opening or remain wide open. Hold damper in closed position by a brass chain and catch. Extend chains 300 mm (12 inches) below and engage catch when damper is closed.

D. See paragraph 3.3 for Intake/Exhaust exposed to high wind velocities.

E. Provide Roof Curb by unit manufacturer. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC for additional requirements.

2.2 EQUIPMENT SUPPORTS

A. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

2.3 AIR OUTLETS AND INLETS

A. Materials:

1. Steel or aluminum. Use aluminum air outlets and inlets for facilities located in high-humidity areas. 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 Diffusion Council Code 1062GRD. 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 drawings. Provide plaster frame for units in plaster ceilings.

a. Square, louver, fully adjustable pattern: Round neck, surface mounting unless shown otherwise on the 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.
d. Slot diffuser/plenum:
   1) Diffuser: Frame and support bars shall be constructed of heavy gauge extruded aluminum. Form slots or use adjustable pattern controllers, to provide stable, horizontal air flow pattern over a wide range of operating conditions.
   2) Galvanized steel boot lined with 13 mm (1/2 inch) thick fiberglass conforming to NFPA 90A and complying with UL 181 for erosion. The internal lining shall be factory-fabricated, anti-microbial, and non-friable.
   3) Provide inlet connection diameter equal to duct diameter shown on drawings or provide transition coupling if necessary. Inlet duct and plenum size shall be as recommended by the manufacturer.
   4) Maximum pressure drop at design flow rate: 37 Pa (0.15-inch W.G.)

2. Linear Bar Grilles and Diffusers: Extruded aluminum, manufacturer's standard finish, and positive holding concealed fasteners.
   a. Margin Frame: Flat, 20 mm (3/4 inch) wide.
   b. Bars: Minimum 5 mm (3/16 inch) wide by 20 mm (3/4 inch) deep, zero deflection unless otherwise shown. Bar spacing shall be a minimum of 3 mm (1/8 inch) on center. Reinforce bars on 450 mm (18 inch) center for sidewall units and on 150 mm (6 inch) center for units installed in floor or sills.

c. Provide opposed blade damper and equalizing or control grid where shown .

3. Supply Registers: Double deflection type with horizontal face bars and opposed blade damper with removable key operator.
   a. Margin: Flat, 30 mm (1-1/4 inches) wide.
   b. Bar spacing: 20 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.
4. Supply Grilles: Same as registers but without the opposed blade damper.
5. Jet Diffusers: Aluminum construction (nozzle and frame) suitable for wall or ceiling mounting or direct mounting on ducts.

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 30 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 30 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 1/2 by 1/2 by 1/2-inch grid providing 90% 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 drawings. All necessary appurtenances shall be provided to allow for mounting.

E. Supply Registers in Psychiatric Rooms: Supply air registers shall be security type, steel with perforated faceplate, flat surface margin, extension sleeve, opposed blade damper and back mounting flanges. Faceplate shall be 5 mm (3/16 inch) (minimum) with 5x5 mm holes on 7

mm (3/16 by 3/16-inch holes on 9/32 inch) spacing and a minimum free area of 45 percent. Wall sleeve shall be 5 mm (3/16 inch) thick (minimum).

F. Air Inlet Registers in Psychiatric Rooms: Return, exhaust, transfer and relief air registers shall be security type, steel with perforated faceplate, flat surface margin, wall sleeve, opposed blade damper and back mounting flanges. Faceplate shall be 5 mm (3/16 inch) (minimum) with 5x5 mm holes on 7 mm (3/16 by 3/16-inch holes on 9/32 inch) spacing and a minimum free area of 45 percent. Wall sleeve shall be 5 mm (3/16 inch) thick (minimum).

G. Acoustic Transfer Grille: Aluminum, suitable for partition or wall mounting.

2.4 WIRE MESH GRILLE

A. Fabricate grille with 2 x 2 mesh 13 mm (1/2 inch) galvanized steel or aluminum hardware cloth in a spot-welded galvanized steel frame with approximately 40 mm (1-1/2 inch) margin.

B. Use grilles where shown in unfinished areas such as mechanical rooms.

2.5 FILTER RETURN/EXHAUST GRILLE

A. Provide grille with in stream 1-inch deep MERV 4 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 30 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. Comply with provisions of Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION, particularly regarding coordination with other trades and work in existing buildings.

B. 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 INTAKE/ EXHAUST HOODS EXPOSED TO WIND VELOCITY

Provide additional support and bracing to all exposed ductwork installed on the roof or outside the building to withstand wind velocity of 145 km/h (90 mph) or, in coastal areas, as defined in ASCE 7 Fig. 1.

3.3 TESTING, ADJUSTING AND BALANCING (TAB)

Refer to Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC.

3.4 OPERATING AND PERFORMANCE TESTS

Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

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SECTION 23 81 00
DECENTRALIZED UNITARY HVAC EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies split-systems.

B. 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 more 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 03 30 00, CAST-IN-PLACE CONCRETE.

D. Section 07 72 00, ROOF ACCESSORIES.

E. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

F. Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC and STEAM GENERATION EQUIPMENT

G. Section 23 05 93, TESTING, ADJUSTING, and BALANCING FOR HVAC.

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 23 00, REFRIGERANT PIPING.

L. Section 23 31 00, HVAC DUCTS and CASINGS.

M. Section 23 82 16, AIR COILS

1.3 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.

1.4 SUBMITTALS

A. Submit in accordance with specification Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES

B. Manufacturer's literature and data:

1. Sufficient information, including capacities, pressure drops, and piping connections clearly presented, shall be included to determine compliance with drawings and specifications 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.

C. Certification: Submit proof of specified ARI Certification.

D. Performance Rating: Submit catalog selection data showing equipment ratings and compliance with required sensible-to-heat-ratio, energy efficiency ratio (EER), and coefficient of performance (COP).

E. Operating and Maintenance Manual: Submit three copies of Operating and Maintenance manual to Resident Engineer three weeks prior to final inspection.

F. 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 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.

B. Air-Conditioning, Heating, and Refrigeration Institute (AHRI):

210/240-2023(2020).....Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment

270-2015(ADN1 2015).....Sound Rating of Outdoor Unitary Equipment

310/380-2017.....Standard for Packaged Terminal Air-Conditioners and Heat Pumps (CSA-C744-04)

340/360-2015.....Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment

520-2004.....Performance Rating of Positive Displacement Condensing Units

C. Air Movement and Control Association (AMCA):

210-2016.....Laboratory Methods of Testing Fans for Aerodynamic Performance Rating (ANSI)

410-1996.....Recommended Safety Practices for Users and Installers of Industrial and Commercial Fans

D. American National Standards Institute (ANSI):

S12.51-2012(R2020).....Acoustics - Determination of Sound Power Levels of Sound Energy Levels of Noise Sources Using Sound Pressure - Precision Methods for Reverberation Rooms (same as ISO 3741:2010)

E. American Society of Civil Engineers (ASCE)

ASCE 7-2017.....Minimum Design Loads and Associated Criteria for Buildings and Other Structures

F. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE):

Handbook 2020.....HVAC Systems and Equipment

15 & 34-2019.....Safety Standard for Refrigeration Systems (ANSI)

62.1-2019(2021).....Ventilation for Acceptable Indoor Air Quality (ANSI)

G. American Society of Testing and Materials (ASTM):

B117-2019.....Standard Practice for Operating Salt Spray (Fog) Apparatus

H. Federal Specifications (Fed. Spec.):

A-A-50502-2009..... Air conditioner (Unitary Heat Pump) Air to Air (3000-300,000 Btu)

I. Military Specifications (Mil. Specs.):

DTL-53022F-2019(2021) ..Primer, Epoxy Coating, Corrosion Inhibiting Lead and Chromate Free

PRF-32550-2016(2020) ...Metal-Rich Primer

J. National Electrical Manufacturer's Association (NEMA):
ICS 1-2000(R2015).....Industrial Controls and Systems: General Requirements
MG 1-2016(2018).....Motors and Generators (ANSI)

K. National Fire Protection Association (NFPA) Publications:
90A-2021.....Standard for the Installation of Air-Conditioning and Ventilating Systems

PART 2 - PRODUCTS

2.1 UNITARY AIR CONDITIONERS - GENERAL

A. Applicable ARI Standards:
1. Cooling Capacity 39.6 kW (135,000 Btu/h) and More: AHRI 340/ 360.
2. Cooling Capacity Less Than 39.6 kW (135,000 Btu/h): 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.

2.3 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.

D. 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. 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.
4. Fan: Direct drive, centrifugal fan.
5. 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.
6. Filters: Disposable, with MERV rating of 7 or higher according to ASHRAE 52.2.

E. 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 gage ports shall be brass and located outside of the casing.
2. Compressor: Hermetically sealed, inverter-driven, 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: R-410A unless otherwise indicated.
5. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with AHRI 210/240, and with liquid subcooler.
6. Fan: Aluminum, propeller type, directly connected to motor.

7. Motor: Permanently lubricated, with integral thermal-overload protection.
8. Low Ambient Kit: Permit operation down to minus 18 deg C (0 deg F).
9. Mounting Base: Polyethylene.
10. 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. Install units level and plumb maintaining manufacturer’s recommended clearances and tolerances.

B. Install ground-mounting, compressor-condenser components on 100 mm (4-inch) thick, reinforced concrete base; 100 mm (4 inches) larger 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.

C. 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.

D. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

E. 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 normal-weight, 20.7-MPa (3000-psi), compressive strength (28-day) concrete mix inside roof curb, 100 mm (4 inches) thick.

E. Ground equipment and install power wiring, switches, and controls for self contained and split systems.

F. 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.

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 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.

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 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.

3.6 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 23 08 00 – COMMISSIONING OF HVAC SYSTEMS.

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SECTION 23 82 16
AIR COILS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Heating and cooling coils for air handling unit and duct applications

1.2 RELATED WORK

A. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES

B. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS

C. Section 23 05 11, COMMON WORK RESULTS FOR HVAC

D. Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS

E. Section 23 09 23, DDC SYSTEMS for HVAC

F. Section 23 31 00, HVAC DUCTS AND CASINGS

1.3 QUALITY ASSURANCE

A. Refer to paragraph, QUALITY ASSURANCE, 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 Standard 410 and shall bear the AHRI certification label.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Manufacturer's Literature and Data for Heating and Cooling Coils: Submit type, size, arrangements and performance details. Present application ratings in the form of tables, charts or curves.

C. Provide installation, operating and maintenance instructions.

D. Certification Compliance: Evidence of listing in current ARI Directory of Certified Applied Air Conditioning Products.

E. Coils may be submitted with Section 23 36 00, AIR TERMINAL UNITS, Section 23 73 00, INDOOR CENTRAL-STATION AIR-HANDLING UNITS, Section 23 74 13, PACKAGED, OUTDOOR, CENTRAL-STATION AIR-HANDLING UNITS, or Section 23 82 00, CONVECTION HEATING AND COOLING UNITS.

F. 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 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.

B. Air Conditioning and Refrigeration Institute (AHRI):
Directory of Certified Applied Air Conditioning Products
AHRI 410-2001.....Forced-Circulation Air-Cooling and Air-Heating Coils

C. American Society for Testing and Materials (ASTM):
B75/75M-2019.....Standard Specifications for Seamless Copper Tube

D. National Fire Protection Association (NFPA):
70-2017.....National Electric Code

E. National Electric Manufacturers Association (NEMA):
250-2014.....Enclosures for Electrical Equipment (1,000 Volts Maximum)

PART 2 - PRODUCTS

2.1 VOLATILE REFRIGERANT COILS

A. Continuous circuit, straight tubes, dry expansion type equipped with multi-port distribution header, less expansion valve.

B. Minimum 16 mm (5/8-inch) tube diameter.

C. Designed for R22 or other EPA approved refrigerants.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Follow coil manufacturer's instructions for handling, cleaning, installation and piping connections.

B. Comb fins, if damaged. Eliminate air bypass or leakage at coil sections.

3.2 STARTUP AND TESTING

A. The Commissioning Agent will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the COR and Commissioning Agent. Provide a minimum of 7 days prior notice.

3.3 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00 – COMMISSIONING OF HVAC SYSTEMS and as required by Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS 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 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 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.

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 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, 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 clearances shall not be less than specified in the NEC.

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. 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.
   3. 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 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

B. 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.

C. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits for conductors and cables.

DE. 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.

B. American Society of Testing Material (ASTM):

D2301-10.....Standard Specification for Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape

D2304-10.....Test Method for Thermal Endurance of Rigid Electrical Insulating Materials

D3005-10.....Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape

C. National Electrical Manufacturers Association (NEMA):

WC 70-09.....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):

44-14.....Thermoset-Insulated Wires and Cables

83-14.....Thermoplastic-Insulated Wires and Cables

467-13.....Grounding and Bonding Equipment

486A-486B-13.....Wire Connectors

486C-13.....Splicing Wire Connectors

486D-15.....Sealed Wire Connector Systems

486E-15.....Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors

493-07.....Thermoplastic-Insulated Underground Feeder and Branch Circuit Cables

514B-12.....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. All conductors shall be copper.

C. Single Conductor and Cable:

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. 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.
4. For modifications and additions to existing wiring systems, color coding shall conform to the existing wiring system.
5. 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.		

6. 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.

7. 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.

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 all 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. Install cable supports for all vertical feeders in accordance with the NEC. Provide split wedge type which firmly clamps each individual cable and tightens due to cable weight.

F. In panelboards, cabinets, wireways, switches, enclosures, and equipment assemblies, neatly form, train, and tie the conductors with non-metallic 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 and Cable 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. No more than three branch circuits shall be installed 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 cables around the manhole walls, but do not bend to a radius less than six times the overall cable diameter.

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 cable markings are covered by tape, apply tags to cable, 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 DIRECT BURIAL CABLE INSTALLATION

A. Tops of the cables:

1. Below the finished grade: Minimum 600 mm (24 inches) unless greater depth is shown.

2. Below road and other pavement surfaces: In conduit as specified, minimum 760 mm (30 inches) unless greater depth is shown.
3. Do not install cables under railroad tracks.

B. Under road and paved surfaces: Install cables in concrete-encased galvanized steel rigid conduits. Size as shown on plans, but not less than 50 mm (2 inches) trade size with bushings at each end of each conduit run. Provide size/quantity of conduits required to accommodate cables plus one spare.

C. Work with extreme care near existing ducts, conduits, cables, and other utilities to prevent any damage.

D. Excavation and backfill is specified in Section 31 20 00, EARTH MOVING. In addition:
1. Place 75 mm (3 inches) bedding sand in the trenches before installing the cables.
2. Place 75 mm (3 inches) shading sand over the installed cables.
3. Install continuous horizontal 25 mm by 200 mm (1 inch x 8 inches) preservative-impregnated wood planking 75 mm (3 inches) above the cables before backfilling.

E. Provide horizontal slack in the cables for contraction during cold weather.

F. Install the cables in continuous lengths. Splices within cable runs shall not be accepted.

G. Connections and terminations shall be listed submersible-type designed for the cables being installed.

H. Warning tape shall be continuously placed 300 mm (12 inches) above the buried cables.

3.10 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.
d. Test results shall be submitted to the COR indicating manufacturer and model number of equipment used, verification of equipment calibration, identification and location of cables tested.

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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.

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 COTR.

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.

B. American Society for Testing and Materials (ASTM):

B1-13.....Standard Specification for Hard-Drawn Copper Wire

B3-13.....Standard Specification for Soft or Annealed Copper Wire

B8-11.....Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

C. Institute of Electrical and Electronics Engineers, Inc. (IEEE):

81-12.....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):

44-14 .....Thermoset-Insulated Wires and Cables

83-14 .....Thermoplastic-Insulated Wires and Cables

467-13 .....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.

2.4 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.

3.2 INACCESSIBLE GROUNDING CONNECTIONS

A. Make grounding connections, which are normally buried or otherwise inaccessible, by exothermic weld.

3.3 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.

3.4 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 power and lighting 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.

3.5 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.

3.6 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.

on the drawings.

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. Grounding system resistance shall comply with the electric utility company ground resistance requirements.

3.9 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.

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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 00, EARTHWORK: 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.

B. American Iron and Steel Institute (AISI):

S100-12.....North American Specification for the Design of Cold-Formed Steel Structural Members

C. National Electrical Manufacturers Association (NEMA):

C80.1-15.....Electrical Rigid Steel Conduit

C80.3-15.....Steel Electrical Metal Tubing

C80.6-05.....Electrical Intermediate Metal Conduit

FB1-14.....Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable

FB2.10-13.....Selection and Installation Guidelines for Fittings for use with Non-Flexible Conduit or Tubing (Rigid Metal Conduit, Intermediate Metallic Conduit, and Electrical Metallic Tubing)

FB2.20-14.....Selection and Installation Guidelines for Fittings for use with Flexible Electrical Conduit and Cable

TC-2-13.....Electrical Polyvinyl Chloride (PVC) Tubing and Conduit

TC-3-13.....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):

1-05.....Flexible Metal Conduit

5-16.....Surface Metal Raceway and Fittings

6-07.....Electrical Rigid Metal Conduit - Steel

50-15.....Enclosures for Electrical Equipment

360-13.....Liquid-Tight Flexible Steel Conduit

467-13.....Grounding and Bonding Equipment

514A-13.....Metallic Outlet Boxes

514B-12.....Conduit, Tubing, and Cable Fittings

514C-14.....Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers

651-11.....Schedule 40 and 80 Rigid PVC Conduit and Fittings

651A-11.....Type EB and A Rigid PVC Conduit and HDPE Conduit

797-07.....Electrical Metallic Tubing

1242-14.....Electrical Intermediate Metal Conduit – Steel

PART 2 - PRODUCTS

2.1 MATERIAL

A. Conduit Size: In accordance with the NEC, but not less than 19 mm (0..75-inch) unless otherwise shown. Where permitted by the NEC, 19

mm (0.75-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 19 mm (0.75-inch).
2. Rigid Steel Conduit (RMC): Shall conform to UL 6 and NEMA C80.1.
4. Rigid Intermediate Steel Conduit (IMC): Shall conform to UL 1242 and NEMA C80.6.
5. 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.
6. Flexible Metal Conduit: Shall conform to UL 1.
7. Liquid-tight Flexible Metal Conduit: Shall conform to UL 360.
8. Direct Burial Plastic Conduit: Shall conform to UL 651 and UL 651A, heavy wall PVC or high density polyethylene (PE).
9. 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. Grounding Bushing: With an attached lug or tang for a bonding conductor.
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.

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. 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. Conduit for Conductors 600 V and Below: Rigid steel, IMC, rigid aluminum, or EMT. Mixing different types of conduits in the system is prohibited.

B. Align and run conduit parallel or perpendicular to the building lines.

C . Install horizontal runs close to the ceiling or beams and secure with conduit straps.

D. Support horizontal or vertical runs at not over 2.4 M (8 feet) intervals.

E. Surface Metal Raceways: Use only where shown on drawings.

F. 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 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.

3.6 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.

3.7 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.

3.8 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 "SIG-FA JB No. 1."

I. On all branch circuit junction box covers, identify the circuits with black marker.

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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 31 20 00, Excavation: Trenching, backfill, and compaction.

1.3 QUALITY ASSURANCE

A. 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 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 Resident Engineer 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.

B. American Concrete Institute (ACI):
Building Code Requirements for Structural Concrete
318-14/318M-14.....Building Code Requirements for Structural Concrete & Commentary
SP-66-04.....ACI Detailing Manual

C. American National Standards Institute (ANSI):
77-14.....Underground Enclosure Integrity

D. American Society for Testing and Materials (ASTM):
C478 REV A-15.....Standard Specification for Precast Reinforced Concrete Manhole Sections
C858-10.....Underground Precast Concrete Utility Structures
C990-09.....Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants.

E. National Electrical Manufacturers Association (NEMA):
TC 2-13.....Electrical Polyvinyl Chloride (PVC) Conduit
TC 3-15.....Polyvinyl Chloride (PVC) Fittings for Use With Rigid PVC Conduit And Tubing
TC 6 & 8-13.....Polyvinyl Chloride (PVC) Plastic Utilities Duct For Underground Installations
TC 9-04.....Fittings For Polyvinyl Chloride (PVC) Plastic Utilities Duct For Underground Installation

F. National Fire Protection Association (NFPA):
70-17.....National Electrical Code (NEC)
70E-15.....National Electrical Safety Code

G. Underwriters Laboratories, Inc. (UL):
6-07.....Electrical Rigid Metal Conduit-Steel
467-13.....Grounding and Bonding Equipment
651-11.....Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings
651A-11.....Schedule 40 and 80 High Density Polyethylene (HDPE) Conduit

PART 2 - PRODUCTS

2.1 PRE-CAST CONCRETE MANHOLES AND HARDWARE

A. Structure: Factory-fabricated, reinforced-concrete, monolithically-poured walls and bottom. Frame and cover shall form top of manhole.

B. Cable Supports:

1. Cable stanchions shall be hot-rolled, heavy duty, hot-dipped galvanized "T" section steel, 56 mm (2.25 inches) x 6 mm (0.25 inch) in size, and punched with 14 holes on 38 mm (1.5 inches) centers for attaching cable arms.
2. Cable arms shall be 5 mm (0.1875 inch) gauge, hot-rolled, hot-dipped galvanized sheet steel, pressed to channel shape. Arms shall be approximately 63 mm (2.5 inches) wide x 350 mm (14 inches) long.
3. Insulators for cable supports shall be porcelain, and shall be saddle type or type that completely encircles the cable.
4. Equip each cable stanchion with one spare cable arm, with three spare insulators for future use.

C. Ladder: Fiberglass with 400 mm (16 inches) rung spacing. Provide securely-mounted ladder for every manhole over 1.2 M (4 feet) deep.

D. Ground Rod Sleeve: Provide a 75 mm (3 inches) PVC sleeve in manhole floors so that a driven ground rod may be installed.

E. Sump: Provide 305 mm x 305 mm (12 inches x 12 inches) covered sump frame and grated cover.

2.2 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 or SIGNAL as applicable 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.

2.3 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.

2.4 GROUNDING

A. Ground Rods and Ground Wire: Per Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

2.5 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.

2.6 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 00, Excavation 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 Resident Engineer.
G. Provide fencing along the construction site and at all open excavations and tunnels to control access by unauthorized personnel. Chain Link Panel Fencing Temporary panel fencing must be galvanized steel chain

link panels 1.8 m, 6 feet high. Multiple fencing panels may be linked together at the bases to form long spans as needed. Each panel base must be weighted down using sandbags or other suitable materials in order for the fencing to withstand anticipated winds while remaining upright. Fencing must remain rigid and taut with a minimum of 90.7 kg 200 pounds of force exerted on it from any direction with less than 100 mm 4 inches of deflection. Completely remove fencing at the completion of construction and restore surfaces disturbed or damaged to its original condition.

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. Underground conduit stub-ups and sweeps to equipment inside of buildings shall be galvanized rigid metal conduit half-lap wrapped with PVC tape, and shall extend a minimum of 1.5 M (5 feet) outside the building foundation. Tops of conduits below building slab shall be minimum 610 mm (24 inches) below bottom of slab.
5. Stub-ups and sweeps to 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, pull boxes, 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 Resident Engineer.
11. Provide concrete in accordance with Section 32 05 23 CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS In addition, provide concrete for encasement of underground ducts with 20 MPa 3000 psi minimum 28-day compressive strength. Concrete associated with electrical work for other than encasement of underground ducts must be 30 MPa 4000 psi minimum 28-day compressive strength unless specified otherwise.

D. 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.

E. 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.

F. 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.

G. 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 Resident Engineer.
4. Mandrel pulls shall be witnessed by the Resident Engineer/.

---END---

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 for execution, is defined in Section 01 91 00 GENERAL COMMISSIONING REQUIRMENTS. A Commissioning Agent (CxA) appointed by the A&E 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 shall 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 CxA 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 Contracting Officer Representative (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 VA COR after submission and approval of formal training plans.

B. Refer to Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS and Division 26 Sections for additional Contractor training requirements.

----- END -----

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 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 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 09 23, LIGHTING CONTROLS: Lighting controls integral to panelboards.

H. 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.

B. International Code Council (ICC):

IBC-15.....International Building Code

C. National Electrical Manufacturers Association (NEMA):

PB 1-11.....Panelboards

250-14.....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):

50-15.....Enclosures for Electrical Equipment

67-09.....Panelboards

489-16.....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 breaker or main lugs, 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 shall be connected.

G. Neutral bus shall be copper and 100%rated, mounted on insulated supports.

H. Grounding bus bar shall be copper and 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.

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 71, ELECTRICAL SYSTEM PROTECTIVE DEVICE STUDY

E. Breaker magnetic trip setting shall be set to maximum, unless otherwise noted.

F. 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. Furnish new panelboards with integral surge protective devices. Refer to Section 26 43 13, SURGE PROTECTIVE DEVICES.

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 shall 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.

---END---

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SCHEDULE OF NEW TR PANELS

BLDG #	ROOM #	PANEL ID	(PROPOSED) NAME	MAINS, TYPE	FED FROM	BRANCH	RACK QTY	BRANCH BREAKERS						
1	103	A		100A, MLO		CRITICAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	1 25A/2P (1)	8 20A/1P	23 SPACES	42 TOTAL
1	103	B		100A, MLO		NORMAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	0 20A/2P	10 20A/1P	23 SPACES	42 TOTAL
1	202	A		100A, MLO		CRITICAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	1 25A/2P (1)	8 20A/1P	23 SPACES	42 TOTAL
1	202	B		100A, MLO		NORMAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	0 20A/2P	10 20A/1P	23 SPACES	42 TOTAL
2	133	A		100A, MLO		CRITICAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	1 25A/2P (1)	8 20A/1P	23 SPACES	42 TOTAL
2	133	B		100A, MLO		NORMAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	0 20A/2P	10 20A/1P	23 SPACES	42 TOTAL
2	256	A		100A, MLO		CRITICAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	1 25A/2P (1)	8 20A/1P	23 SPACES	42 TOTAL
2	256	B		100A, MLO		NORMAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	0 20A/2P	10 20A/1P	23 SPACES	42 TOTAL
2	359	A		100A, MLO		CRITICAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	1 25A/2P (1)	8 20A/1P	23 SPACES	42 TOTAL
2	359	B		100A, MLO		NORMAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	0 20A/2P	10 20A/1P	23 SPACES	42 TOTAL
2	424	A		100A, MLO		CRITICAL	1 RACKS	0 60A/3P	1 30A/3P	1 20A/3P	1 25A/2P (1)	8 20A/1P	26 SPACES	42 TOTAL
2	424	B		100A, MLO		NORMAL	1 RACKS	0 60A/3P	1 30A/3P	1 20A/3P	0 20A/2P	10 20A/1P	26 SPACES	42 TOTAL
3	105	A		100A, MLO		CRITICAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	1 25A/2P (1)	8 20A/1P	23 SPACES	42 TOTAL
3	105	B		100A, MLO		NORMAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	0 20A/2P	10 20A/1P	23 SPACES	42 TOTAL
3	205	A		100A, MLO		CRITICAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	1 25A/2P (1)	8 20A/1P	23 SPACES	42 TOTAL
3	205	B		100A, MLO		NORMAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	0 20A/2P	10 20A/1P	23 SPACES	42 TOTAL
3	305	A		100A, MLO		CRITICAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	1 25A/2P (1)	8 20A/1P	23 SPACES	42 TOTAL
3	305	B		100A, MLO		NORMAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	0 20A/2P	10 20A/1P	23 SPACES	42 TOTAL
4	102E	A		100A, MLO		CRITICAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	1 25A/2P (1)	8 20A/1P	23 SPACES	42 TOTAL
4	102E	B		100A, MLO		NORMAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	0 20A/2P	10 20A/1P	23 SPACES	42 TOTAL
5	G06A	A		100A, MLO		CRITICAL	1 RACKS	0 60A/3P	1 30A/3P	1 20A/3P	1 25A/2P (1)	8 20A/1P	26 SPACES	42 TOTAL
5	G06A	B		100A, MLO		NORMAL	1 RACKS	0 60A/3P	1 30A/3P	1 20A/3P	0 20A/2P	10 20A/1P	26 SPACES	42 TOTAL
5	110A	A		100A, MLO		CRITICAL	1 RACKS	0 60A/3P	1 30A/3P	1 20A/3P	1 25A/2P (1)	8 20A/1P	26 SPACES	42 TOTAL
5	110A	B		100A, MLO		NORMAL	1 RACKS	0 60A/3P	1 30A/3P	1 20A/3P	0 20A/2P	10 20A/1P	26 SPACES	42 TOTAL
5	212C	A		100A, MLO		CRITICAL	1 RACKS	0 60A/3P	1 30A/3P	1 20A/3P	1 25A/2P (1)	8 20A/1P	26 SPACES	42 TOTAL
5	212C	B		100A, MLO		NORMAL	1 RACKS	0 60A/3P	1 30A/3P	1 20A/3P	0 20A/2P	10 20A/1P	26 SPACES	42 TOTAL
6	8	A		100A, MLO		CRITICAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	1 25A/2P (1)	8 20A/1P	23 SPACES	42 TOTAL
6	8	B		100A, MLO		NORMAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	0 20A/2P	10 20A/1P	23 SPACES	42 TOTAL
6	101	A		100A, MLO		CRITICAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	1 25A/2P (1)	8 20A/1P	23 SPACES	42 TOTAL
6	101	B		100A, MLO		NORMAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	0 20A/2P	10 20A/1P	23 SPACES	42 TOTAL
6	201	A		100A, MLO		CRITICAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	1 25A/2P (1)	8 20A/1P	23 SPACES	42 TOTAL
6	201	B		100A, MLO		NORMAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	0 20A/2P	10 20A/1P	23 SPACES	42 TOTAL
6	310	A		100A, MLO		CRITICAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	1 25A/2P (1)	8 20A/1P	23 SPACES	42 TOTAL
6	310	B		100A, MLO		NORMAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	0 20A/2P	10 20A/1P	23 SPACES	42 TOTAL
7	45A	A		100A, MLO		CRITICAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	1 25A/2P (1)	8 20A/1P	23 SPACES	42 TOTAL
7	45A	B		100A, MLO		NORMAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	0 20A/2P	10 20A/1P	23 SPACES	42 TOTAL
7	17	A		100A, MLO		CRITICAL	1 RACKS	0 60A/3P	1 30A/3P	1 20A/3P	1 25A/2P (1)	8 20A/1P	26 SPACES	42 TOTAL
7	17	B		100A, MLO		NORMAL	1 RACKS	0 60A/3P	1 30A/3P	1 20A/3P	0 20A/2P	10 20A/1P	26 SPACES	42 TOTAL
7	1A-184A	A		100A, MLO		CRITICAL	3 RACKS	0 60A/3P	1 30A/3P	3 20A/3P	1 25A/2P (1)	8 20A/1P	20 SPACES	42 TOTAL
7	1A-184A	B		100A, MLO		NORMAL	3 RACKS	0 60A/3P	1 30A/3P	3 20A/3P	0 20A/2P	10 20A/1P	20 SPACES	42 TOTAL
7	1A-117	A		100A, MLO		CRITICAL	3 RACKS	0 60A/3P	1 30A/3P	3 20A/3P	1 25A/2P (1)	8 20A/1P	20 SPACES	42 TOTAL
7	1A-117	B		100A, MLO		NORMAL	3 RACKS	0 60A/3P	1 30A/3P	3 20A/3P	0 20A/2P	10 20A/1P	20 SPACES	42 TOTAL
7	D-33	A		100A, MLO		CRITICAL	3 RACKS	0 60A/3P	1 30A/3P	3 20A/3P	1 25A/2P (1)	8 20A/1P	20 SPACES	42 TOTAL
7	D-33	B		100A, MLO		NORMAL	3 RACKS	0 60A/3P	1 30A/3P	3 20A/3P	0 20A/2P	10 20A/1P	20 SPACES	42 TOTAL
7	267A	A		100A, MLO		CRITICAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	1 25A/2P (1)	8 20A/1P	23 SPACES	42 TOTAL
7	267A	B		100A, MLO		NORMAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	0 20A/2P	10 20A/1P	23 SPACES	42 TOTAL
7	2M4	A		100A, MLO		CRITICAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	1 25A/2P (1)	8 20A/1P	23 SPACES	42 TOTAL
7	2M4	B		100A, MLO		NORMAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	0 20A/2P	10 20A/1P	23 SPACES	42 TOTAL
7	373D	A		100A, MLO		CRITICAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	1 25A/2P (1)	8 20A/1P	23 SPACES	42 TOTAL
7	373D	B		100A, MLO		NORMAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	0 20A/2P	10 20A/1P	23 SPACES	42 TOTAL
7	3M4	A		100A, MLO		CRITICAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	1 25A/2P (1)	8 20A/1P	23 SPACES	42 TOTAL
7	3M4	B		100A, MLO		NORMAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	0 20A/2P	10 20A/1P	23 SPACES	42 TOTAL
7	471A	A		100A, MLO		CRITICAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	1 25A/2P (1)	8 20A/1P	23 SPACES	42 TOTAL
7	471A	B		100A, MLO		NORMAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	0 20A/2P	10 20A/1P	23 SPACES	42 TOTAL
7	402	A		100A, MLO		CRITICAL	3 RACKS	0 60A/3P	1 30A/3P	3 20A/3P	1 25A/2P (1)	8 20A/1P	20 SPACES	42 TOTAL
7	402	B		100A, MLO		NORMAL	3 RACKS	0 60A/3P	1 30A/3P	3 20A/3P	0 20A/2P	10 20A/1P	20 SPACES	42 TOTAL
8	105C	A		100A, MLO		CRITICAL	1 RACKS	0 60A/3P	1 30A/3P	1 20A/3P	1 25A/2P (1)	8 20A/1P	26 SPACES	42 TOTAL
8	105C	B		100A, MLO		NORMAL	1 RACKS	0 60A/3P	1 30A/3P	1 20A/1P	0 20A/2P	10 20A/1P	26 SPACES	42 TOTAL
8	305E	A		100A, MLO		CRITICAL	1 RACKS	0 60A/3P	1 30A/3P	1 20A/3P	1 25A/2P (1)	8 20A/1P	26 SPACES	42 TOTAL
8	305E	B		100A, MLO		NORMAL	1 RACKS	0 60A/3P	1 30A/3P	1 20A/3P	0 20A/2P	10 20A/1P	26 SPACES	42 TOTAL
9	135	A		100A, MLO		CRITICAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	1 25A/2P (1)	8 20A/1P	23 SPACES	42 TOTAL
9	135	B		100A, MLO		NORMAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	0 20A/2P	10 20A/1P	23 SPACES	42 TOTAL
9	218	A		100A, MLO		CRITICAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	1 25A/2P (1)	8 20A/1P	23 SPACES	42 TOTAL
9	218	B		100A, MLO		NORMAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	0 20A/2P	10 20A/1P	23 SPACES	42 TOTAL
9	315	A		100A, MLO		CRITICAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	1 25A/2P (1)	8 20A/1P	23 SPACES	42 TOTAL
9	315	B		100A, MLO		NORMAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	0 20A/2P	10 20A/1P	23 SPACES	42 TOTAL
15	7F	A		100A, MLO		CRITICAL	1 RACKS	0 60A/3P	1 30A/3P	1 20A/3P	1 25A/2P (1)	8 20A/1P	26 SPACES	42 TOTAL
15	7F	B		100A, MLO		NORMAL	1 RACKS	0 60A/3P	1 30A/3P	1 20A/3P	0 20A/2P	10 20A/1P	26 SPACES	42 TOTAL
16	110B	A		100A, MLO		CRITICAL	1 RACKS	0 60A/3P	1 30A/3P	1 20A/3P	1 25A/2P (1)	8 20A/1P	26 SPACES	42 TOTAL
16	110B	B		100A, MLO		NORMAL	1 RACKS	0 60A/3P	1 30A/3P	1 20A/3P	0 20A/2P	10 20A/1P	26 SPACES	42 TOTAL
45	170	A		100A, MLO		CRITICAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	1 25A/2P (1)	8 20A/1P	23 SPACES	42 TOTAL
45	170	B		100A, MLO		NORMAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	0 20A/2P	10 20A/1P	23 SPACES	42 TOTAL
45	173	A		100A, MLO		CRITICAL	1 RACKS	0 60A/3P	1 30A/3P	1 20A/3P	1 25A/2P (1)	8 20A/1P	26 SPACES	42 TOTAL
45	173	B		100A, MLO		NORMAL	1 RACKS	0 60A/3P	1 30A/3P	1 20A/3P	0 20A/2P	10 20A/1P	26 SPACES	42 TOTAL
45	268	A		100A, MLO		CRITICAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	1 25A/2P (1)	8 20A/1P	23 SPACES	42 TOTAL
45	268	B		100A, MLO		NORMAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	0 20A/2P	10 20A/1P	23 SPACES	42 TOTAL
45	272	A		100A, MLO		CRITICAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	1 25A/2P (1)	8 20A/1P	23 SPACES	42 TOTAL
45	272	B		100A, MLO		NORMAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	0 20A/2P	10 20A/1P	23 SPACES	42 TOTAL
49	166	A		100A, MLO		CRITICAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	1 25A/2P (1)	8 20A/1P	23 SPACES	42 TOTAL
49	166	B		100A, MLO		NORMAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	0 20A/2P	10 20A/1P	23 SPACES	42 TOTAL
136	32	A		100A, MLO		CRITICAL	1 RACKS	0 60A/3P	1 30A/3P	1 20A/3P	1 25A/2P (1)	8 20A/1P	26 SPACES	42 TOTAL
136	32	B		100A, MLO		NORMAL	1 RACKS	0 60A/3P	1 30A/3P	1 20A/3P	0 20A/2P	10 20A/1P	26 SPACES	42 TOTAL
142	12	A		100A, MLO		CRITICAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	1 25A/2P (1)	8 20A/1P	23 SPACES	42 TOTAL
142	12	B		100A, MLO		NORMAL	2 RACKS	0 60A/3P	1 30A/3P	2 20A/3P	0 20A/2P	10 20A/1P	23 SPACES	42 TOTAL

General Notes: A. Spaces as indicated in this schedule means unused circuit breaker mounting spaces. Spaces shall be provided with blank covers as indicated in paragraph 3.1.E.

Key Notes: (1) Circuit breaker for mini-split HVAC unit(s).

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.

B. National Electrical Manufacturers Association (NEMA):
   WD 1-99(R2015).....General Color Requirements for Wiring Devices
   WD 6-16 .....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):
   5-16.....Surface Metal Raceways and Fittings
   20-10.....General-Use Snap Switches
   231-16.....Power Outlets
   467-13.....Grounding and Bonding Equipment
   498-17.....Attachment Plugs and Receptacles
   943-16.....Ground-Fault Circuit-Interrupters
   1449-14.....Surge Protective Devices
   1472-15.....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 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 ivory 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. Bodies shall be red in color.
   b. 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.

D. Receptacles - 20, 30, and 50 ampere, 250 Volts: Shall be complete with appropriate cord grip plug.

2.2 TOGGLE SWITCHES

A. Toggle switches shall be totally enclosed tumbler type with nylon bodies. Handles shall be ivory 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.

2.4 WALL PLATES

A. Wall plates for switches and receptacles shall be type 302 stainless steel or smooth nylon. Oversize plates are not acceptable.
B. Color shall be ivory 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 or Wall plates shall be type 302 stainless steel, with the word “EMERGENCY” engraved in 6 mm (1/4 inch) red 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.

B. Twist Lock receptacles:

1. Twistlock receptacles male/female shall be 125volt 20 amp single phase configuration NEMA L5-20 or 120/208v 20amp 3 phase configuration NEMA L21-20 both area rated for NEMA 1.
2. Twist lock L5-20 receptacles shall be capable of being free hung with 3 conductor #12 SO type cable with basket style strain relief.
3. Twist lock L21-20 receptacles shall be capable of being wired with 5 conductors #12 SO type cable with basket style strain relief.
4. Twistlock male/female receptacles shall be listed by an approved testing laboratory.
5. Multiconductor SO type cable shall be as specified in Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLE.

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.

---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.

B. International Code Council (ICC):
   IBC-15.....International Building Code

C. National Electrical Manufacturers Association (NEMA):
   FU 1-12.....Low Voltage Cartridge Fuses
   KS 1-13.....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):

98-16.....Enclosed and Dead-Front Switches

248 1-11.....Low Voltage Fuses

489-13.....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.

2.4 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. Feeders: Class L, time delay Class RK1, time delay Class RK5, time delay Class J, time delay.

C. Other Branch Circuits: Class RK1, time delay Class RK5, time delay Class J, time delay.

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.

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SECTION 26 33 53
STATIC UNINTERRUPTIBLE POWER SUPPLY

PART 1 - - GENERAL DESCRIPTION

A. This section specifies the furnishing, installation, connection, and testing of the static uninterruptible power supply, indicated in this section as UPS.

1.2 RELATED WORK

A. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: 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.

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 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. 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. If 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 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. ational Fire Protection Association (NFPA):

70-23.....National Electrical Code (NEC)

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. System Capacity: Unless stated otherwise, the parameters listed are under full rated output load at a minimum of 0.9 power factor, with batteries fully charged and floating on the DC bus and with nominal input voltage. Overall 100 kVA, 100 kW, N+1 redundant, at 40 °C.

B. Battery Capacity: Discharge time to end voltage: 15 minutes, at 25 °C (77 °F). Battery shall be capable of delivering 125 percent of full rated output load at initial start-up.

C. System Bus Bracing: Braced for amperes symmetrical interrupting capacity as shown on drawings.

D. AC Input:

1. Voltage 208 volts line-to-line.
2. Number of phases: 3-phase, 4-wire, plus ground.
3. Voltage Range: Plus 10 percent, minus 15 percent, without affecting battery float voltage or output voltage.
4. Frequency: 60 Hz, plus or minus 5 percent.
5. Total harmonic current distortion (THD) reflected into the primary line: 5 percent maximum.

E. 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 percent.
6. Harmonic content (RMS voltage): 5 percent maximum total harmonic distortion with 100% nonlinear load.
7. Load power factor operating range: 1.0 to 0.8 lagging.
8. Phase displacement:
   a. Balanced load: Plus or minus 1 degree of bypass input.
9. Overload capability (at full voltage) (excluding battery):
   1) 125 percent load for 10 minutes.
   2) 150 percent load for 1 minute.

F. Voltage Transient Response:
   1. 100 percent load step: Plus or minus 5 percent.

2.2 UPS

A. General Description: UPS module shall consist of a rectifier/charger unit and a 3-phase inverter module unit with their associated transformers, synchronizing equipment, input and output circuit breakers, and accessories as required for operation.

B. 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.

C. 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.
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.

D. External Protection: UPS module shall have built-in self-protection against under voltage, 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.

E. 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.

2.3 STATIC BYPASS TRANSFER SWITCH

A. 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.

1. 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 disconnection shall be equipped with auxiliary contacts and provision for padlocking in either the "on" or "off" position.

2.4 SYSTEM CONTROL CABINET – MULTI-MODULE UPS

A. The UPS shall be provided with a LCD 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. The system control cabinet shall communicate with each UPS module, the static bypass transfer switch and its bypass disconnect, the UPS input and output circuit breakers, and the UPS maintenance bypass switchboard.

1. Module Meters:
   a. Meters shall have 1 percent accuracy.
   b. The following functions shall be monitored and displayed:
      1) Input voltage, phase-to-phase (all three phases).
      2) Input current, all three phases.
      3) Input frequency.
      4) Battery voltage.
      5) Battery current (charge/discharge).
      6) Output voltage, phase-to-phase and phase-to-neutral (all three phases).
      7) Output current, all three phases.
      8) Output frequency.
      9) Output kilowatts.
      10) Elapsed time meter to indicate hours of operation, 6 digits.
      11) Bypass voltage, phase-to-phase and phase-to-neutral (all three phases).
      12) Output kilovars.
      13) Output kilowatt hours, with 15-minute interval.
2. Module Controls:

a. Module shall have the following controls:
   1) Alarm test/reset function.
   2) Module input protective device trip function.
   3) Module output protective device trip function.
   4) Battery protective device trip function.
   5) Emergency Power off (EPO) pushbutton, with guard.
   6) Control power off switch.
   7) Static bypass transfer switch enable/disable selector switch.

3. Module Alarm Indicators:
   a. 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.
      1) Input AC power source failure.
      2) Input protective device open.
      3) Output protective device open.
      4) Overload.
      5) Overload shutdown.
      6) DC overvoltage.
      7) DC ground fault.
      8) Low battery.
      9) Battery discharged.
      10) Battery protective device open.
      11) Cooling fan failure.
      12) Equipment over temperature.
      13) Control power failure.
      14) Charger off.
      15) Inverter off.
      16) Emergency off.
      17) UPS on battery.
      18) Load on static bypass.
      19) Static bypass transfer switch disabled.
      20) Inverter output overvoltage, under voltage, over frequency, and under frequency.
      21) Bypass source overvoltage, under voltage, over frequency, and under frequency.
      22) Bypass source to inverter out of synchronization.

2.5 BATTERY SYSTEM

A. General: A storage battery with sufficient ampere-hour rating to maintain UPS output at full capacity for the specified duration shall be provided for each UPS module.

B. Battery Type: Lead calcium.

C. Battery Construction: The battery shall be of the valve-regulated, sealed, non-gassing, recombinant type.

D. 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.

E. Battery Cables: Battery-to-battery connections shall be stranded cable with proper cable supports.

F. Battery Disconnect: Each battery cabinet or rack shall have a fused disconnect switch or circuit breaker, lockable in the “off” position, provided in a NEMA 1 enclosure.

G. Electrolyte Spill Containment and Neutralization: Provide spill control and neutralization means integral to the battery cabinet or battery rack assembly. Provide spare neutralization materials in a manufacturer’s cabinet.

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.

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:

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. 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. At final inspection, an as-built one line diagram shall be laminated or mounted under acrylic glass, and installed in a frame mounted near the UPS.

B. 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.

C. 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 36 23
AUTOMATIC TRANSFER SWITCHES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, connection, and testing of open-transition automatic transfer switches with bypass isolation, indicated as automatic transfer switches or ATS 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 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 personal safety and to provide a low impedance path for possible ground fault currents.

D. Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS: Conduits.

E. Section 27 05 33, RACEWAYS AND BOXES FOR COMMUNICATION SYSTEMS: Raceways for communications cabling.

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. A factory-authorized representative shall be capable of providing emergency maintenance and repairs at the project site within 4 hours maximum of notification.

C. Automatic transfer switch, bypass/isolation switch, and annunciation control panels shall be products of the same manufacturer.

1.4 FACTORY TESTS

A. ATS 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. Perform visual inspection to verify that each ATS is as specified.

2. Perform mechanical test to verify that ATS sections are free of mechanical defects.
3. Perform insulation resistance test to ensure electrical integrity and continuity of entire system.
4. Perform main switch contact resistance test.
5. Perform electrical tests to verify complete system electrical operation.

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 voltage rating, continuous current rating, number of phases, withstand and closing rating, dimensions, weights, mounting details, conduit entry provisions, front view, side view, equipment and device arrangement, elementary and interconnection wiring diagrams, factory relay settings, and accessories.
   c. For automatic transfer switches that are networked together to a common means of annunciation and/or control, submit interconnection diagrams as well as site and building plans, showing connections for normal and emergency sources of power, load, control and annunciation components, and interconnecting communications paths. Equipment locations on the diagrams and plans shall match the site, building, and room designations on the drawings.
   d. Complete nameplate data, including manufacturer's name and catalog number.
   e. A copy of the markings that are to appear on the automatic transfer switches when installed.
   f. Certification from the manufacturer that representative ATS 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) Schematic signal and control diagrams, with all terminals identified, matching terminal identification in the automatic transfer switches.
      2) Include information for testing, repair, troubleshooting, assembly, disassembly, and factory recommended/required periodic maintenance procedures and frequency.
      3) Provide a replacement and spare parts list. Include a list of tools and instruments for testing and maintenance purposes.
   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. Certifications:
   a. When submitting the shop drawings, submit a certified test report from a recognized independent testing laboratory that a representative sample has passed UL 1008 prototype testing.
   b. Two weeks prior to final inspection, submit the following.
      1) Certification by the manufacturer that the ATS conform to the requirements of the drawings and specifications.
      2) Certification by the Contractor that transfer switches have 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 designation only.

B. Institute of Electrical and Electronic Engineers (IEEE):

446-95.....Emergency and Standby Power Systems for Industrial and Commercial Applications

C37.90.1-12.....Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus

C62.41.1-02.....Guide on the Surges Environment in Low-Voltage (1000 V and Less) AC Power Circuits

C62.41.2-02.....Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits

C. International Code Council (ICC):

IBC-18.....International Building Code

D. National Electrical Manufacturers Association (NEMA):

250-20.....Enclosures for Electrical Equipment (1000 Volts Maximum)

ICS 6-93.....Enclosures

ICS 4-15.....Application Guideline for Terminal Blocks

MG 1-21.....Motors and Generators

E. National Fire Protection Association (NFPA):

70-23.....National Electrical Code (NEC)

99-21.....Health Care Facilities

110-22.....Emergency and Standby Power Systems

F. Underwriters Laboratories, Inc. (UL):

50-15.....Enclosures for Electrical Equipment

508-18.....Industrial Control Equipment

891-19.....Switchboards

1008-14.....Transfer Switch Equipment

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Automatic transfer switches shall comply with IEEE, NEMA, NFPA, UL, and have the following features:

1. Automatic transfer switches shall be open transition switches, 3-pole, draw-out construction, electrically operated, mechanically held open contact type, without integral overcurrent protection. Automatic transfer switches utilizing automatic or non-automatic

molded case circuit breakers, insulated case circuit breakers, or power circuit breakers as switching mechanisms are not acceptable.

2. Automatic transfer switches shall be completely factory-assembled and wired such that only external circuit connections are required in the field.
3. Each automatic transfer switch shall be equipped with an integral bypass/isolation switch.
4. Ratings:
   a. Phases, voltage, continuous current, poles, and withstand and closing ratings shall be as shown on the drawings.
   b. Transfer switches are to be rated for continuous duty at specified continuous current rating on 60Hz systems.
   c. Maximum automatic transfer switch rating: 800 A.
5. Markings:
   a. Markings shall be in accordance with UL 1008.
6. Tests:
   a. Automatic transfer switches shall be tested in accordance with UL 1008. The contacts of the transfer switch shall not weld during the performance of withstand and closing tests when used with the upstream overcurrent device and available fault current specified.
7. Surge Withstand Test:
   a. Automatic transfer switches utilizing solid-state devices in sensing, relaying, operating, or communication equipment or circuits shall comply with IEEE C37.90.1.
8. Housing:
   a. Enclose automatic transfer switches in wall- or floor-mounted steel cabinets, with metal gauge not less than No. 14, in accordance with UL 508, or in a switchboard assembly in accordance with UL 891, as shown on the drawings.
   b. Enclosure shall be constructed so that personnel are protected from energized bypass-isolation components during automatic transfer switch maintenance.
   c. Automatic transfer switch components shall be removable without disconnecting external source or load power conductors.

d. Finish: Cabinets shall be given a phosphate treatment, painted with rust-inhibiting primer, and finish-painted with the manufacturer's standard enamel or lacquer finish.
e. Viewing Ports: Provide viewing ports so that contacts may be inspected without disassembly.

9. Operating Mechanism:
   a. Actuated by an electrical operator.
   b. Electrically and mechanically interlocked so that the main contact cannot be closed simultaneously in either normal and emergency position.
   c. Normal and emergency main contacts shall be mechanically locked in position by the operating linkage upon completion of transfer. Release of the locking mechanism shall be possible only by normal operating action.
   d. Contact transfer time shall not exceed six cycles.
   e. Operating mechanism components and mechanical interlocks shall be insulated or grounded.
10. Contacts:
   a. Main contacts: Silver alloy.
   b. Neutral contacts: N/A
   c. Current carrying capacity of arcing contacts shall not be used in the determination of the automatic transfer switch rating, and shall be separate from the main contacts.
   d. Main and arcing contacts shall be visible for inspection with cabinet door open and barrier covers removed.
11. Manual Operator:
   a. Capable of operation by one person in either direction under no load.
12. Replaceable Parts:
   a. Include the main and arcing contacts individually or as units, as well as relays, and control devices.
   b. Automatic transfer switch contacts and accessories shall be replaceable from the front without removing the switch from the cabinet and without removing main conductors.
13. Sensing Features:
   a. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be

adjustable from 85 to 100% of nominal, and dropout voltage is adjustable from 75 to 98% of pickup value. Factory set for pickup at 90% and dropout at 85%.

b. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.

c. Voltage/Frequency Lockout Relay: Prevent premature transfer to the engine-generator. Pickup voltage shall be adjustable from 85 to 100% of nominal. Factory set for pickup at 90%. Pickup frequency shall be adjustable from 90 to 100% of nominal. Factory set for pickup at 95%.

d. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.

e. Test Switch: Simulate normal-source failure.

f. Switch-Position Indication: Indicate source to which load is connected.

g. Source-Available Indication: Supervise sources via transfer switch normal- and emergency-source sensing circuits.

h. Normal Power Indication: Indicate "Normal Source Available."

i. Emergency Power Indication: Indicate "Emergency Source Available."

j. Transfer Override Control: Overrides automatic retransfer control so that automatic transfer switch shall remain connected to emergency power source regardless of condition of normal source. Control panel shall indicate override status.

k. Engine Starting Contacts: One isolated and normally closed and one isolated and normally open; rated 5 A at 30 V DC minimum.

l. Engine Shutdown Contacts: Time delay adjustable from zero to 15 minutes, and factory set for 5 minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.

m. Engine-Generator Exerciser: Programmable exerciser starts engine-generator(s) and transfers load to them from normal source for a preset time, then retransfers and shuts down engine-generator(s) after a preset cool-down period. Initiates exercise cycle at

preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings shall be for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period.

14. Controls:
    a. Controls shall provide indication of switch status and be equipped with alarm diagnostics.
    b. Controls shall control operation of the automatic transfer switches.
15. Factory Wiring: Train and bundle factory wiring and label either by color-code or by numbered/lettered wire markers. Labels shall match those on the shop drawings.
16. Annunciation, Control, and Programming Interface Components: Devices for communicating with remote programming devices, annunciators, or control panels shall have open-protocol communication capability matched with remote device.

2.2 BYPASS-ISOLATION SWITCH

A. Provide each automatic transfer switch with two-way bypass-isolation manual type switch. The bypass-isolation switch shall permit load by-pass to either normal or emergency power source and complete isolation of the automatic transfer switch, independent of transfer switch position. Bypass and isolation shall be possible under all conditions including when the automatic transfer switch is removed from service.

B. Operation: The bypass-isolation switch shall have provisions for operation by one person through the movement of a maximum of two handles at a common dead front panel in no more than 15 seconds. Provide a lock, which must energize to unlock the bypass switch, to prevent bypassing to a dead source. Provide means to prevent simultaneous connection between normal and emergency sources.
    1. Bypass to normal (or emergency): Operation of bypass handle shall allow direct connection of the load to the normal (or emergency) source, without load interruption or by using a break-before-make design, or provide separate load interrupter contacts to momentarily interrupt the load.
        a. Ensure continuity of auxiliary circuits necessary for proper operation of the system.

b. A red indicating lamp shall light when the automatic transfer switch is bypassed.
c. Bypassing source to source: If the power source is lost while in the bypass position, bypass to the alternate source shall be achievable without re-energization of the automatic transfer switch service and load connections.

2. Isolation: Operation of the isolating handle shall isolate all live power conductors to the automatic transfer switch without interruption of the load.
   a. Interlocking: Provide interlocking as part of the bypass-isolation switch to eliminate personnel-controlled sequence of operation, and to prevent operation to the isolation position until the bypass function has been completed.
   b. Padlocking: Include provisions to padlock the isolating handle in the isolated position.
   c. Visual verification: The isolation blades shall be visible in the isolated position.
3. Testing: It shall be possible to test (normal electrical operation) the automatic transfer switch and engine-generator(s) with the isolation contacts closed and the load bypassed without interruption of power to the load.

C. Ratings: The electrical capabilities and ratings of the bypass-isolation switch shall be compatible with those of the associated automatic transfer switch, including any required additional withstand tests.

2.3 REMOTE ANNUNCIATOR SYSTEM

A. Remote annunciator panel shall annunciate conditions for indicated automatic transfer switches. Annunciation shall include the following:
   1. Sources available, as defined by actual pickup and dropout settings of automatic transfer switch controls.
   2. Switch position.
   3. Switch in test mode.
   4. Failure of communication link.

B. Remote annunciator panel shall be visual and audible type with LED display panel, audible signal, and silencing switch.

1. Panel shall indicate each automatic transfer switch monitored, the location of automatic transfer switch, and the identity of load it serves.
2. Mounting: Steel cabinet, flush or surface mounted, as shown on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install automatic transfer switches and associated remote components in accordance with the NEC, as shown on the drawings, and manufacturer’s instructions.

B. Anchor automatic transfer switches with rustproof bolts, nuts, and washers not less than 12 mm (1/2 inch) diameter, in accordance with manufacturer’s instructions, and as shown on drawings.

C. In seismic areas, automatic transfer switches shall be adequately anchored and braced per details on structural contract drawings to withstand the seismic forces at the location where installed.

D. Anchor annunciator panel to wall.

3.2 ACCEPTANCE CHECKS AND TESTS

A. An authorized representative of the automatic transfer switch 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:
   a. Compare equipment nameplate data with specifications and approved shop drawings.
   b. Inspect physical, electrical, and mechanical condition.
   c. Confirm correct application of manufacturer's recommended lubricants.
   d. Verify appropriate anchorage, required area clearances, and correct alignment.
   e. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey after energization.

f. Verify grounding connections.

g. Verify ratings of sensors.

h. Vacuum-clean enclosure interior. Clean enclosure exterior.

i. Exercise all active components.

j. Verify that manual transfer warning signs are properly placed.

k. Verify the correct operation of all sensing devices, alarms, and indicating devices.

2. Electrical tests:

a. Perform insulation-resistance tests.

b. After energizing circuits, demonstrate the interlocking sequence and operational function for each automatic transfer switch at least three times.

1) Test bypass-isolation unit functional modes and related automatic transfer switch operations.

2) Power failure of normal source shall be simulated by opening upstream protective device. This test shall be performed a minimum of five times.

3) Power failure of emergency source with normal source available shall be simulated by opening upstream protective device for emergency source. This test shall be performed a minimum of five times.

4) Low phase-to-ground voltage shall be simulated for each phase of normal source.

5) Operation and settings shall be verified for specified automatic transfer switch operational feature, such as override time delay, transfer time delay, return time delay, engine shutdown time delay, exerciser, auxiliary contacts, and supplemental features.

6) Verify pickup and dropout voltages by data readout or inspection of control settings.

7) Verify that bypass and isolation functions perform correctly, including the physical removal of the automatic transfer switch while in bypass mode.

c. When any defects are detected, correct the defects and repeat the tests as requested by the COR at no additional cost to the Government.

3.3 FIELD SETTINGS VERIFICATION

A. The automatic transfer switch settings shall be verified in the field by an authorized representative of the manufacturer.

3.4 FOLLOW-UP VERIFICATION

A. Upon completion of acceptance checks and tests, the Contractor shall show by demonstration in service that the automatic transfer switches are in good operating condition and properly performing the intended function.

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 automatic transfer switches, 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.

B. Institute of Engineering and Electronic Engineers (IEEE):

IEEE C62.41.2-02.....Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits

IEEE C62.45-08.....Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits

C. National Fire Protection Association (NFPA):

70-23.....National Electrical Code (NEC)

D. Underwriters Laboratories, Inc. (UL):

UL 1283-17.....Electromagnetic Interference Filters

UL 1449-21.....Surge Protective Devices

PART 2 - PRODUCTS

2.1 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.

2.2 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.

---END---

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.

B. American Society for Testing and Materials (ASTM):
C635/C635M REV A-13.....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-79-08.....Electrical and Photometric Measurements of Solid-State Lighting Products
   LM-80-15.....Measuring Lumen Maintenance of LED Light Sources
   LM-82-12.....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):
   C62.41-91(R1995).....Surge Voltages in Low Voltage AC Power Circuits
G. International Code Council (ICC):
   IBC-15.....International Building Code
H. National Electrical Manufacturer's Association (NEMA):
   SSL 1-16.....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):
   924-16.....Emergency Lighting and Power Equipment
   1598-08.....Luminaires
   2108-15.....Low-Voltage Lighting Systems
   8750-15.....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. LED lamps and drivers shall be serviceable while the fixture is in its normally installed position. LED Lamps and drivers shall not be mounted to removable reflectors or wireway covers unless so specified.

D. Recessed fixtures mounted in an insulated ceiling shall be listed for use in insulated ceilings.

E. Mechanical Safety: Lighting fixture closures (lens doors, trim frame, hinged housings and so forth) 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.

F. 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.

G. Lighting fixtures shall have a specific means for grounding metallic wireways and housings to an equipment grounding conductor.

H. Light Transmitting Components for LED 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.

2.3 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 and color temperature 3000˚ K unless otherwise specified in LIGHTING FIXTURE SCHEDULE.
   c. Minimum Rated Life: 50,000 hours per IES L70.
   d. Light output lumens as indicated in the LIGHTING FIXTURE SCHEDULE.

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 shall 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. 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 shall 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 shall 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.
5. Single or double pendant-mounted or chain hung lighting fixtures:

a. Each stem for pendent mounting 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.

b. Chain hung fixtures shall be securely mounted directly to the ceiling or to an outlet box cover. Fixture or lighting chains shall be listed for use. Power for fixtures shall be through cord and twist lock plug via a junction box. Cord and plug shall not carry the weight of the fixture.

6. 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, and so forth), 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 Contracting Officer Representative (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.

---END---

SECTION 27 05 11
REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section includes common requirements for communications installations and applies to all sections of Division 27.

B. Provide completely functioning communications systems.

C. Comply with VAAR 852.236-71 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
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. 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.

8. 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.
9. 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.
10. Electrostatic Interference (ESI) or Electrostatic Discharge Interference: Refer to EMI and RFI.
11. 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.
12. 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.
13. Grounding Electrode Conductor: (GEC) Conductor connected to earth grounding electrode.
14. Grounding Electrode System: Electrodes through which an effective connection to earth is established, including supplementary, communications system grounding electrodes and GEC.
15. Grounding Equalizer or Backbone Bonding Conductor (BBC): Conductor that interconnects elements of telecommunications grounding infrastructure.
16. 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.
17. Microducts: All forms of air blown fiber pathways.

18. Ohm: A unit of restive measurement.
19. Received Signal Strength Indication (RSSI): A measurement of power present in a received RF signal.
20. Service Provider Demarcation Point (SPDP): Not owned by LEC or service provider but designated by Government as point within facility considered the DEMARC.
21. Sound (SND): Changing air pressure to audible signals over given time span.
22. System: Specific hardware, firmware, and software, functioning together as a unit, performing task for which it was designed.
23. 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.
24. 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.
25. 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.

B. Government Codes, Standards and Executive Orders: Refer to

1. US Department of Commerce/National Institute of Standards Technology,(NIST):

   FIPS PUB 140-3.....Telecommunications Information Security Algorithms

   FIPS 197.....Advanced Encryption Standard (AES)

   FIPS 199.....Standards for Security Categorization of Federal Information and Information Systems

2. 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)

3. US Department of Health and Human Services:

   The Health Insurance Portability and Accountability Act of 1996 (HIPAA) Privacy, Security and Breach Notification Rules

4. US Department of Justice:

   2010 Americans with Disabilities Act Standards for Accessible Design (ADAAD).

5. 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

6. 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):

1-2023.....Flexible Metal Conduit
5-2022.....Surface Metal Raceway and Fittings
6-2022.....Rigid Metal Conduit
44-2021 .....Thermoset-Insulated Wires and Cables
50-2024.....Enclosures for Electrical Equipment
83-2020.....Thermoplastic-Insulated Wires and Cables
360-2024.....Liquid-Tight Flexible Steel Conduit
444-2023.....Communications Cables
467-2022.....Grounding and Bonding Equipment
486A-486B-2023.....Wire Connectors
486C-2023.....Splicing Wire Connectors
486D-2023.....Sealed Wire Connector Systems
486E-2024.....Standard for Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
493-2023.....Thermoplastic-Insulated Underground Feeder and Branch Circuit Cable
497-2022.....Protectors for Paired Conductors
497A-2019.....Secondary protectors for Communications Circuits

497B-2022.....Protectors for Data Communications and Fire-Alarm Circuits
497C-2022.....Protectors for Coaxial Communications Circuits
497D-2007.....Component Secondary Protectors for Communications Circuits Used with Specified Voltage Suppression
510-2024.....Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape
514A-2024.....Metallic Outlet Boxes
514B-2024.....Fittings for Cable and Conduit
514C-2024.....Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers
651-2022.....Schedule 40 and 80 Rigid PVC Conduit
651A-2024.....Type EB and A Rigid PVC Conduit and HDPE Conduit
723-2023.....Test for Surface Burning Characteristics of Building Materials
797-2023.....Electrical Metallic Tubing
970-2024.....Retail Fixtures and Merchandise Displays
1242-2022.....Intermediate Metal Conduit
1449-2022.....Standard for Transient Voltage Surge Suppressors
1479-2024.....Fire Tests of Through-Penetration Fire Stops
1666-2021.....Standard for Wire/Cable Vertical (Riser) Tray Flame Tests
1685-2020.....Vertical Tray Fire Protection and Smoke Release Test for Electrical and Fiber Optic Cables
1861-2024.....Outline of Investigation for Power-Operated Chemical Pumps and Compressors
1863-2019.....Standard for Safety, communications Circuits Accessories
2024-2021.....Standard for Cable Routing Assemblies and Communications Raceways
2196-2020.....Standard for Test of Fire Resistive Cable
60950-1 ed. 2-2019...Information Technology Equipment Safety

D. Industry Standards:

1. American Institute of Architects (AIA): 2006 Guidelines for Design & Construction of Health Care Facilities.
2. American Society for Testing and Materials (ASTM):
   B1 (2018).....Standard Specification for Hard-Drawn Copper Wire
   B8 (2023).....Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
   D1557 (2021).....Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort 56,000 ft-lbf/ft3 (2,700 kN-m/m3)
   D2301 (2024).....Standard Specification for Vinyl Chloride Plastic Pressure Sensitive Electrical Insulating Tape
   B258 (2018).....Standard Specification for Standard Nominal Diameters and Cross-Sectional Areas of AWG Sizes of Solid Round Wires Used as Electrical Conductors
   D709(2017).....Standard Specification for Laminated Thermosetting Materials
   D4566 (2020).....Standard Test Methods for Electrical Performance Properties of Insulations and Jackets for Telecommunications Wire and Cable
3. Building Industry Consulting Service International(BICSI):
   004-2018.....Information Technology Systems Design and Implementation Best Practices for Healthcare Institutions and Facilities
   607-2011.....Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
   005-2016 .....Electronic Safety and Security (ESS) System Design and Implementation Best Practices
   007-2020 .....Standards for Intelligent Buildings
4. Electronic Components Assemblies and Materials Association,(ECA).
   RS-270-1973.....Tools, Crimping, Solderless Wiring Devices – Recommended Procedures for User Certification
   310-E-2005.....Cabinets, and Associated Equipment

5. Facility Guidelines Institute: 2010 Guidelines for Design and Construction of Health Care Facilities.
6. Insulated Cable Engineers Association (ICEA):
   S-84-608-2021.....Telecommunications Cable, Filled Polyolefin Insulated Copper Conductor,
   S-87-640-2011.....Optical Fiber Outside Plant Communications Cable
   S-90-661-2021.....Category 3, 5, & 5e Individually Unshielded Twisted-Pair Indoor Cable for Use in General Purpose and LAN Communication Wiring Systems
   S-130-760-2021.....Broadband Twisted Pair Cable Aircore, Polyolefin Insulated, Copper Conductors
   S-99-689-2012.....Broadband Twisted Pair Cable Filled, Polyolefin Insulated, Copper Conductors
   S-116-732-2024.....Standard for Category 6 and 6A, 100 Ohm, Individually Unshielded Twisted Pairs, Indoor Cables (With or Without an Overall Shield) for use in LAN Communication Wiring Systems
7. 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
   C62.41.2-2002(c2012)
   Cor 1-2012 .....Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits 4)
   C62.45-2002.....IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits
   81-2012.....Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System
   1100-2005.....IEEE Recommended Practice for Powering and Grounding Electronic Equipment
8. International Code Council:
   AC193-2020.....Mechanical Anchors in Concrete Elements

9. International Organization for Standardization (ISO):

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

10. National Electrical Manufacturers Association (NEMA):

250-2020.....Enclosures for Electrical Equipment (1,000V Maximum)

C62.61-1993.....American National Standard for Gas Tube Surge Arresters on Wire Line Telephone Circuits

FB 1-2014.....Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing EMT) and Cable

OS 1-2020.....Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports

TC 3-2021.....Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing

BI 50016-2024.....Cable Tray Installation Guidelines

11. National Fire Protection Association (NFPA):

70E-2024.....Standard for Electrical Safety in the Workplace

70-2023.....National Electrical Code (NEC)

72-2025.....National Fire Alarm Code

75-2024.....Standard for the Fire Protection of Information Technological Equipment

76-2024.....Recommended Practice for the Fire Protection of Telecommunications Facilities

77-2024.....Recommended Practice on Static Electricity

90A-2024.....Standard for the Installation of Air Conditioning and Ventilating Systems

99-2024.....Health Care Facilities Code

101-2024.....Life Safety Code

241-2022.....Safeguarding construction, alternation and Demolition Operations

262 - 2023.....Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces

780-2023.....Standard for the Installation of Lightning Protection Systems

1221-2019.....Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems

5000-2024.....Building Construction and Safety Code

12. Society for Protective Coatings (SSPC):

SP 6/NACE No.3-2007..Commercial Blast Cleaning

13. Society of Cable Telecommunications Engineers (SCTE):

15-2022 .....Specification for Trunk, Feeder and Distribution Coaxial Cable

14. Telecommunications Industry Association (TIA):

120 Series.....Telecommunications Land Mobile communications (APCO/Project 25) (January 2014)

155-A.....Guidelines for the Assessment and Mitigation of Installed Category 6 Cabling to Support 10GBASE-T

TSB-162-B.....Telecommunications Cabling Guidelines for Wireless Access Points

423-B.....Electrical Characteristics of Unbalanced Voltage Digital Interface Circuits

455-C.....General Requirements for Standard Test Procedures for Optical Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices, and other Fiber Optic Components

455-61-A.....FOTP-61 Measurement of Fiber of Cable Attenuation Using an OTDR

472D000-B.....Fiber Optic Communications Cable for Outside Plant Use

492AAAA .....62.5-µ Core Diameter/125-um Cladding Diameter Class 1a Graded-Index Multimode Optical Fibers

492AAAB .....50-um Core Diameter/125-um Cladding Diameter Class IA Graded-Index Multimode Optically Optimized American Standard Fibers

492CAAA.....Detail Specification for Class IVa Dispersion- Unshifted Single-Mode Optical Fibers

492E000.....Sectional Specification for Class IVd Nonzero-Dispersion Single-Mode Optical Fibers for the 1,550 nm Window

526-7-B.....Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant – OFSTP-7

526.14-A.....Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant – SFSTP-14

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

569.....Revision/Edition C Telecommunications Pathways and Spaces

574.....Position Non-Synchronous Interface between Data Terminal equipment and Data Circuit Terminating Equipment Employing Serial Binary Interchange

590-A.....Standard for Physical Location and Protection of Below Ground Fiber Optic Cable Plant

598-D.....Optical Fiber Cable Color Coding

604-10-C.....Fiber Optic Connector Intermateablility Standard

606-D.....Administration Standard for Telecommunications Infrastructure

607-E.....Generic Telecommunications Bonding and Grounding (Earthing) For Customer Premises

613.....High Speed Serial Interface for Data Terminal Equipment and Data Circuit Terminal Equipment

758-B.....Customer-owned Outside Plant Telecommunications Infrastructure Standard

854.....A Full Duplex Ethernet Specification for 1000 Mb/s (1000BASE-TX) Operating over Category 6 Balanced Twisted-Pair Cabling

862-A.....Structured Cabling Infrastructure Standard for Intelligent Building Systems

942-C.....Telecommunications Infrastructure Standard for Data Centers

1152-A.....Requirements for Field Testing Instruments and Measurements for Balanced Twisted Pair Cabling

1179.....Healthcare Facility Telecommunications Infrastructure Standard

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. Field Cutting and Patching: Section 09 91 00, PAINTING.

B. Additional submittal requirements: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

C. Availability and source of references and standards specified in applicable publications: Section 01 42 19, REFERENCE STANDARDS.

D. Control of environmental pollution and damage for air, water, and land resources: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

E. Requirements for non-hazardous building construction and demolition waste: Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.

F. 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.

G. Sealant and caulking materials and their application: Section 07 92 00, JOINT SEALANTS.

H. Underground ducts, raceways, precast manholes and pull boxes: Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION.

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.
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.
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. 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 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:
      a. ANSI/TIA-1152 Level IIIe twisted pair cabling test instrument.
      b. Optical time domain reflectometer (OTDR).

3. Supply only test equipment with a calibration tag from Government-accepted calibration service dated not more than 12 months prior to test.
4. 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:
a. Telecommunications rooms.
2. Logical Drawings: Provide logical riser or schematic drawings for all systems.
a. Provide riser diagrams systems and interconnection drawings for equipment assemblies; show termination points and identify wiring connections.
3. 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:
   a. Approved shop drawing for each item of equipment.
   b. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of equipment.
   c. A control sequence describing start-up, operation, and shutdown.
   d. Description of function of each principal item of equipment.
   e. Installation and maintenance instructions.
   f. Safety precautions.
   g. Diagrams and illustrations.
   h. Test Results and testing methods.
   i. Performance data.
   j. 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.
   k. Warranty documentation indicating end date and equipment protected under warranty.
   l. 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:
   a. Final room numbers and actual backbone cabling and pathway locations and labeling.
   b. Inputs and outputs of equipment identified according to labels installed on cables and equipment
   c. Device locations with labels.
   d. Conduit.
   e. Head-end equipment.
   f. Wiring diagram.
   g. Labeling and administration documentation.
5. Submit Record Wiring Diagrams within five business days after final cable testing.
6. Deliver Record Wiring Diagrams as CAD files in .dwg formats as determined by COR.
7. 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:
      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.

4. 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:
   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.

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.

PART 2 - PRODUCTS

Not Used.

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.
   a. Fill spaces in openings after installation of conduit or cable.
   b. Provide fill for floor penetrations to prevent passage of water, smoke, fire, and fumes.
   c. Provide fire resistant fill in rated floors and walls, to prevent passage of air, smoke and fumes.
7. Install sleeves through floors watertight and extend minimum 50.8 mm (2 inches) above floor surface.
8. Match and set sleeves flush with adjoining floor, ceiling, and wall finishes where raceways passing through openings are exposed in finished rooms.
9. Annular space between conduit and sleeve must be minimum 6 mm (1/4 inch).
10. Do not provide sleeves for slabs-on-grade, unless specified or indicated otherwise.

11. Comply with requirements for firestopping, for sleeves through rated fire walls and smoke partitions.
12. Do not support piping risers or conduit on sleeves.
13. Identify unused sleeves and slots for future installation.
14. 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.
   a. Verify materials, equipment, and utilities to be removed are inactive, not required, or in use after completion of project.
   b. Replace with equivalent any material, equipment and utilities that were removed by contractor that are required to be left in place.
2. 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:
   a. Notify COR in writing at least 14 days in advance of proposed utility interruptions.
   b. 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 16, COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES for communication equipment cabinet assembly.
3. Refer to Section 27 05 53, IDENTIFICATION FOR COMMUNICATIONS SYSTEMS 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. Remove and replace defective work.
3. Remove and replace non-conforming work.

B. Provide and maintain temporary partitions or dust barriers adequate to prevent spread of dust and dirt to adjacent areas.

C. Protect adjacent installations during cutting and patching operations.

D. Protect structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

E. 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 852.236-71 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. Test horizontal cabling using approved level IIIe certification tester for Category 6a performance compliance in accordance with ANSI/TIA-1152-A. Basic tests quired:
   a. Wire map.
   b. Length (feet).
   c. Insertion loss (dB).
   d. NEXT (dB).
   e. Return loss (dB).
8. Review entire communications circulating ground system, each TGB and grounding connection, grounding electrode and outside lightning protection system.
9. Review cable tray, conduit and path/wire way installation practice.
10. OEM and contractor to perform:
    a. Fiber optical cable field inspection tests via attenuation measurements on factory reels; provide results along with OEM certification for factory reel tests.
    b. Coaxial cable field inspection tests via attenuation measurements on factory reels; provide results along with OEM certification for factory reel tests.
    c. Baseband cable field inspection tests via attenuation measurements on factory reels and provide results along with OEM certification for factory reel tests.

11. 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.
12. Provide results of interim inspections to COR.
13. If major or multiple deficiencies are discovered, additional interim inspections could be required until deficiencies are corrected, before permitting further system installation.
    a. Additional inspections are scheduled at direction of COR.
    b. Re-inspection of deficiencies noted during interim inspections, must be part of system's Final Acceptance Proof of Performance Test.
    c. The interim inspection cannot affect the system's completion date unless directed by COR.
14. 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:
    a. Verify systems are fully operational and meet performance requirements, utilizing accepted test equipment and spectrum analyzer.
    b. 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.
2. Measure and record signal, aural and control carrier levels of each data channel, at each of the following minimum points in system:
    a. TR interconnections.
    b. Main Computer Room/Data Center.
    c. Others as required by AHJ (SMCS 005OP2H3).
3. 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:
   a. COR.
   b. OEM representatives.
   c. VACO:
      1) CFM representative.
      2) AHJ-SMCS 005OP2H3, (202)461-5310.
   d. VISN-CIO, Network Officer and VISN representatives.
   e. 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.
   f. Local Community Safety Personnel:
      1) Fire Marshal representative.
      2) Disaster Coordinator representative.
      3) EMS Representatives: Police, Sherriff, City, County or State representatives.
4. Test system utilizing accepted test equipment to certify proof of performance and Life and Public Safety compliance, FCC, NRTL, NFPA and OSHA compliance.
   a. 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: VACO AHJ representative (SMCS 005OP2H3) 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:
   a. Without Acceptance: Until system fully meets conditions of construction documents, system’s ownership, use, operation and warranty commences at Government’s final acceptance date.
   b. 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.
   c. 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.

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SECTION 27 05 26
GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies grounding and bonding requirements of communications installations based on the requirements of ANSI/TIA-607-E, 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. Telecommunications Bonding Conductors.
3. Joining Requirements.
4. Overvoltage Surge Protectors.

1.3 REFERENCES

A. VA Infrastructure Standard for Telecommunications Spaces.

B. ANSI/TIA-607-E, 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 11, 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.

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. NEMA S hole pattern.

C. Primary Bonding Busbar (PBB). The PBB is a dedicated extension of the building grounding electrode system for the telecommunications infrastructure. The PBB may 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 16” length.
7. B.O.D. Burndy CB14416S.

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 4” 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.
   5. B.O.D. Burndy CB14212S.

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.
   4. B.O.D. PDU Cables GBP-RGB-H19-01-KIT.

2.2 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-E 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.

2.3 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-E. 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.
4. 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.
5. 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.
4. 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.)
5. 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.

6. 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.

D. 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.

2.4 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.

B. Compliance. Protectors shall be compliant with UL 497 and/or UL 497A, as applicable.

C. Performance. Protectors shall be rated to support copper UTP performance Category 5e at 100MHz.

D. 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.

E. Construction. Provide protection for each pair.

F. Termination shall be insulation-displacement contact.

G. 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-E. 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.

---END---

SECTION 27 05 33
RACEWAYS AND BOXES FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies conduit, fittings, and boxes to form complete, coordinated, raceway systems. Raceways are required for communications cabling unless shown or specified otherwise.

1.2 RELATED WORK

A. Bedding of conduits: Section 31 20 00, EARTH MOVING.

B. Mounting board for Telecommunication Rooms: Section 06 10 00, ROUGH CARPENTRY.

C. Sealing around penetrations to maintain integrity of fire rated construction: Section 07 84 00, FIRESTOPPING.

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 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS, 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. Provide coordination drawings, coordinate with mechanical, plumbing, sprinkler and electrical contractors.

C. 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 Intermediate Steel Conduit (IMC): Conform to UL 1242, ANSI C80.6.
3. 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.
4. Flexible Galvanized Steel Conduit: Conform to UL 1.
5. Liquid-tight Flexible Metal Conduit: Conform to UL 360.
6. Direct Burial Plastic Conduit: Conform to UL 651 and UL 651A, heavy wall PVC, or high-density polyethylene (HDPE).
7. 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. Tightening of set screws with pliers is prohibited.

g. Provide OEM approved fittings.

2. 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. Diecast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are not permitted.

e. Provide OEM approved fittings.

3. 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.

4. 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.

5. Direct Burial Plastic Conduit Fittings: Provide fittings meeting requirements of UL 514C and NEMA TC3, and as recommended by conduit manufacturer. Provide transition from PVC to IMC or Rigid conduit indoor above 3 inches of floor.

6. Surface Metal Raceway: Conform to UL 5 and "telecommunications service" rated with approved length-way partitions and cable straps to prevent wires and cables from changing from one partitioned pathway to another.
7. Surface Metal Raceway Fittings: As recommended by raceway manufacturer.
8. 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.
9. Wireway Fittings: As recommended by wireway OEM.

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.
6. All communications outlets shall be 4-11/16 inch boxes with a minimum of 2-1/2-inch-deep with single or two gang 3/4 mud ring as shown on the drawings.

F. Wireways: Equip with hinged covers, except where removable covers are shown.

G. Warning Tape: Detectable, 4-Mil (ASTM D1593) polyethylene 51 mm (2 inch) wide tape detectable type, red with black letters, and imprinted with “CAUTION BURIED COMMUNICATIONS CABLE BELOW”.

H. Flexible Nonmetallic Communications Raceway (Innerduct) and Fittings:

1. General: Provide UL 910 listed plenum, riser, and general purpose corrugated pliable communications raceway for optical fiber cables and communications cable applications; select in accordance with provisions of NEC Articles 770 and 800.
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 interduct 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; one piece runs from ENTR to MH; MH to MH; DEMARC to MCR/TER; TR to TR. Innerduct connectors are not permitted between rooms.

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.

I. Outlet Boxes:

1. Flush wall mounted minimum 11.9 cm (4-11/16 inches) square, 9.2 cm (3-5/8 inches) deep pressed galvanized steel with single or double gang ¾ mud ring.
2. Flush wall mounted 12.7 cm (5 inches) square x 7.3 cm (2-7/8 inches); deep pressed galvanized steel.
3. 2-Gang Tile Box:
   a. Flush backbox type for installation in block walls.
   b. Minimum 92 mm (3-5/8 inches) deep.

J. 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.

2.2 COMMUNICATIONS HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND COMMUNICATIONS WIRING

A. Description: Comply with ANSI/SCTE 77.

B. Color of Frame and Cover: Gray.

C. Configuration: Units shall be designed for flush burial and have closed bottom, unless otherwise indicated.

D. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.

E. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

F. Cover Legend: Molded lettering, as indicated for each service. “SIGNAL” or “COMMUNICATIONS”

G. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

H. Handholes 750 mm wide by 1050 mm long and 1200 mm deep (30 inches wide by 42 inches long and 48 inches deep) shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

I. Structure Load

J. Light Duty = Pedestrian traffic only.

K. Tier 5 = Sidewalk applications.

L. Tier 8 = Sidewalk applications with safety factor for non-deliberate vehicular traffic.

M. Tier 15 = Driveways, parking lots, and off roadway applications subject to occasional non-deliberate heavy vehicular traffic.

N. Tier 22 = Driveways, parking lots, and off roadway applications subject to occasional non-deliberate heavy vehicular traffic.

O. 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.

P. 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.

Q. 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.

R. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with cover of polymer-concrete or reinforced concrete hot-diped galvanized-steel diamond plate.

S. Cable arms shall be 5 mm (0.1875 inch) gauge, hot-rolled, hot dipped galvanized sheet steel, pressed to channel shape. Arms shall be approximately 63 mm (2.5 inches) wide x 350 mm (14 inches) long.

2.3 PRE-CAST CONCRETE COMMUNICATIONS MANHOLES AND HARDWARE

A. Structure: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom. Frame and cover shall form top of manhole.

B. Cable Supports:

1. Cable stanchions shall be hot-rolled, heavy duty, hot dipped galvanized "T" section steel, 56 mm (2.25 inches) x 6 mm (0.25 inch) in size and punched with 14 holes on 38 mm (1.5 inches) centers for attaching cable arms.
2. Cable arms shall be 5 mm (0.1875 inch) gauge, hot-rolled, hot dipped galvanized sheet steel, pressed to channel shape. Arms shall be approximately 63 mm (2.5 inches) wide x 350 mm (14 inches) long.
3. Insulators for cable supports shall be porcelain and shall be saddle type or type that completely encircles the cable.
4. Equip each cable stanchion with one spare cable arm, with three spare insulators for future use.

C. Ladder: Fiberglass with 400 mm (16 inches) rung spacing. Provide securely mounted ladder for every manhole over 1.2 M (4 feet) deep.

D. Ground Rod Sleeve: Provide a 75 mm (3 inches) PVC sleeve in manhole floors so that a driven ground rod shall be installed.

E. Sump: Provide 305 mm x 305 mm (12 inches x 12 inches) covered sump frame and grated cover.

F. Minimum size: 6 feet wide, 9 feet long and 7 feet deep with 30-inch round manhole lockable cover engraved with "SIGNAL" OR "COMMUNICATIONS"

2.4 WARNING TAPE

A. Standard, 4-Mil polyethylene 76mm (3 inches) wide tape non-detectable type, red with black letters, and imprinted with "CAUTION BURIED COMMUNICATIONS CABLE BELOW". Mount tape 12 inches below finish grade.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION AND REQUIREMENTS

A. Raceways typically required for cabling systems unless otherwise indicated:

System	Specification Section	Installed Method
Grounding	27 05 26	Conduit Not Required
Communications Copper Horizontal Cabling	27 15 13	Conduit to Cable Tray Partitioned Cable Tray

B. Penetrations:

1. Cutting or Holes:

a. Locate holes in advance of installation. Where they are 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:
1) Seal clearances around conduit and make watertight as specified in Section 07 92 00, JOINT SEALANTS or directed by waterproofing manufacturer.

C. Conduit Installation:
1. Minimum conduit size of 32 mm (1 1/4 inch), but not less than size required for 40 percent fill.
2. Install insulated bushings on all conduit ends.
3. Extend vertical conduits/sleeves through floors minimum 75 mm (3 inches) above floor and minimum 75 mm (3 inches) below ceiling of floor below.
4. Terminate conduit runs to and from a backboard in a closet or interstitial space at top or bottom of backboard. Install conduits to enter telecommunication rooms next to wall and flush with backboard.
5. Where drilling is necessary for vertical conduits, locate holes so as not to affect structural sections.
6. Seal empty conduits located in telecommunications rooms or on backboards with a standard non-hardening putty compound to prevent entrance of moisture and gases and to meet fire resistance requirements.
7. Minimum radius of communication conduit bends:

Sizes of Conduit Trade Size	Radius of Conduit Bends mm, Inches
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)

8. Provide 19 mm (3/4 inch) thick fire-retardant plywood specified in Section 06 10 00, ROUGH CARPENTRY on wall of communication closets where shown on drawings. Mount plywood with bottom edge 300 mm (12 inches) above finished floor and top edge 2.74 m (9 feet) A.F.F. Paint the plywood to match wall finish, DO NOT PAINT THE LABEL.
9. Provide pull wire in all empty conduits; sleeves through floor are exceptions.
10. Complete each entire conduit run installation before pulling in cables.
11. Flattened, dented, or deformed conduit is not permitted.
12. Ensure conduit installation does not encroach into ceiling height head room, walkways, or doorways.
13. Cut conduit square with a hacksaw, ream, remove burrs, and draw tight.
14. Install conduit mechanically continuous and in straight run parallel with the corridor.
15. Install pull boxes after every 180 degrees of bends (two 90-degree bends). Size boxes per TIA 569. Support box with ¼ inch rod.
16. 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).
17. Support conduit within 300 mm (1 foot) of changes of direction, and within 300 mm (1 foot) of each enclosure to which connected.
18. Close ends of empty conduit with plugs or caps to prevent entry of debris, until cables are pulled in.
19. Conduit shall be supported within 150 mm (6 inches) of the cable tray.
20. Conduit installations under fume and vent hoods are prohibited.
21. 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.
22. Do not use aluminum conduits in wet locations.
23. Unless otherwise indicated on drawings or specified herein, conceal conduits within finished walls, floors, and ceilings.
24. 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.

25. 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.

D. 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.

E. Furred or Suspended Ceilings and in Walls:

1. Rigid steel, IMC. 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.

F. Exposed Work Installation:

1. Unless otherwise indicated on drawings, exposed conduit is only permitted in telecommunications rooms.
   a. Provide rigid steel, IMC..
   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. Surface Metal Raceways: Use only where shown on drawings.
6. 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.

G. 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.

H. 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.

I. 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.

J. Box Installation:

1. Boxes for Concealed Conduits:
   a. Flush mounted.
   b. Provide raised covers for boxes to suit wall or ceiling, construction, and finish.
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.

K. Flexible Nonmetallic Communications Raceway (Innerduct), Installation:

1. Install supports from building structure for horizontal runs at intervals not to exceed 900 mm (3 feet) and at each end.
2. Install supports from building structure for vertical runs at intervals not to exceed 1.2 m (4 feet) and at each side of joints.
3. Install only in accessible spaces not subject to physical damage or corrosive influences.
4. Make bends manually to assure internal diameter of tubing is not effectively reduced.
5. 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 EXISTING CONDUITS

A. Existing conduit can be used for new work.

B. If existing conduit is going to be used for new cables, the contractor shall clean the conduit from mud and dirt, pull all unused cables before the new cables are pulled/installed.

C. Contractor shall provide protection for the new cable while pulling it in the existing conduit.

D. Perform simple continuity test after cable installation.

3.3 TESTING

A. Examine fittings and locknuts for secureness.

B. Test RMC, IMC and EMT systems for electrical continuity.

C. Perform simple continuity test after cable installation.

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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. 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 11, 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. Cable waterfalls.
4. Ground strap kits.

E. B.O.D. Cablofil CF105.

2.2 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.

B. Finish. Coated to prevent rust.

C. Materials. Ladder rack shall be manufactured from steel . Stringers will be 4” high (flange facing in) and manufactured from steel. Cross members will be 1” x 1".

D. Size. Ladder rack shall be nominally sized a minimum of 12” width.

E. Rung Spacing. Minimum 9”.

F. 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. Floor connector.

G. B.O.D. Cablofil 1D80

PART 3 - EXECUTION

3.1 IMPLEMENTATION

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).

- - - E N D - - -

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 05 36, CABLE TRAYS FOR COMMUNICATIONS SYSTEMS.

C. Fiber optic cabling: 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

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 IMPLEMENTATION

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 shall provide a list of submittals that shall 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 shall 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 shall 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 shall witness and document the testing.
   a. Provide test reports to Commissioning Agent. Commissioning Agent shall 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 11 16
COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies Information Technology (IT) equipment enclosures for use in VA telecommunications spaces.

1.2 SUMMARY

Section Includes:

A. Server Cabinets.

B. Network Channel Racks.

C. Network Cabinets.

D. Telecommunications Enclosures.

E. Pathway Racks.

1.3 REFERENCES

A. VA Infrastructure Standard for Telecommunications Spaces.

1.4 RELATED WORK:

A. Cabling termination equipment, rack-mounted: Section 27 11 19, COMMUNICATIONS TERMINATION BLOCKS AND PATCH PANELS.

B. Power distribution equipment: Section 27 11 26, COMMUNICATIONS RACK MOUNTED POWER PROTECTION AND POWER STRIPS.

C. Grounding and bonding equipment: Section 27 05 26, GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS.

D. Labeling and identification requirements: Section 27 05 53, IDENTIFICATION FOR COMMUNICATIONS SYSTEMS.

1.5 SUBMITTALS:

A. Submit in accordance with Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

PART 2 - PRODUCTS

2.1 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” wide, and 40” deep (30” 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. Color. The rack and all components shall be white in color.

E. Equipment Mounting Rack. The rack shall provide an EIA-310-E compliant 19” racking system with front and rear rails using EIA-tapped 10-32 holes.

F. 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 with doors on both left and right of the rack (size commensurate with the requirement).
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.).

2.2 MAIN DISTRIBUTION AREA NETWORK CABINETS. -

Basis of design part number was developed by Chatsworth Products and the below are all included in the summary part number. If an alternate is submitted, it must match the Basis of Design Product TSZ1532386.

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” wide, and 46” deep, including side panels and doors.

C. Doors and Panels.

1. Front Door. Provide a single locking, latched, hinged metal front door for the network cabinet with minimum 75% open perforated design for airflow.
2. Rear Door. Provide a double hinged metal rear door for the server cabinet. 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.

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. d-rings, spools, bend radius limiters, finger cable managers, waterfalls, etc.).
7. (2) Side panels with brushed-sealed cable openings

2.2 TELECOMMUNICATIONS ENCLOSURES (TE).

Telecommunications Enclosures (TEs) are swing-out wall-mounted enclosures.

A. Height. TEs shall provide 26 standard rack units (RU) of space for mounting equipment.

B. Dimensions. Nominal dimensions for TE is48” tall, 24” wide, and 30” 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).

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Casters on floor-mounted enclosures shall be retracted and the enclosures leveled and stabilized.

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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

SECTION INCLUDES:

A. Copper UTP Angled Patch Panels.

B. Fiber Optic Distribution Cabinets.

C. Fiber Optic Distribution Cassettes.

D. Fiber Optic Splice Cassettes.

E. Horizontal Cable Managers.

F. 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. Labeling and identification requirements: Section 27 05 53, IDENTIFICATION FOR COMMUNICATIONS SYSTEMS.

C. Copper UTP cabling: Section 27 13 13, COMMUNICATIONS COPPER BACKBONE CABLING.

D. Copper UTP cabling termination: Section 27 13 13.13, COMMUNICATIONS COPPER CABLE SPLICING AND TERMINATIONS.

E. Fiber optic cabling: Section 27 13 23, COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING.

F. 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 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

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.

E. Provide CAT 6A UTP horizontal cabling requirements as follows:

a. HDA to MDA, and WAO to TR.
b. WAO to TR which is typical NON pre-terminated solution where cabling is run and RJ45 connectors are field terminated.
c. Both cabling requirements will use 48 port high density angled CAT 6A patch panels.

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 accept 12-strand multi-fiber push-on (MPO) connectors or 24-strand multi-fiber push-on (MPO) connectors. Adapters on the front of the cassette shall accept 6 duplex Lucent connector (LC) fiber pairs.
C. Polarity. Provide type A universal polarity 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.
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. 2U, 19” rack mountable.
B. Door. Horizontal cable managers shall have a double-hinged front cover to protect installed cables.

2.6 BLANKING PANELS.

A. Form Factor. 19” rack-mountable, flat or angled to extend 4” (104mm) forward from the mounting rail to match the equipment installed.
B. Transition. Blanking panel shall have a transition cover from angled front to flat front as required.
C. Quantity. Provide blanking panels to fill 75% of all RUs in all server cabinets and network cabinets.

PART 3 - NOT USED.

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SECTION 27 11 26
COMMUNICATIONS RACK MOUNTED POWER PROTECTION AND POWER STRIPS

PART 1 - GENERAL

1.1 DESCRIPTION

A. 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.

1.4 RELATED WORK

A. General electrical requirements that are common to more than one section in Division 27: Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

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 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

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.

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.

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.

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 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 or16A (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 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. Multimode Optical Fiber Backbone Cables.

B. Single Mode Optical Fiber Backbone Cables.

C. Hybrid Optical Fiber Backbone 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 11, COMMON WORK RESULTS FOR COMMUNICATIONS SYSTEMS.

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 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 and outside plant use, for campus backbone (interbuilding and intrabuilding) use.

A. Performance Category. Inside/outside rated OS2 is specified for all 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 strands of fiber are specified. Cables shall be dielectric and tight-buffered for OS1, loose-tube gel-filled for OS2 (riser), and loose-tube dry-tape for OS2 (plenum).

2.3 HYBRID OPTICAL FIBER BACKBONE CABLES.

A. Hybrid cables containing multiple 12-strand bundles (subunits) of multimode and/or single mode fiber are 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.

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SECTION 27 13 23.13
COMMUNICATIONS OPTICAL FIBER SPLICING AND TERMINATIONS

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies requirements for terminations of fiber optic cabling.

1.2 SUMMARY

Section Includes:

A. 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:

Submit in accordance with Section 27 05 11 REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION

3.1 TERMINATION REQUIREMENTS.

A. Terminate fiber optic cabling with duplex Lucent connector (LC) adapters, 12-fiber multi-fiber push on (MPO) connectors, or 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 15 10
DATA PORT

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the type, quantity, room location and details for data cabling, jacks, and raceway to the facility. This information shall be used in conjunction with the drawing package for application of data drops and location of work area outlets.

1.2 RELATED WORK

A. Section 27 05 11 Requirements for Communication Installations

B. Section 27 05 33 Raceways and Boxes for Communications Installations

1.3 QUALITY ASSURANCE

A. In installing cabling locations, the contractor is required restore all work areas to the condition prior to starting work per the general conditions.

B. All data ports shall be put in place to prioritize services to existing active computers, phones, printers, and equipment.

C. Contractor to pre-survey all spaces prior to installation to ensure that the number of data jacks are sufficient to replace the ones presently in use. Notify COR prior to installation

D. Anytime the number of ports specified for a room do not provide service for all equipment, computers and equipment, the contractor to notify the COR immediately.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Material for the new data ports shall be as defined and specified in the division 27 specs.

B. The excel spread sheet attached is for the location, quantities, raceway needs, cover plates, jacks, terminations, labeling of the new location of work area outlets.

C. Provide raceway for each WAO and run all the way to the cable tray with grounding bushing.

D. Provide J-hooks for the data cables when cable tray is not present.

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. All data drops shall be installed in conduit, cut wall as needed, patch wall to match existing wall and paint to match, running conduit to the cable tray in ICCU, Emergency, operating rooms and any other critical patient care room.

D. Provide new surface raceway to meet the CAT 6A requirements for surface raceway and data boxes with the maximum 40% fill.

E. All existing cables, connectors shall be removed after the new cabling is installed.

F. 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. (i.e., risers, underground, horizontal.).
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 shall be reviewed and accepted by COR, IT Service, FMS and SMCS 005OP2H3 (202-461-5310) prior to installation.
5. Wire Pulling:
   a. Provide installation equipment that prevents cutting or abrasion of insulation during pulling of cables.
   b. Use ropes made of nonmetallic material for pulling cables.

c. Attach pulling lines for fiber and copper cables by means of either woven basket grips or pulling eyes attached to conductors, as accepted by COR. Attached pulleys to the cable tray.

d. Pull multiple cables into cable tray or conduit together.

G. 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.

H. Labeling:

1. Industry Standard: Provide labeling in accordance with ANSI/TIA-606-C.
2. Print lettering of labels with laser jet 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”.

I. Cable Slack

1. Provide 3 m (10 ft) in TR rooms for copper balanced twisted pair cabling.
2. Provide 6 m (20 ft) in TR rooms for Fiber optical cabling.
3. Provide 1 m (3 ft) in the work area outlet for balanced twisted pair cabling.
4. Support cables properly above the ceiling either by J-Hooks or wire basket tray.

3.2 FIELD QUALITY CONTROL

A. Interim Inspection:

1. Verify that equipment provided adheres to installation requirements of this section. Interim inspection shall 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 shall 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. 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 of test time, with notification of the acceptance test.

D. Verification Tests:
1. Test UTP and/or STP 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 ANSI/TIA-568.3-D 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 ANSI/TIA-568.3-D using Method A, Optical Power Meter and Light Source and Method B, OTDR . Perform verification acceptance test.

E. Performance Testing:
1. Perform 4 PR UTP Category 6A tests in accordance with ANSI/TIA-568.1.E and ANSI-TIA-568.2-D. 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 ANSI/TIA-568.3-D.

F. 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.

G. Fiber testing shall meet the following:
1. TIA 526-14 Optical Loss measurements of installed multi-mode fiber optic plant.
2. TIA 526-7 Measurement of Optical power loss of installed single-mode cable plant.
3. ANSI/TIA-606-C Administration standard for commercial telecommunications infrastructure.

3.3 TESTING OF COMPLETD CABLING

A. Once UTP and fiber data cabling has been pulled and terminated at both ends, the contractor shall test each cable run to confirm it is capable

of supporting data transmission rates indicated in the bid document above and shall conforms to the cabling standards listed above.

B. The contractor shall supply a report documenting the test results.

C. The report shall be submitted in electronic format prior to acceptance by OIT.

D. Within the TRs, the network switch ports mounted inside the racks are divided into two physically different networks:
(1) OIT and (2) FMS, each with a maximum number of data ports allowed per rack. Port counts vary depending on the number of racks in the TR. Refer to TR elevations in the ISTS. Patch panel ports shall not be patched over to switch ports located in another rack and shall remain within the same rack. The contractor shall not install more CAT6A data cables than the maximum number of switch ports allowed, per network, in each rack.

E. Report shall include an excel spread sheet of every area outlet, location, ID tag, where it is fed from and pass or fail, with the following headings: Building Name: TR name and Number:

1. Room name
2. Room number.
3. Location of WAO.
4. Label.
5. Port number.
6. TR name
7. Patch panel name and port number.
8. Pass or fail.
9. Notes.

3.4 EXISTING DATA DEMOLITION

A. See attached excel spread sheet for the demolition of ALL existing data drops, cabling, surface raceway, boxes, cover plates, patch panels, racks and all related material.

B. Contractor is responsible for confirming all the WAO locations.

3.5 NEW DATA DROPS

A. See attached excel spread sheet for the new data drops for the work area outlets.

B. Contractor is responsible for confirming all the WAO locations.

C. Within the TRs, the network switch ports mounted inside the racks are divided into two physically different networks (1) OIT and (2) FMS,

each with a maximum number of data ports allowed per rack. Port counts vary depending on the number of racks in the TR. Refer to TR elevations in the ISTS. Patch panel ports shall not be patched over to switch ports located in another rack and shall remain within the same rack. The contractor shall not install more CAT6A data cables than the maximum number of switch ports allowed, per network, in each rack.

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Alexandria VA Existing Data Drop Survey
Building 1 - 1st Floor

Room	Tag	#Data Drops (124)	#Voice Drops (104)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
1-101 (Corr)	AP06	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
1-103	2515	2	2	CAT 5	CAT 3			None	Concrete Column	Paint	None	Drop Ceiling	No	N/A
1-103	2516	2	2	CAT 5	CAT 3	Phone	Computer	WM	Plaster	Paint	None	Drop Ceiling	No	N/A
1-104	2540	2	2	CAT 5E	N/A	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
1-104	AP05	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
1-104	XXXX	2	2	CAT 5	N/A	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
1-105	2518	2	2	CAT 5	CAT 3	Phone	Computer	WM	Plaster	Paint	None	Drop Ceiling	No	Furniture
1-105	105-1	4	0	CAT 5	N/A			WM	Plaster	Paint	None	Drop Ceiling	No	N/A
1-105	XXXX	2	2	CAT 5	CAT 3	Phone	Computer	WM	Plaster	Paint	None	Drop Ceiling	No	Furniture
1-106	106-1	0	4	CAT 5E	N/A		Computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
1-108	2521	2	2	CAT 5	CAT 3		Computer	WM	Plaster	Paint	None	Drop Ceiling	No	Furniture
1-108	2522	2	2	CAT 5	CAT 3	Phone	Computer	WM	Plaster	Paint	None	Drop Ceiling	No	N/A
1-108	2523	2	2	CAT 5	CAT 3			WM	Plaster	Paint	None	Drop Ceiling	No	N/A
1-108	2524	2	2	CAT 5	CAT 3	Phone	Computer	WM	Plaster	Paint	None	Drop Ceiling	No	N/A
1-108	2525	2	2	CAT 5	CAT 3		Computer	WM	Plaster	Paint	None	Drop Ceiling	No	N/A
1-108	2531	2	2	CAT 5	CAT 3			WM	Plaster	Paint	None	Drop Ceiling	No	N/A
1-108	2640	2	2	CAT 5	CAT 3	Phone	Computer	WM	Plaster	Paint	None	Drop Ceiling	No	N/A
1-108	2641	2	2	CAT 5	CAT 3	Phone	Computer	WM	Plaster	Paint	None	Drop Ceiling	No	Furniture
1-108	108-1	4	0	CAT 5	N/A		Computer/Equip	WM	Plaster	Paint	None	Drop Ceiling	No	N/A
1-108	108-2	4	0	CAT 5	N/A		Computer/Equip	WM	Plaster	Paint	None	Drop Ceiling	No	N/A
1-109A	2527	2	2	CAT 5	N/A	Phone	Computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
1-109B	2526	2	2	CAT 5	N/A	Phone	Computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
1-111	111	2	2	CAT 5	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
1-111	2642	2	2	CAT 5	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
1-111	2644	2	2	CAT 5	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
1-112	AP04	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
1-112	XXXX	2	2	CAT 5	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
1-112	XXXX	2	2	CAT 5	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
1-117	2501	1	2	CAT 5	N/A	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	N/A
1-117	2502	2	2	CAT 5	N/A	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	N/A
1-117	AP11	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
1-119	2507	2	2	CAT 5E	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
1-119	2508	2	2	CAT 5E	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
1-119	2533	2	2	CAT 5E	N/A		Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
1-119	119-1	2	2	CAT 5E	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
1-119	119-2	2	2	CAT 5E	N/A		Printer/Equipment	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
1-119	XXXX	2	2	CAT 5E	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
1-119A	XXXX	2	2	CAT 5E	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
1-119B	AP09	2	0	CAT 5E	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
1-119B	XXXX	2	2	CAT 5E	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
1-119B	XXXX	2	2	CAT 5E	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
1-119C	2503	2	2	CAT 5E	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
1-120	2511	2	2	CAT 5E	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
1-120	2537	2	2	CAT 5E	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
1-120	2541	2	2	CAT 5E	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
1-120A	2540	2	2	CAT 5E	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
1-120A	AP07	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
1-120A	XXXX	2	2	CAT 5E	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
1-120B	2509	2	2	CAT 5E	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
1-120B	XXXX	2	2	CAT 5E	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
1-121	2512	2	2	CAT 5E	N/A		Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
1-121	2530	2	2	CAT 5E	N/A		Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
1-121	AP10	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
1-122	2513	2	2	CAT 5	N/A	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
1-122	AP12	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
1-B-1	2401	2	2	CAT 5E	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture

Alexandria VA Existing Data Drop Survey
Building 1 - 1st Floor

Room	Tag	#Data Drops (124)	#Voice Drops (104)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
1-B-2	2403	2	2	CAT 5E	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
1-B-2	2404	2	2	CAT 5E	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
1-B-2	2405	2	2	CAT 5E	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
1-B-2A	2402	2	2	CAT 5E	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
1-B-3	2408	2	0	CAT 5E	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
1-B-3	AP03	1	2	CAT 5E	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
1-B-3A	2406	2	2	CAT 5E	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
1-B-8A	AP03	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
1-C-1	AP08	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
1-C-2	AP08	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture

Alexandria VA Existing Data Drop Survey
Building 1 - 2nd Floor

Room	Tag	#Data Drops (81)	#Voice Drops (79)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
1-201	2622	2	2	CAT 5	N/A	Phone		None	Block	Paint	None	Drop Ceiling	No	Furniture
1-201	2628	2	2	CAT 5	N/A	Phone	computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
1-201	2638	2	2	CAT 5	N/A	Phone		None	Block	Paint	None	Drop Ceiling	No	Furniture
1-201	(NO ID)	2	2	CAT 5	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
1-202	2601	2	2	CAT 5	N/A		printer	None	Block	Paint	None	Drop Ceiling	No	Furniture
1-202	2629	2	2	CAT 5	N/A		printer	None	Block	Paint	None	Drop Ceiling	No	Furniture
1-203	2634	2	2	CAT 5	N/A	Phone	computer	None	Block	Paint	None	Drop Ceiling	No	N/A
1-203	2634	2	2	CAT 5	N/A			None	Block	Paint	None	Drop Ceiling	No	N/A
1-203	AP05	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
1-203A	2603	2	2	CAT 5	N/A	Phone	computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
1-204	AP04	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
1-204	AP12	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
1-204B	2607	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
1-204C	2605	2	2	CAT 5	N/A	Phone	Computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
1-204C	2632	2	2	CAT 5	N/A	Phone	printer	None	Block	Paint	None	Drop Ceiling	No	Furniture
1-204C	AP01	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
1-204D	XXXX	2	2	CAT 5	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
1-204E	2604	2	2	CAT 5	N/A	Phone		None	Block	Paint	None	Drop Ceiling	No	Furniture
1-204E	2631	2	2	CAT 5	N/A		Computer/Printer	None	Block	Paint	None	Drop Ceiling	No	Furniture
1-204F	2606	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
1-204F	2633	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
1-204F	AP03	0	1	CAT 5	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
1-205	2608	2	2	CAT 5	N/A	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
1-205	2624	2	1	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
1-205	2625	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
1-206	AP07	0	1	CAT 5E	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
1-210	AP14	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
1-210	XXXX	2	2	CAT 5	N/A	Phone	Computer/Printer	None	Block	Paint	None	Drop Ceiling	No	N/A
1-211	2611	2	2	CAT 5	N/A	Phone	Computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
1-212	2614	2	2	CAT 5	N/A	Phone		None	Block	Paint	None	Drop Ceiling	No	Furniture
1-212	2615	2	2	CAT 5E	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
1-212	2635	2	2	CAT 5	N/A		Computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
1-212	2815	2	2	CAT 5	N/A	Phone	Computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
1-212	(NO ID)	0	1	CAT 5	N/A			None	Block	Paint	None	Drop Ceiling	No	N/A
1-212	AP09	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
1-212A	2635	2	2	CAT 5	N/A	Phone	Computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
1-212A	(NO ID)	0	1	CAT 5	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
1-212A	AP09	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
1-213	2626	2	2	CAT 5	N/A	Phone		None	Block	Paint	None	Drop Ceiling	No	N/A
1-213	2627	2	2	CAT 5	N/A	Phone		None	Block	Paint	None	Drop Ceiling	No	N/A
1-213	(NO ID)	0	1	CAT 5	N/A			None	Block	Paint	None	Drop Ceiling	No	Equipment
1-213	(NO ID)	0	2	CAT 5	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
1-213	(NO ID)	0	1	CAT 5	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
1-213	AP10	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
1-213	XXXX	2	2	CAT 5	N/A		Printer	None	Block	Paint	None	Drop Ceiling	No	Furniture
1-213	XXXX	2	2	CAT 5	N/A	Phone	computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
1-213A	AP11	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
1-213A	XXXX	2	2	CAT 5	N/A	Phone	computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
1-214	2619	2	2	CAT 5	N/A	Phone	computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
1-215	2620	2	2	CAT 5E	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
1-215	XXXX	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
1-215A	2621	2	2	CAT 5E	N/A		Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture

Alexandria VA Existing Data Drop Survey
Building 2 - 1st Floor

Room	Tag	#Data Drops (157)	#Voice Drops (121)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
2-100	AP19	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-100	AP21	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-101A	XXXX	2	2	CAT 5	N/A	Phone	Computer	WM	Plaster	Paint	None	Drop Ceiling	No	Furniture
2-102	2760	2	2	CAT 5	N/A			None	block	Paint	None	Drop Ceiling	No	Furniture
2-103	2732	2	2	CAT 5	N/A			None	block	Paint	None	Drop Ceiling	No	Furniture
2-103	2739	2	2	CAT 5	N/A	phone	computer	None	block	Paint	None	Drop Ceiling	No	Furniture
2-103	2772	2	2	CAT 5	N/A			None	block	Paint	None	Drop Ceiling	No	Furniture
2-103	2773	2	2	CAT 5	N/A			None	block	Paint	None	Drop Ceiling	No	Furniture
2-103	2774	2	2	CAT 5	N/A		Printer/Equipment	None	block	Paint	None	Drop Ceiling	No	Furniture
2-103	2775	2	2	CAT 5	N/A			None	block	Paint	None	Drop Ceiling	No	Furniture
2-103	AP18	1	0	CAT 5	N/A		wifi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
2-106	(NO ID)	2	1	CAT 5	N/A	Phone	Computer	None	block	Paint	None	Drop Ceiling	No	Furniture
2-106	AP13	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-107	XXXX	2	2	CAT 5	N/A			None	block	Paint	None	Drop Ceiling	No	Furniture
2-108	2702	2	2	CAT 5	N/A			None	block	Paint	None	Drop Ceiling	No	N/A
2-108	AP04	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-109	2703	2	2	CAT 5	N/A			None	block	Paint	None	Drop Ceiling	No	N/A
2-109	2735	2	2	CAT 5	N/A			None	block	Paint	None	Drop Ceiling	No	N/A
2-110	AP02	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-114	2761	2	2	CAT 5	N/A	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-114	2762	2	2	CAT 5	N/A		Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-114	2763	2	2	CAT 5	N/A	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-114	2764	2	2	CAT 5	N/A		Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-114	2765	2	2	CAT 5	N/A		Printer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-114	2766	2	2	CAT 5	N/A	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-114	AP05	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
2-116	2767	2	2	CAT 5	N/A	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-116	2768	2	2	CAT 5	N/A	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-116A	2769	2	2	CAT 5	N/A	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-116A	AP07	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
2-117	2712	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-117	AP12	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
2-117A	2706	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-117A	2746	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-117B	2749	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-117C	2707	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-117C	2747	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-117C	AP11	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
2-117D	2708	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-117D	2712	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-117E	2731	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-117E	2745	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-117E	AP10	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
2-117F	2709	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-117F	AP09	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
2-117G	2710	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-117H	AP08	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
2-117H	AP08	1	0	CAT 5	N/A		wifi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-117K	XXXX	2	2	CAT 5	N/A			None	block	Paint	None	Drop Ceiling	No	Furniture
2-118	XXXX	2	2	CAT 5	N/A			None	block	Paint	None	Drop Ceiling	No	Furniture
2-120	2744	2	2	CAT 5	N/A	phone		None	block	Paint	None	Drop Ceiling	No	N/A
2-120	(NO ID)	0	1	CAT 5	N/A			None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-120	AP15	1	0	CAT 5	N/A		wifi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-121	2733	2	2	CAT 5	N/A	phone		None	block	Paint	None	Drop Ceiling	No	N/A
2-121	2742	2	2	CAT 5	N/A		computer	None	block	Paint	None	Drop Ceiling	No	N/A
2-122	2737	2	2	CAT 5	N/A		Printer	None	block	Paint	None	Drop Ceiling	No	Furniture

Alexandria VA Existing Data Drop Survey
Building 2 - 1st Floor

Room	Tag	#Data Drops (157)	#Voice Drops (121)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
2-122	2738	2	2	CAT 5	N/A			None	block	Paint	None	Drop Ceiling	No	Furniture
2-122	2770	2	2	CAT 5	N/A		computer	None	block	Paint	None	Drop Ceiling	No	Furniture
2-122	2771	2	2	CAT 5	N/A	phone		None	block	Paint	None	Drop Ceiling	No	Furniture
2-122	AP17	1	0	CAT 5	N/A		wifi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-123	2714	2	2	CAT 5	CAT 5			WM / SMB	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-123	2715	2	2	CAT 5	CAT 5			WM / SMB	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-123	APXX	1	0	CAT 5	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-124	XX-XXX	2	2	CAT 5	CAT 3			WM / SMB	Drywall	Paint	None	Drop Ceiling	No	Other
2-125	(NO ID)	1	1	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-125	(NO ID)	0	2	N/A	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-126	APXX	1	0	CAT 5	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-126B	(NO ID)	1	1	CAT 5	CAT 5			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-126B	APXX	1	0	CAT 5	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-126D	APXX	1	0	CAT 5	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-126E	D-2	1	1	CAT 5	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-127	APXX	1	0	CAT 5	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-127A	(NO ID)	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-127A	APXX	1	0	CAT 5	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-128A	2720	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-128B	2719	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-128E	2740	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-128E	(NO ID)	1	0	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-128E	APXX	1	0	CAT 5	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-128F	2726	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-128F	2758	2	2	CAT 5	CAT 3			WM / SMB	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-128F	(NO ID)	1	0	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-128F	AP29	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
2-128G	2724	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-128G	2725	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-128G	APXX	1	0	CAT 5	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-128H	(NO ID)	1	0	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-128H	(NO ID)	1	0	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-128H	AP32	1	0	CAT 5	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-129	(NO ID)	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-131	2734	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-133	2728	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-133	APXX	1	0	CAT 5	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-134	2729	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-134	APXX	1	0	CAT 5E	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-C-1	AP01	1	0	CAT 5	N/A		wifi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-C-1	AP06	1	0	CAT 5	N/A		wifi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-SW -1	AP20	1	0	CAT 5	N/A		wifi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-SW -1	AP21	1	0	CAT 5	N/A		wifi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-SW -1	AP21	1	0	CAT 5	N/A		wifi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-SW -1	AP28	1	0	CAT 5	N/A		wifi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A

Alexandria VA Existing Data Drop Survey
Building 2 - 2nd Floor

Room	Tag	#Data Drops (212)	#Voice Drops (181)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
1-SS-2	AP14	1	0	CAT 5	N/A		wifi	None	block	Paint	other	hard lid	No	N/A
2-200	AP11	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
2-200	AP14	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
2-200	AP18	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
2-200 (Corr)	AP02	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
2-201	3234	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-201	3234	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-201	3243	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-201	3245	2	2	CAT 5	N/A	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-201	3246	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-201	3248	2	2	CAT 5	N/A	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-201	3286	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-201B	3232	2	2	CAT 5	N/A	phone	computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-201B	3286	2	2	CAT 5	N/A	phone	computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-201B	AP19	1	0	CAT 5	N/A		wifi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-201C	3243	2	2	CAT 5	N/A	phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-203	3249	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-203	3249	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-203	3288	2	2	CAT 5	N/A	phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-203	3288	2	2	CAT 5	N/A	phone		None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-203	AP29	1	0	CAT 5	N/A		wifi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
2-203	AP29	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
2-203A	3289	2	2	CAT 6	CAT 3		Printer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-204 (Corr)	AP28	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-205	3269	2	2	CAT 5	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	N/A
2-206	AP29	1	0	CAT 5	N/A		wifi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
2-209	XXXX	2	2	CAT 5	N/A	phone	Computer	None	block	Paint	None	Drop Ceiling	No	Furniture
2-210	3203	2	2	CAT 5	N/A	phone	computer	None	block	Paint	None	Drop Ceiling	No	Furniture
2-210	3204	2	2	CAT 5	N/A	phone	computer	None	block	Paint	None	Drop Ceiling	No	Furniture
2-210	3271	2	2	CAT 5	N/A		Printer	None	block	Paint	None	Drop Ceiling	No	Furniture
2-210	(NO ID)	0	1	CAT 5	N/A			None	block	Paint	None	Drop Ceiling	No	Furniture
2-210	AP23	1	0	CAT 5	N/A		wifi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
2-211	3205	2	2	CAT 5	N/A	phone	Computer/Equip	None	block	Paint	None	Drop Ceiling	No	Furniture
2-211	AP22	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-212	XXXX	2	2	CAT 5	N/A	phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-212	XXXX	2	2	CAT 5	N/A	phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-212	XXXX	2	2	CAT 5	N/A	phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-213	3207	2	2	CAT 5E	CAT 3	Phone	Computer/Printer	WM	Plaster	Paint	None	Drop Ceiling	No	Furniture
2-214	3208	2	2	CAT 5	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	N/A
2-217	3290	2	2	CAT 5	N/A	phone	Computer	None	block	Paint	None	Drop Ceiling	No	Furniture
2-217	3297	2	2	CAT 5	N/A		Computer/Equip	None	block	Paint	None	Drop Ceiling	No	N/A
2-217	AP32	1	0	CAT 5	N/A		wifi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-217	AP33	1	0	CAT 5	N/A		wifi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-217B	3294	2	2	CAT 5	N/A	phone	Computer/Equip	None	block	Paint	None	Drop Ceiling	No	N/A
2-217B	AP34	1	0	CAT 5	N/A		wifi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-217C	3292	2	2	CAT 5	N/A	phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-217C	XXXX	2	2	CAT 5	N/A	phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-217D	AP31	1	0	CAT 5	N/A		wifi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-219	3210	2	2	CAT 5	N/A	phone	Computer	None	block	Paint	None	Drop Ceiling	No	Furniture
2-219	3211	2	2	CAT 5	N/A			None	block	Paint	None	Drop Ceiling	No	Furniture
2-220	3212	2	2	CAT 5	CAT 3			WM	Plaster	Paint	None	Drop Ceiling	No	N/A
2-220	3213	2	2	CAT 5	CAT 3	Phone	Computer/Printer	WM	Plaster	Paint	None	Drop Ceiling	No	N/A
2-220	AP35	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-221	3214	2	2	CAT 5	N/A	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-221	3268	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-221	AP36	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture

Alexandria VA Existing Data Drop Survey
Building 2 - 2nd Floor

Room	Tag	#Data Drops (212)	#Voice Drops (181)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
2-222	3215	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	N/A
2-222	3216	2	2	CAT 5	N/A	phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	N/A
2-223	3267	2	2	CAT 5E	CAT 3	Fax	Printer/Equipment	None	Plaster	Paint	None	Drop Ceiling	No	Furniture
2-226	3218	2	2	CAT 5E	CAT 3	Phone	Computer	WM	Plaster	Paint	None	Drop Ceiling	No	Furniture
2-227	3219	2	2	CAT 5	N/A	phone	Computer/Printer/Equipment	None	block	Paint	None	Drop Ceiling	No	Furniture
2-228	AP27	1	0	CAT 5	N/A		wifi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-228	XXXX	2	2	CAT 5	N/A	phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-229	3221	2	2	CAT 5	N/A	phone	Computer/Printer/Equipment	None	block	Paint	None	Drop Ceiling	No	Furniture
2-230	XXXX	2	2	CAT 5	CAT 3	Phone	Computer/Printer	3/4"	Plaster	Paint	None	Drop Ceiling	No	Furniture
2-231	2332	2	2	CAT 5	N/A		Computer	None	block	Paint	None	Drop Ceiling	No	Furniture
2-231	AP33	1	0	CAT 5	N/A		wifi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-232	3224	2	2	CAT 5E	CAT 3	Phone	Computer	Raceway	Plaster	Paint	None	Drop Ceiling	No	N/A
2-232	AP16	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-233	3251	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-234	3285	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-235	3225	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-235	3225	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-235	(NO ID)	1	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-236	3226	2	0	CAT 5	N/A			None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
2-236	AP13	1	0	CAT 5	N/A		wifi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
2-238	3227	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-238	3228	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-238	3260	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-238	AP06	1	0	CAT 5	N/A		wifi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
2-239	3229	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-239	3230	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-239	3262	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-239	3263	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-240	3232	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-240	AP05	0	1	CAT 5	N/A		wifi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
2-241	3231	2	2	CAT 5E	CAT 3			WM	Plaster	Paint	None	Drop Ceiling	No	N/A
2-241	(NO ID)	2	2	CAT 5E	CAT 3			WM	Plaster	Paint	None	Drop Ceiling	No	N/A
2-241	AP04	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-241A	AP03	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-242	3235	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-242	3259	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-242A	3266	2	1	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-242B	(NO ID)	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-242C	3238	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-242D	3236	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-242D	3296	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-243 (Corr)	3250	0	1	CAT 5	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	N/A
2-245	3254	2	2	CAT 5	CAT 3			WM	Drywall	Paint	None	Drop Ceiling	No	N/A
2-245	3255	2	2	CAT 5	CAT 5E			WM	Drywall	Paint	None	Drop Ceiling	No	N/A
2-245	AP09	1	0	CAT 5	N/A		wifi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-246	3282	2	2	CAT 5E	CAT 3			WM	Plaster	Paint	None	Drop Ceiling	No	Furniture
2-247A	3281	2	2	CAT 5	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	N/A
2-248	3257	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-248	3273	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-248	3274	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-248	3275	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-248	3276	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-248	3277	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-248	3278	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-248	3279	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-248	3280	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture

Alexandria VA Existing Data Drop Survey
Building 2 - 2nd Floor

Room	Tag	#Data Drops (212)	#Voice Drops (181)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
2-248	AP08	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
2-249	2329	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-249	(NO ID)	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-249	AP10	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
2-250	3241	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-251	(NO ID)	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-255	AP15	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-255B	3242	2	2	CAT 5	CAT 3			WM	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-255B	3270	2	2	CAT 5	CAT 3	Fax	Printer	WM	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-256	XXXX	2	2	CAT 5	CAT 3	Phone	Computer	None	Plaster	Paint	None	Drop Ceiling	No	Furniture
2-257 (Corr)	AP17	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-C-2	(NO ID)	0	1	CAT 5	N/A	Phone		None	block	Paint	None	Drop Ceiling	No	N/A
2-C-2	AP21	1	0	CAT 5	N/A		wifi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-C-2	AP24	1	0	CAT 5	N/A		wifi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-C-2	AP25	1	0	CAT 5	N/A		wifi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A

Alexandria VA Existing Data Drop Survey
Building 2 - 3rd Floor

Room	Tag	#Data Drops (180)	#Voice Drops (149)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
2-301	3747	2	2	CAT 5E	CAT 3	Phone	Computer	None	Plaster	Paint	None	Drop Ceiling	No	N/A
2-301	3748	2	2	CAT 5E	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	N/A
2-301	AP22	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-301B	3755	2	2	CAT 5E	CAT 3	Phone	Computer	WM	Plaster	Paint	None	Drop Ceiling	No	N/A
2-301C	(NO ID)	2	2	CAT 5	CAT 3	Phone	Computer	None	Plaster	Paint	None	Drop Ceiling	No	Furniture
2-303	303-1	2	2	CAT 5	CAT 3	Phone	Computer	None	Plaster	Paint	None	Drop Ceiling	No	N/A
2-303	303-2	2	2	CAT 5	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	N/A
2-303	AP23	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-305	3763	2	2	CAT 5E	CAT 3	Phone	Computer	WM	Plaster	Paint	None	Drop Ceiling	No	Furniture
2-306	3773	2	2	CAT 5	N/A			None	Block	Paint	None	Drop Ceiling	No	N/A
2-306	AP26	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-308	3701	2	2	CAT 5	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
2-308	3702	2	2	CAT 5	N/A	phone	computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
2-308	AP38	2	2	CAT 5	N/A		WIFI	None	Block	Paint	None	Drop Ceiling	No	Furniture
2-309	3703	2	2	CAT 5	N/A	phone	computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
2-310	3703	2	2	CAT 5	N/A	phone	computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
2-310	3704	2	2	CAT 5	N/A	phone		None	Block	Paint	None	Drop Ceiling	No	Furniture
2-310	4210	2	2	CAT 5	N/A	phone	computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
2-310	AP33	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-311	3706	2	2	CAT 5	N/A			None	Block	Paint	None	Drop Ceiling	No	Equipment
2-311	3707	2	2	CAT 5	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
2-311	3766	2	2	CAT 5	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
2-311	3767	2	2	CAT 5	N/A		Printer	None	Block	Paint	None	Drop Ceiling	No	Furniture
2-311	4211	2	2	CAT 5	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
2-311	AP34	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-311	XXXX	2	2	CAT 5	N/A	phone	COMPUTER	None	Block	Paint	None	Drop Ceiling	No	Furniture
2-312	708	2	2	CAT 5	N/A	phone	computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
2-313	3709	2	2	CAT 5	N/A		Computer/Equip	None	Block	Paint	None	Drop Ceiling	No	Furniture
2-313	XXXX	2	2	CAT 5	N/A	phone	Computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
2-314	3768	2	2	CAT 5	N/A		Printer	None	block	Paint	None	Drop Ceiling	No	Furniture
2-316	3765	2	2	CAT 5	N/A	phone	Computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
2-316	(NO ID)	2	2	CAT 5	N/A	phone	Computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
2-316	AP37	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-316	AP38	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-316A	AP39	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-316B	AP40	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-320	3711	2	2	CAT 5	N/A	phone		None	block	Paint	None	Drop Ceiling	No	Furniture
2-320	3712	2	2	CAT 5	N/A		Computer	None	block	Paint	None	Drop Ceiling	No	Furniture
2-320	320-1	2	2	CAT 5	N/A		Computer	None	block	Paint	None	Drop Ceiling	No	Furniture
2-320	320-2	2	2	CAT 5	N/A		Computer	None	block	Paint	None	Drop Ceiling	No	Furniture
2-321	3713	2	2	CAT 5	N/A		Printer	None	block	Paint	None	Drop Ceiling	No	Furniture
2-322	3714	2	2	CAT 5	N/A	phone	computer	None	block	Paint	None	Drop Ceiling	No	Furniture
2-322	AP31	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-323	3715	2	2	CAT 5	N/A	phone	Computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
2-323	AP30	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
2-324	XXXX	2	2	CAT 5	N/A	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-325	XXXX	2	2	CAT 5	N/A	phone	computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
2-326	326	2	2	CAT 5	CAT 3	Phone	Computer	None	Plaster	Paint	None	Drop Ceiling	No	N/A
2-330	3719	2	2	CAT 5	N/A	phone	Computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
2-331	3721	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-332	3722	2	2	CAT 5	N/A			WM	Plaster	Paint	None	Drop Ceiling	No	N/A
2-332	(NO ID)	0	1	N/A	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	N/A
2-333	3723	2	2	CAT 5	N/A		Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-333	AP02	1	0	CAT 5	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-334	(NO ID)	0	1	CAT 5	N/A			None	Other	Paint	None	Drop Ceiling	No	Furniture
2-334	AP18	1	0	CAT 5	N/A		wifi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture

Alexandria VA Existing Data Drop Survey
Building 2 - 3rd Floor

Room	Tag	#Data Drops (180)	#Voice Drops (149)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
2-335	3751	2	2	CAT 5	N/A	phone	computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
2-336	3724	2	2	CAT 5	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	N/A
2-337	3725	2	2	CAT 5E	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	N/A
2-339	3391	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-339	3726	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-339	3727	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-339	AP12	1	0	CAT 5	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-340	3728	2	0	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-340	3729	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-340	AP11	1	0	CAT 5	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-341	3730	2	2	CAT 5E	CAT 3			WM	Plaster	Paint	None	Drop Ceiling	No	N/A
2-341	3731	2	2	CAT 5E	CAT 3			WM	Plaster	Paint	None	Drop Ceiling	No	N/A
2-342	3771	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-342	3774	2	2	CAT 5	CAT 3			WM / SMB	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-342	AP10	1	0	CAT 5E	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-342A	3772	2	2	CAT 5	CAT 3			WM / SMB	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-342A	AP09	1	0	CAT 5E	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-343	2759	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-343	3756	1	0	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-343	3758	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-343	3760	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-343	3761	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-343	343-1	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-343	343-2	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-343	AP01	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
2-343	AP02	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
2-345	3762	2	2	CAT 5	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	Furniture
2-345	AP08	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-346	3732	2	2	CAT 5	N/A	phone	Computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
2-347	AP03	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-347	XXXX	2	2	CAT 5	N/A	phone	computer	None	Block	Paint	None	Drop Ceiling	No	N/A
2-348	3734	2	2	CAT 5	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
2-348	3735	2	2	CAT 5	N/A	phone	Computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
2-348	AP04	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-349	3736	2	2	CAT 5	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
2-349	3737	2	2	CAT 5	N/A		computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
2-349	AP05	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-350	3738	2	2	CAT 5	N/A	phone	Computer/Equip	None	block	Paint	None	Drop Ceiling	No	Furniture
2-351	3739	2	2	CAT 5	N/A		computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
2-352	3740	2	2	CAT 5	N/A			None	block	Paint	None	Drop Ceiling	No	Furniture
2-353	3741	2	2	CAT 5	N/A	phone	computer	None	block	Paint	None	Drop Ceiling	No	Furniture
2-353	AP07	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
2-355	AP16	1	0	CAT 5	N/A		WIFI	None	Drywall	Paint	None	Drop Ceiling	No	N/A
2-357	3754	2	2	CAT 5	CAT 3			WM	Plaster	Paint	None	Drop Ceiling	No	N/A
2-358	3743	2	2	CAT 5	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	N/A
2-359	3744	2	2	CAT 5E	CAT 3	Phone	Computer	WM	Plaster	Paint	None	Drop Ceiling	No	Furniture
2-359	AP19	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-C-3	(NO ID)	0	1	CAT 5	N/A	phone		None	block	Paint	None	Drop Ceiling	No	N/A
2-C-3	AP17	1	0	CAT 5	N/A		wifi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-C-3	AP20	1	0	CAT 5	N/A		wifi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-C-3	AP25	1	0	CAT 5	N/A		wifi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-C-3	AP32	1	0	CAT 5	N/A		wifi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
2-C-3	AP35	1	0	CAT 5	N/A		wifi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A

Alexandria VA Existing Data Drop Survey
Building 2 - 4th Floor

Room	Tag	#Data Drops (49)	#Voice Drops (38)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
2-402	402A-D	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-403	403A-D	2	0	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-404	AP01	1	0	CAT 5	N/A		wifi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-404	AP02	1	0	CAT 5	N/A		wifi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-404	AP03	1	0	CAT 5	N/A		wifi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-404	AP04	1	0	CAT 5	N/A		wifi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-404	AP05	1	0	CAT 5	N/A		wifi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-404	AP06	1	0	CAT 5	N/A		wifi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-404	AP07	1	0	CAT 5	N/A		wifi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-404	AP08	1	0	CAT 5	N/A		wifi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-404	AP09	1	0	CAT 5	N/A		wifi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-418	(NO ID)	1	1	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-420	420ABCD	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	N/A
2-420	420EFGH	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-421	(NO ID)	1	1	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-421	421ABCD	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	N/A
2-423	243ABCD	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-424	424ABCD	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-424	424CCDDEEFF	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-424	424EFGH	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-424	424IJKL	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-424	424MNOP	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-424	424QRST	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-424	424UVWX	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-424	424YZAABB	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-425	425ABCD	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-425	425EFGH	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-425	425IJKL	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-425	425MNOP	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
2-427	427ABCD	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture

Alexandria VA Existing Data Drop Survey
Building 3 - 1st Floor

Room	Tag	#Data Drops (187)	#Voice Drops (162)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
3-102	AP07	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
3-105	4704	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-106	4715	2	2	CAT 5	CAT 3	Phone		WM / SMB	Block	Paint	None	Drop Ceiling	No	Furniture
3-106	4719	2	1	CAT 5	CAT 3			None	Furred Column	Paint	None	Drop Ceiling	No	Furniture
3-106	4729	2	2	CAT 5	CAT 3		Computer	WM / SMB	Block	Paint	None	Drop Ceiling	No	Casework
3-106	AP14	1	0	CAT 5	CAT 3		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
3-107	AP11	2	2	CAT 5	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	N/A
3-108	4703	2	1	CAT 5	N/A		Phone/Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-108	(NO ID)	0	1	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-111	4071	2	2	CAT 5E	CAT 3	Phone		None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-111	4716	2	2	CAT 5E	CAT 3	Phone		None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-112	4705	2	2	CAT 5E	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-112A	AP09	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
3-113	AP08	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
3-114	4718	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-114	4720	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-114	4721	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-114	4722	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-114A	4714	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-114A	4723	2	2	CAT 5	N/A	Phone	Computer	Other	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-114A	4724	2	2	CAT 5	N/A		Phone/Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-115	4726	2	2	CAT 5	CAT 3			None	Block	Paint	None	Drop Ceiling	No	Furniture
3-115	4727	2	2	CAT 5	CAT 3			None	Block	Paint	None	Drop Ceiling	No	Furniture
3-115	4728	2	2	CAT 5	CAT 3			None	Block	Paint	None	Drop Ceiling	No	Furniture
3-115A	AP02	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
3-116	AP01	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
3-117	4710	2	2	CAT 5E	CAT 3	Phone	Computer	None	Furred Column	Paint	None	Drop Ceiling	No	Casework
3-118	XXXX	2	2	CAT 5E	CAT 3			None	Block	Paint	None	Drop Ceiling	No	Furniture
3-118A	AP05	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
3-118A	XXXX	2	2	CAT 5E	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
3-119	AP01	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
3-120	4710	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-121	4713	2	2	CAT 5E	CAT 3			None	Block	Paint	None	Drop Ceiling	No	Casework
3-121	(NO ID)	0	1	N/A	CAT 3			None	Block	Paint	None	Drop Ceiling	No	Casework
3-121	AP06	1	0	CAT 5E	N/A		WiFi	None	Block	Paint	None	Drop Ceiling	No	Furniture
3-121A	AP05	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
3-124	4713	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-124	(NO ID)	0	1	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-124	AP06	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
3-1B3 TO 1B2 (Co	AP01	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
3-1B3 TO 1B4 (Co	AP01	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
3-1B3 TO 1B4 (Co	AP02	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
C31-1	AP03	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
C31-1	AP13	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
C31-2	AP10	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
3-205	XXXX	2	2	CAT 5	CAT 3	Phone	Computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
3-206	XXXX	2	2	CAT 5	CAT 3	Phone	Computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
3-207	XXXX	2	2	CAT 5	CAT 3	Phone	Computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
3-208	4808	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-209	XXXX	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-210	4810	2	2	CAT 5	N/A	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-211	4811	2	2	CAT 5	N/A	Phone	Computer	None	Block	Paint	None	Drop Ceiling	No	N/A
3-214	4821	2	2	CAT 5E	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
3-214	4826	2	2	CAT 5E	CAT 3	Phone	Computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
3-214	4829	2	2	CAT 5E	CAT 3	Phone	Computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
3-214	AP05	2	2	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A

Alexandria VA Existing Data Drop Survey
Building 3 - 1st Floor

Room	Tag	#Data Drops (187)	#Voice Drops (162)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
3-214	AP06	2	2	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
3-214	XXXX	2	2	CAT 5E	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
3-214	XXXX	2	2	CAT 5E	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
3-214	XXXX	2	2	CAT 5E	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
3-214	XXXX	2	2	CAT 5E	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
3-214	XXXX	2	2	CAT 5E	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
3-216	AP07	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
3-219	4829	2	2	CAT 5E	N/A	Phone	Computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
3-219	AP10	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
3-219	XXXX	2	2	CAT 5E	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
3-220	4813	2	2	CAT 5E	N/A	Phone	Computer/Equip	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-220A	(NO ID)	0	1	CAT 5	N/A			None	Block	Paint	None	Drop Ceiling	No	N/A
3-220A	(NO ID)	2	2	CAT 5	N/A	Phone	Computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
3-221	AP11	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
3-221	XXXX	2	2	CAT 5	N/A		Phone/Computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
3-222	4816	2	2	CAT 5	N/A		Printer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-222	4818	2	2	CAT 5	N/A		Computer/Printer/Equipment	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-223	4817	2	2	CAT 5	N/A	Phone	Computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
3-223	(NO ID)	0	2	CAT 5	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
3-224	4823	2	2	CAT 5E	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-224	4824	2	2	CAT 5E	N/A		Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-224	AP08	1	0	CAT 5E	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-224	AP13	1	0	CAT 5E	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-224	XXXX	2	2	CAT 5E	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
C3-2	AP01	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
C3-2	AP04	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
3-305	4925	2	2	CAT 5	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	N/A
3-305	AP05	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
3-306	4901	2	2	CAT 5	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	N/A
3-306	4928	2	2	CAT 5	CAT 3			WM	Plaster	Paint	None	Drop Ceiling	No	N/A
3-308	4903	2	2	CAT 5	CAT 3			None	Block	Paint	None	Drop Ceiling	No	Furniture
3-308	4926	2	2	CAT 5	CAT 3			None	Block	Paint	None	Drop Ceiling	No	Furniture
3-308	AP01	1	0	CAT 5E	N/A		WiFi	None	Block	Paint	None	Drop Ceiling	No	Furniture
3-309	4904	2	2	CAT 5	CAT 3			WM	Plaster	Paint	None	Drop Ceiling	No	N/A
3-309	31,32,33	0	3	CAT 5	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	N/A
3-309	AP02	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
3-310A	4913	2	2	CAT 5	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	N/A
3-310B	4905	2	2	CAT 5	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	N/A
3-311	(NO ID)	0	1	N/A	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	N/A
3-314A	4907	2	2	CAT 5E	N/A	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-314B	XXXX	1	1	CAT 5E	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-314C	4910	2	2	CAT 5E	N/A	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-314C	AP06	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
3-314D	4911	2	2	CAT 5E	N/A	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-314D	AP07	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
3-314E	4914	2	2	CAT 5E	N/A		Computer/Printer/Equipment	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-315	315	1	1	CAT 6	CAT 6	Fax	Printer	WM	Plaster	Paint	None	Drop Ceiling	No	Furniture
3-317	4915	2	2	CAT 5	CAT 3	Phone	Printer	None	Plaster	Paint	None	Drop Ceiling	No	Furniture
3-317	AP15	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
3-317A	4916	2	2	CAT 5	CAT 3	Phone	Computer	None	Plaster	Paint	None	Drop Ceiling	No	N/A
3-319	4917	2	2	CAT 5	CAT 3	Phone		None	Plaster	Paint	None	Drop Ceiling	No	N/A
3-320	4918	2	2	CAT 5	N/A	Phone	Computer	None	Block	Paint	None	Drop Ceiling	No	N/A
3-320	(NO ID)	0	1	N/A	CAT 3	Phone		None	Block	Paint	None	Drop Ceiling	No	N/A
3-320	AP12	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
3-320 (Corr)	AP14	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
3-320A	XXXX	2	2	CAT 5	N/A			None	Block	Paint	None	Drop Ceiling	No	N/A

Alexandria VA Existing Data Drop Survey
Building 3 - 1st Floor

Room	Tag	#Data Drops (187)	#Voice Drops (162)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
3-321	4924	2	2	CAT 5	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	N/A
3-322	4920	0	1	N/A	CAT 3	Phone		None	Plaster	Paint	None	Drop Ceiling	No	N/A
3-323	4921	2	2	CAT 5	CAT 3	Phone	Computer/Equip	WM	Plaster	Paint	None	Drop Ceiling	No	N/A
3-323	4922	2	2	CAT 5	CAT 3			WM	Plaster	Paint	None	Drop Ceiling	No	N/A
3-323	AP16	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
3-324	4931	2	2	CAT 5	N/A	Phone	Computer	None	Block	Wallpa	None	Drop Ceiling	No	Furniture
3-324	AP10	2	2	CAT 5	N/A		WiFi	None	Block	Paint	None	Drop Ceiling	No	N/A
C3-3	AP03	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
C33-1	AP08	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture

Alexandria VA Existing Data Drop Survey
Building 3 - 2nd Floor

Room	Tag	#Data Drops (63)	#Voice Drops (59)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
3-205	XXXX	2	2	CAT 5	CAT 3	Phone	Computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
3-206	XXXX	2	2	CAT 5	CAT 3	Phone	Computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
3-207	XXXX	2	2	CAT 5	CAT 3	Phone	Computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
3-208	4808	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-209	XXXX	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-210	4810	2	2	CAT 5	N/A	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-211	4811	2	2	CAT 5	N/A	Phone	Computer	None	Block	Paint	None	Drop Ceiling	No	N/A
3-214	4821	2	2	CAT 5E	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
3-214	4826	2	2	CAT 5E	CAT 3	Phone	Computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
3-214	4829	2	2	CAT 5E	CAT 3	Phone	Computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
3-214	AP05	2	2	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
3-214	AP06	2	2	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
3-214	XXXX	2	2	CAT 5E	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
3-214	XXXX	2	2	CAT 5E	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
3-214	XXXX	2	2	CAT 5E	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
3-214	XXXX	2	2	CAT 5E	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
3-214	XXXX	2	2	CAT 5E	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
3-216	AP07	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
3-219	4829	2	2	CAT 5E	N/A	Phone	Computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
3-219	AP10	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
3-219	XXXX	2	2	CAT 5E	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
3-220	4813	2	2	CAT 5E	N/A	Phone	Computer/Equip	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-220A	(NO ID)	0	1	CAT 5	N/A			None	Block	Paint	None	Drop Ceiling	No	N/A
3-220A	(NO ID)	2	2	CAT 5	N/A	Phone	Computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
3-221	AP11	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
3-221	XXXX	2	2	CAT 5	N/A		Phone/Computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
3-222	4816	2	2	CAT 5	N/A		Printer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-222	4818	2	2	CAT 5	N/A		Computer/Printer/Equipment	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-223	4817	2	2	CAT 5	N/A	Phone	Computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
3-223	(NO ID)	0	2	CAT 5	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
3-224	4823	2	2	CAT 5E	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-224	4824	2	2	CAT 5E	N/A		Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-224	AP08	1	0	CAT 5E	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-224	AP13	1	0	CAT 5E	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-224	XXXX	2	2	CAT 5E	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
C3-2	AP01	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
C3-2	AP04	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A

Alexandria VA Existing Data Drop Survey
Building 3 - 3rd Floor

Room	Tag	#Data Drops (57)	#Voice Drops (52)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
3-305	4925	2	2	CAT 5	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	N/A
3-305	AP05	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
3-306	4901	2	2	CAT 5	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	N/A
3-306	4928	2	2	CAT 5	CAT 3			WM	Plaster	Paint	None	Drop Ceiling	No	N/A
3-308	4903	2	2	CAT 5	CAT 3			None	Block	Paint	None	Drop Ceiling	No	Furniture
3-308	4926	2	2	CAT 5	CAT 3			None	Block	Paint	None	Drop Ceiling	No	Furniture
3-308	AP01	1	0	CAT 5E	N/A		WiFi	None	Block	Paint	None	Drop Ceiling	No	Furniture
3-309	4904	2	2	CAT 5	CAT 3			WM	Plaster	Paint	None	Drop Ceiling	No	N/A
3-309	31,32,33	0	3	CAT 5	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	N/A
3-309	AP02	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
3-310A	4913	2	2	CAT 5	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	N/A
3-310B	4905	2	2	CAT 5	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	N/A
3-311	(NO ID)	0	1	N/A	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	N/A
3-314A	4907	2	2	CAT 5E	N/A	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-314B	XXXX	1	1	CAT 5E	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-314C	4910	2	2	CAT 5E	N/A	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-314C	AP06	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
3-314D	4911	2	2	CAT 5E	N/A	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-314D	AP07	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
3-314E	4914	2	2	CAT 5E	N/A		Computer/Printer/Equipment	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
3-315	315	1	1	CAT 6	CAT 6	Fax	Printer	WM	Plaster	Paint	None	Drop Ceiling	No	Furniture
3-317	4915	2	2	CAT 5	CAT 3	Phone	Printer	None	Plaster	Paint	None	Drop Ceiling	No	Furniture
3-317	AP15	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
3-317A	4916	2	2	CAT 5	CAT 3	Phone	Computer	None	Plaster	Paint	None	Drop Ceiling	No	N/A
3-319	4917	2	2	CAT 5	CAT 3	Phone		None	Plaster	Paint	None	Drop Ceiling	No	N/A
3-320	4918	2	2	CAT 5	N/A	Phone	Computer	None	Block	Paint	None	Drop Ceiling	No	N/A
3-320	(NO ID)	0	1	N/A	CAT 3	Phone		None	Block	Paint	None	Drop Ceiling	No	N/A
3-320	AP12	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
3-320 (Corr)	AP14	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
3-320A	XXXX	2	2	CAT 5	N/A			None	Block	Paint	None	Drop Ceiling	No	N/A
3-321	4924	2	2	CAT 5	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	N/A
3-322	4920	0	1	N/A	CAT 3	Phone		None	Plaster	Paint	None	Drop Ceiling	No	N/A
3-323	4921	2	2	CAT 5	CAT 3	Phone	Computer/Equip	WM	Plaster	Paint	None	Drop Ceiling	No	N/A
3-323	4922	2	2	CAT 5	CAT 3			WM	Plaster	Paint	None	Drop Ceiling	No	N/A
3-323	AP16	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
3-324	4931	2	2	CAT 5	N/A	Phone	Computer	None	Block	Wallpa	None	Drop Ceiling	No	Furniture
3-324	AP10	2	2	CAT 5	N/A		WiFi	None	Block	Paint	None	Drop Ceiling	No	N/A
C3-3	AP03	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
C33-1	AP08	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture

Alexandria VA Existing Data Drop Survey
Building 4

Room	Tag	#Data Drops (72)	#Voice Drops (47)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
4-100 (Corr)	AP19	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
4-101	5301	2	2	CAT 5E	CAT 3		Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
4-101	5302	2	2	CAT 5E	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
4-101	5304	2	2	CAT 5E	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
4-101	5305	2	2	CAT 5E	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
4-101	5306	2	2	CAT 5E	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
4-101	AP01	1	0	CAT 5E	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
4-101	AP02	1	0	CAT 5E	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
4-101 (Corr)	AP03	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
4-102	5307	2	2	CAT 5	CAT 3	Phone		None	Drywall	Paint	None	Drop Ceiling	No	Furniture
4-102A	XXXX	2	2	CAT 5	N/A	Phone		None	Drywall	Paint	None	Drop Ceiling	No	Furniture
4-102B	5312	2	2	CAT 5	CAT 3	Phone		None	Drywall	Paint	None	Drop Ceiling	No	Furniture
4-102B	AP5	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
4-102C	5313	2	2	CAT 5E	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
4-102D	5315	2	1	CAT 5E	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
4-102E	5314	2	2	CAT 5E	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
4-104	AP12	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
4-106	AP09	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	None	No	N/A
4-108	AP14	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
4-111 (Corr)	AP17	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
4-115 (Corr)	AP18	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
4-117 (Corr)	AP16	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
4-118	AP08	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	None	No	N/A
4-119 (Corr)	AP07	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
4-120	5347	2	2	CAT 3	CAT 1	Phone		None	Drywall	Paint	None	Drop Ceiling	No	Furniture
4-2- (Kitchen)	5324	0	1	CAT 5	N/A	Phone		None	Drywall	Paint	None	Drop Ceiling	No	N/A
4-2- (Kitchen)	5335	0	1	CAT 5	N/A	Phone		None	Drywall	Paint	None	Drop Ceiling	No	N/A
4-2- (Kitchen)	AP01	1	0	CAT 5	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	N/A
4-2- (Kitchen)	AP03	1	0	CAT 5	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	N/A
4-2- (Kitchen)	AP04	1	0	CAT 5	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	N/A
4-2- (Kitchen)	AP06	1	0	CAT 5	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	N/A
4-2- (Kitchen)	AP07	1	0	CAT 5	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	N/A
4-2- (Kitchen)	AP09	1	0	CAT 5	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	N/A
4-2- (Kitchen)	AP10	1	0	CAT 5	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	N/A
4-2- (Kitchen)	AP12	1	0	CAT 5	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	N/A
4-2- (Kitchen)	APXX	1	0	CAT 5	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	N/A
4-202	XXXX	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Equipment
4-203	5316	2	2	CAT 5	N/A	Phone	Phone/Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
4-203	5325	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
4-214	5317	2	2	CAT 5	N/A		Computer	None	Drywall	Paint	None	Drop Ceiling	No	N/A
4-214	5318	2	2	CAT 5	N/A	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
4-214	5320	1	2	CAT 5	N/A		Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
4-214	AP11	1	0	CAT 5	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	N/A
4-215	5319	2	2	CAT 5	N/A	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
4-215	5321	2	2	CAT 5	N/A	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
4-215	XXXX	2	2	CAT 5	N/A	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
4-216	XXXX	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	N/A
4-219	5322	2	2	CAT 5	N/A	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
4-219	AP14	1	0	CAT 5	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	N/A
4-CORR TO B3	AP02	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Hard Lid	No	N/A
4-CORR TO B5	AP01	1	0	CAT 5E	N/A		WiFi	None	Other	Paint	None	Drop Ceiling	No	N/A
4-CORR TO B5	AP01	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A

Alexandria VA Existing Data Drop Survey
Building 5 - Basement

Room	Tag	#Data Drops (45)	#Voice Drops (25)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
5-G- (Corr)	AP01	1	0	CAT 5	N/A		WiFi	None	Block	Paint	None	Drop Ceiling	No	Furniture
5-G- (Corr)	AP09	1	0	CAT 5	N/A		WiFi	None	Block	Paint	None	Drop Ceiling	No	Furniture
5-G- (Corr)	AP16	1	0	CAT 5	N/A		WiFi	None	Block	Paint	None	Drop Ceiling	No	Furniture
5-G- (Corr)	AP19	1	0	CAT 5	N/A		WiFi	None	Block	Paint	None	Drop Ceiling	No	Furniture
5-G03	5405	2	2	CAT 5	CAT 3			None	Block	Paint	None	Drop Ceiling	No	Furniture
5-G03	112D-G03-1	4	0	CAT 5	N/A			WM / SMB	Block	Paint	None	Drop Ceiling	No	Furniture
5-G03	AP17	1	0	CAT 5	N/A		WiFi	None	Block	Paint	None	Drop Ceiling	No	Furniture
5-G03A	5502	2	2	CAT 5	CAT 3	Phone	Computer/Printer	None	Block	Paint	None	Drop Ceiling	No	Furniture
5-G03B	5409	2	2	CAT 5	CAT 3	Phone	Computer/Printer	None	Block	Paint	None	Drop Ceiling	No	Furniture
5-G04	AP15	1	0	CAT 5	N/A		WiFi	None	Block	Paint	None	Drop Ceiling	No	Furniture
5-G06	AP11	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
5-G06	AP12	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
5-G09	5404	2	2	CAT 5	CAT 3	Phone	Computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
5-G09	5539	2	2	CAT 5	CAT 3	Phone	Computer	WM	Block	Paint	None	Drop Ceiling	No	Furniture
5-G09	AP07	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
5-G09A	5407	2	2	CAT 5	CAT 3	Phone/Fax	Computer/Printer	None	Block	Paint	None	Drop Ceiling	No	Furniture
5-G14	APXX	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Other
5-G15A	APXX	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Other
5-G15A	XX-XXX	2	2	CAT 5	N/A		Computer/Printer	None	Block	Paint	None	Drop Ceiling	No	Other
5-G16	5402	2	2	CAT 5	CAT 3	Phone/Fax	Computer/Printer	WM / SMB	Block	Paint	None	Drop Ceiling	No	Furniture
5-G16	AP 04	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
5-G16	XX-XXX	2	2	CAT 5	N/A			WM / SMB	Block	Paint	None	Drop Ceiling	No	Furniture
5-G16A	AP05	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
5-G18	5403	2	2	CAT 5	CAT 3	Phone	Computer/Printer	WM / SMB	Block	Paint	None	Drop Ceiling	No	Furniture
5-G18	5411	2	2	CAT 5	CAT 3	Phone	Computer/Printer	None	Block	Paint	None	Drop Ceiling	No	Furniture
5-G18	AP08	1	0	CAT 5	N/A		WiFi	None	Block	Paint	None	Drop Ceiling	No	Furniture
5-G18A	XX-XXX	2	2	CAT 5	CAT 3		Computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
5-G18A	XX-XXX	1	1	CAT 5	CAT 3	Phone	Computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
5-GS1	AP13	1	0	CAT 5	N/A		WiFi	None	Block	Paint	None	Drop Ceiling	No	Furniture
C-5-6	AP01	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A

Alexandria VA Existing Data Drop Survey
Building 5 - 1st Floor

Room	Tag	#Data Drops (123)	#Voice Drops (82)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
5-102	5501	2	2	CAT 5	CAT 5E	Phone	Computer	WM	Plaster	Paint	None	Drop Ceiling	No	Furniture
5-102	5543	2	2	CAT 5	CAT 5E	Phone	Computer	WM	Plaster	Paint	None	Drop Ceiling	No	Furniture
5-102	AP13	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
5-104	5502	2	2	CAT 5	CAT 5E			WM	Plaster	Paint	None	Drop Ceiling	No	N/A
5-104	AP15	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
5-104	XXXX	2	2	CAT 5	CAT 5E	Phone	Computer	WM	Plaster	Paint	None	Drop Ceiling	No	Furniture
5-106	AP22	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
5-108	5503	2	2	CAT 5	CAT 3	Phone	Computer	None	Plaster	Paint	None	Drop Ceiling	No	N/A
5-108	5527	2	2	CAT 5	CAT 3	Phone	Computer	None	Plaster	Paint	None	Drop Ceiling	No	N/A
5-108	AP21	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
5-109	5505	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
5-109	5507	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
5-109	5525	2	2	CAT 5	CAT 3			WM	Drywall	Paint	None	Drop Ceiling	No	N/A
5-109	AP18	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
5-109	XXXX	2	1	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
5-109	XXXX	2	2	CAT 5	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
5-109A	5541	2	2	CAT 5	N/A	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
5-109A	(NO ID)	1	0	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
5-109A	XXXX	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
5-109B	5550	2	2	CAT 5	CAT 3	Phone	Computer	WM	Plaster	Paint	None	Drop Ceiling	No	Furniture
5-109B	AP17	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
5-109B	XXXX	2	2	CAT 5	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	Furniture
5-109C	AP19	1	0	CAT 5E	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
5-110	5512	2	2	CAT 5	CAT 3			Raceway	Plaster	Paint	None	Drop Ceiling	No	Furniture
5-110	5513	2	2	CAT 5	CAT 3	Phone		None	Plaster	Paint	None	Drop Ceiling	No	Furniture
5-110	5551	2	2	CAT 5	CAT 3		Computer	WM	Plaster	Paint	None	Drop Ceiling	No	Furniture
5-110	5553	2	2	CAT 5	CAT 3	Fax	Printer	WM	Plaster	Paint	None	Drop Ceiling	No	N/A
5-110	AP16	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
5-110	XXXX	1	1	CAT 5	CAT 3	Phone	Computer	WM	Plaster	Paint	None	Drop Ceiling	No	Furniture
5-110A	5510	2	2	CAT 5	CAT 3	Phone	Computer	None	Plaster	Paint	None	Drop Ceiling	No	Furniture
5-110B	5524	2	2	CAT 5	CAT 3	Phone	Computer	None	Plaster	Paint	None	Drop Ceiling	No	Furniture
5-112	5516	2	2	CAT 5	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	N/A
5-112	5528	2	2	CAT 5	CAT 3	Phone	Printer	None	Plaster	Paint	None	Drop Ceiling	No	N/A
5-112	AP10	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
5-112A	5519	2	2	CAT 5	CAT 3		Computer	None	Plaster	Paint	None	Drop Ceiling	No	Furniture
5-112A	5533	2	2	CAT 5	CAT 3	Phone		None	Plaster	Paint	None	Drop Ceiling	No	Furniture
5-112A	5536	2	2	CAT 5	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	N/A
5-112B	5535	2	2	CAT 5	CAT 3	Phone	Computer/Printer	None	Plaster	Paint	None	Drop Ceiling	No	Furniture
5-112B	5542	2	2	CAT 5	CAT 3		Computer	None	Plaster	Paint	None	Drop Ceiling	No	N/A
5-112B	AP08	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
5-112B	XXXX	2	2	CAT 5	CAT 3	Phone	Computer/Printer	None	Plaster	Paint	None	Drop Ceiling	No	Furniture
5-112C	5515	2	2	CAT 5	CAT 3	Phone	Computer/Printer	None	Plaster	Paint	None	Drop Ceiling	No	Equipment
5-112C	AP09	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
5-112D	5532	2	2	CAT 5	CAT 3	Phone		None	Plaster	Paint	None	Drop Ceiling	No	N/A
5-113	(NO ID)	2	2	CAT 5	CAT 3	Phone	Computer	None	Plaster	Paint	None	Drop Ceiling	No	N/A
5-113	AP03	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
5-115	2586	0	1	N/A	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
5-115	5521	2	2	CAT 5	CAT 3	Phone		None	Drywall	Paint	None	Drop Ceiling	No	N/A
5-115	5522	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
5-115	5546	4	0	CAT 5	N/A		Equipment	WM	Drywall	Paint	None	Drop Ceiling	No	N/A
5-115	5549	3	0	CAT 5	N/A		Equipment	WM	Drywall	Paint	None	Drop Ceiling	No	N/A
5-115	(NO ID)	0	1	N/A	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
5-115	5547A	3	0	CAT 5	N/A		Equipment	None	Drywall	Paint	None	Drop Ceiling	No	N/A
5-115	5547B	3	0	CAT 5	N/A		Equipment	WM	Drywall	Paint	None	Drop Ceiling	No	N/A
5-115	5548A	3	0	CAT 5	N/A		Equipment	None	Drywall	Paint	None	Drop Ceiling	No	N/A
5-115	5548B	3	0	CAT 5	N/A		Equipment	WM	Drywall	Paint	None	Drop Ceiling	No	N/A

Alexandria VA Existing Data Drop Survey
Building 5 - 1st Floor

Room	Tag	#Data Drops (123)	#Voice Drops (82)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
5-115	AP04	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
5-116	5538	2	2	CAT 5	CAT 3	Phone	Computer/Printer	None	Plaster	Paint	None	Drop Ceiling	No	Furniture
5-117	XXXX	2	2	CAT 5	CAT 3	Phone	Computer/Printer	None	Plaster	Paint	None	Drop Ceiling	No	Furniture
5-120	5534	2	2	CAT 5	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	N/A
5-120	AP06	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
5-122	5526	2	2	CAT 5	CAT 3	Phone	Computer/Printer	None	Plaster	Paint	None	Drop Ceiling	No	N/A
5-123	AP11	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
5-123	XXXX	2	2	CAT 5	CAT 3	Phone	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
5-124	XXXX	2	2	CAT 5	CAT 3	Phone	Computer	None	Plaster	Paint	None	Drop Ceiling	No	Furniture
C-5-1	AP01	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
C-5-1	AP02	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
C-5-1	AP05	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
C-5-1	AP07	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
C-5-1	AP12	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
C-5-1	AP14	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
C-5-1	AP20	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A

Alexandria VA Existing Data Drop Survey
Building 5 - 2nd Floor

Room	Tag	#Data Drops (132)	#Voice Drops (136)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
5-201	5601	2	2	CAT 5	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
5-201	5602	2	2	CAT 5	CAT 3	Phone	Computer	None	Furred Block	Paint	None	Drop Ceiling	No	N/A
5-201	5603	2	2	CAT 5	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
5-201	5676	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
5-201	AP07	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
5-202	33	0	1	N/A	CAT 3	Phone		None	Furred Block	Paint	None	Drop Ceiling	No	N/A
5-202	5604	2	2	CAT 5	CAT 3	Phone	Computer	None	Furred Block	Paint	None	Drop Ceiling	No	N/A
5-202	AP16	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
5-204	XXXX	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
5-204	XXXX	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
5-208	AP14	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
5-210	5606	2	2	CAT 5	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
5-211	5608	2	2	CAT 5	CAT 3	Phone	Computer	None	Plaster	Paint	None	Drop Ceiling	No	N/A
5-211A	5607	2	2	CAT 5	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	N/A
5-211A	5648	2	2	CAT 5	CAT 3	Phone	Computer	None	Plaster	Paint	None	Drop Ceiling	No	N/A
5-211A	5650	2	2	CAT 5	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	N/A
5-211A	(NO ID)	0	1	N/A	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	Furniture
5-211A	(NO ID)	0	1	N/A	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	Furniture
5-211A	AP12	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
5-212	5611	2	2	CAT 5	CAT 3	Phone		None	Plaster	Paint	None	Drop Ceiling	No	N/A
5-212	5612	2	2	CAT 5	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	N/A
5-212	5617	2	2	CAT 5	CAT 3	Fax	Computer	None	Plaster	Paint	None	Drop Ceiling	No	Furniture
5-212	5651	2	2	CAT 5	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	N/A
5-212	5670	2	2	CAT 5	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	N/A
5-212	(NO ID)	0	2	N/A	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	Furniture
5-212	(NO ID)	0	1	N/A	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	N/A
5-212	(NO ID)	0	1	N/A	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	N/A
5-212	(NO ID)	2	2	CAT 5	CAT 3			WM	Concrete Column	Paint	None	Drop Ceiling	No	N/A
5-212	(NO ID)	2	2	CAT 5	CAT 3			WM	Concrete Column	Paint	None	Drop Ceiling	No	N/A
5-212	AP11	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
5-212A	5609	2	2	CAT 5	CAT 3	Phone	Computer	None	Plaster	Paint	None	Drop Ceiling	No	Furniture
5-212B	5610	2	2	CAT 5	CAT 3	Phone	Computer	None	Plaster	Paint	None	Drop Ceiling	No	Furniture
5-218	30	0	2	N/A	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
5-218	31	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
5-218	32	0	2	N/A	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
5-218	5618	2	2	CAT 5	CAT 3	Phone	Printer	None	Drywall	Paint	None	Drop Ceiling	No	N/A
5-218	5620	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
5-218	5621	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
5-218	5622	2	2	CAT 5	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	N/A
5-218	5623	2	2	CAT 5	CAT 3	Phone		None	Drywall	Paint	None	Drop Ceiling	No	N/A
5-218	AP10	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
5-219	28	0	2	N/A	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	N/A
5-219	5625	2	2	CAT 5	CAT 3	Phone	Computer	WM	Plaster	Paint	None	Drop Ceiling	No	Furniture
5-219	5674	2	2	CAT 5	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	Furniture
5-219	AP08	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
5-220	5671	2	2	CAT 5	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	Furniture
5-223	86	0	1	N/A	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
5-223	5626	2	2	CAT 5	CAT 3		Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
5-223	5627	2	2	CAT 5	CAT 3	Phone	Printer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
5-223	5628	2	2	CAT 5	CAT 3	Phone	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	N/A
5-223	5629	2	2	CAT 5	CAT 3	Phone	Printer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
5-223	5630	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
5-223	5631	2	2	CAT 5	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	N/A
5-223	AP06	1	0	CAT 5	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	N/A
5-224	(NO ID)	0	2	N/A	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
5-224	(NO ID)	2	2	CAT 5	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture

Alexandria VA Existing Data Drop Survey
Building 5 - 2nd Floor

Room	Tag	#Data Drops (132)	#Voice Drops (136)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
5-224	AP04	1	0	CAT 5	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	N/A
5-225	5633	2	2	CAT 5	CAT 3	Phone	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	N/A
5-225	5635	2	2	CAT 5	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	N/A
5-225	5636	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
5-225	5658	2	2	CAT 5	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
5-225	(NO ID)	0	1	N/A	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
5-225	(NO ID)	0	2	N/A	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
5-225	(NO ID)	2	2	CAT 5	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
5-226	5537	2	2	CAT 5	CAT 3	Phone	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	N/A
5-226A	5638	2	1	CAT 5	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	N/A
5-226B	5639	2	1	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
5-226B	5653	2	2	CAT 5	CAT 3	Phone	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	N/A
5-226B	5656	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
5-226B	AP02	1	0	CAT 5	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	N/A
5-226C	5640	2	2	CAT 5	CAT 3		Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
5-226C	5641	2	2	CAT 5	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
5-227	5653	2	2	CAT 5	CAT 3	Fax		None	Drywall	Paint	None	Drop Ceiling	No	Furniture
5-227	5654	2	2	CAT 5	CAT 3		Printer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
5-228	5642	2	2	CAT 5	CAT 3	Fax	Printer	None	Plaster	Paint	None	Drop Ceiling	No	Furniture
5-228	5643	2	2	CAT 5	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	Furniture
5-228	5644	2	2	CAT 5	CAT 3	Phone	Computer	WM	Plaster	Paint	None	Drop Ceiling	No	N/A
5-228	5657	2	2	CAT 5	CAT 3	Fax	Printer	None	Plaster	Paint	None	Drop Ceiling	No	N/A
5-228	(NO ID)	0	2	N/A	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	N/A
5-228	AP01	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
5-229	5645	2	2	CAT 5	CAT 3	Phone	Computer	None	Plaster	Paint	None	Drop Ceiling	No	Furniture
5-229	5646	2	2	CAT 5	CAT 3			None	Plaster	Paint	None	Drop Ceiling	No	Furniture
5-232	5675	2	2	CAT 5	N/A			None	Plaster	Paint	None	Drop Ceiling	No	Furniture
5-233	5655	0	1	N/A	CAT 3	Phone		None	Furred Column	Paint	None	Drop Ceiling	No	N/A
C-5-2	AP03	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
C-5-2	AP05	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
C-5-2	AP09	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
C-5-2	AP13	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
C-5-2	AP15	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A

Alexandria VA Existing Data Drop Survey
Building 6 - Basement

Room	Tag	#Data Drops (53)	#Voice Drops (34)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
6-001	5801	2	2	CAT 5	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
6-001	5934	2	2	CAT 5	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
6-001	5935	2	2	CAT 5	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
6-001	5936	2	2	CAT 5	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
6-001	5937	2	2	CAT 5	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
6-001	5938	2	2	CAT 5	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
6-001	5940	2	2	CAT 5	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
6-001	5941	2	2	CAT 5	N/A	Phone		None	Block	Paint	None	Drop Ceiling	No	Furniture
6-001	AP07	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
6-001	AP08	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
6-004	AP02	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	None	Yes	N/A
6-006	AP06	1	0	CAT 5	N/A		WiFi	1/2"	Brick	Paint	None	None	No	N/A
6-007	AP09	1	0	CAT 5	N/A		WiFi	None	Other	Paint	None	Drop Ceiling	No	N/A
6-009	AP11	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
6-010	5812	2	2	CAT 5E	CAT 3	Phone		None	Drywall	Paint	None	Drop Ceiling	No	N/A
6-014	AP17	1	0	CAT 5	N/A		WiFi	None	Block	Paint	None	None	No	N/A
6-015	5805	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-015	5806	2	2	CAT 5	N/A	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-015	AP05	1	0	CAT 5	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-015	AP15	1	0	CAT 5	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-016	55802	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-016	(NO ID)	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-016	AP13	1	0	CAT 5	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-017	(NO ID)	0	0	N/A	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
6-017	AP16	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
6-018	5808	2	2	CAT 5	CAT 3	Phone	Computer	WM	Plaster	Paint	None	Drop Ceiling	No	Furniture
6-018	5809	2	2	CAT 5	CAT 3			WM	Plaster	Paint	None	Drop Ceiling	No	Furniture
6-018	5810	2	2	CAT 5	CAT 3	Phone	Computer/Printer	WM	Plaster	Paint	None	Drop Ceiling	No	Furniture
6-018	AP14	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	Yes	N/A
6-020	5807	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
C6-B	AP01	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	none	Drop Ceiling	No	Furniture
C6-B	AP03	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	none	Drop Ceiling	No	Furniture
C6-B	AP05	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
C6-B	AP10	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
C6-B	AP12	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
C6-B	AP15	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
C6-B	AP19	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A

Alexandria VA Existing Data Drop Survey
Building 6 - 1st Floor

Room	Tag	#Data Drops (104)	#Voice Drops (81)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
1NS-6	AP04	1	0	CAT 5	N/A		WiFi	None	Block	Paint	none	Hard Lid	No	Furniture
6-101	5901	2	2	CAT 5E	CAT 3			None	Block	Paint	None	Drop Ceiling	No	Furniture
6-101	5902	2	2	CAT 5E	CAT 3			None	Block	Paint	None	Drop Ceiling	No	Furniture
6-101	AP09	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
6-104	AP10	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
6-109	5904	1	0	CAT 5E	N/A		Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-109	AP03	1	0	CAT 5E	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-110	5905	2	2	CAT 5E	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-111	XXXX	2	2	CAT 5E	CAT 3	Phone	Computer	WM / SMB	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-112	5907	2	2	CAT 5E	CAT 3	Phone	Computer	WM / SMB	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-112	AP01	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
6-113	5908	2	2	CAT 5E	CAT 3	Phone	Computer	WM / SMB	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-114	AP02	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
6-114	XXXX	2	2	CAT 5E	N/A	Phone	Computer	WM / SMB	Furred Column	Paint	None	Drop Ceiling	No	Furniture
6-116	5911	2	2	CAT 5E	CAT 3	Phone	Computer	WM / SMB	Block	Paint	None	Drop Ceiling	No	Furniture
6-116	5931	2	2	CAT 5E	CAT 3	Phone	Computer	WM / SMB	Block	Paint	None	Drop Ceiling	No	Furniture
6-116	5950	2	2	CAT 5E	CAT 3	Phone	Computer	WM / SMB	Block	Paint	None	Drop Ceiling	No	Furniture
6-116	122-6-116A	2	2	CAT 5E	CAT 3	Phone	Computer	WM / SMB	Block	Paint	None	Drop Ceiling	No	Furniture
6-118	5912	2	2	CAT 5	CAT 3	Phone	Computer	WM / SMB	Block	Paint	None	Drop Ceiling	No	Furniture
6-118	AP06	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
6-118	XXXX	2	2	CAT 5	CAT 3	Phone	Computer	WM / SMB	Block	Paint	None	Drop Ceiling	No	Furniture
6-119	5914	2	2	CAT 5	CAT 3	Phone	Computer	WM / SMB	Block	Paint	None	Drop Ceiling	No	Furniture
6-119	5915	2	2	CAT 5	CAT 3	Phone	Computer	WM / SMB	Block	Paint	None	Drop Ceiling	No	Furniture
6-119	5916	2	2	CAT 5	CAT 3			WM / SMB	Block	Paint	None	Drop Ceiling	No	Furniture
6-119	AP8	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
6-120A	5917	2	2	CAT 5E	CAT 3	Phone	Computer	WM / SMB	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-120A	5918	2	2	CAT 5E	CAT 3			WM / SMB	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-120A	5919	2	2	CAT 5E	CAT 3	Phone	Computer	WM / SMB	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-123	5920	2	2	CAT 5	N/A	Phone	computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-123	AP12	1	0	CAT 5	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-124	5921	2	2	CAT 5E	CAT 3	Phone	Computer	WM / SMB	Block	Paint	None	Drop Ceiling	No	Furniture
6-124	5922	2	2	CAT 5E	CAT 3			WM / SMB	Drywall	Paint	None	Drop Ceiling	No	N/A
6-125	5923	2	2	CAT 5E	CAT 3			WM / SMB	Drywall	Paint	None	Drop Ceiling	No	N/A
6-125	5948	2	2	CAT 5E	CAT 3	Phone	Computer	WM / SMB	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-125	AP15	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
6-126	5924	2	2	CAT 5E	CAT 3	Phone	Computer/Equip	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-126	5992	2	2	CAT 5E	CAT 3	Phone	Computer/Equip	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-126	(NO ID)	2	2	CAT 5E	CAT 3	Phone	Computer/Equip	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-128	5927	2	2	CAT 5E	CAT 3	Phone	Computer	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
6-128	5933	2	2	CAT 5E	CAT 3			None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
6-128	AP18	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
6-128	XXXX	2	2	CAT 5E	CAT 3	Phone	Computer	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
6-129	5949	2	2	CAT 5E	CAT 3			WM / SMB	Block	Paint	None	Drop Ceiling	No	Furniture
6-129	AP19	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
6-129	AP20	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
6-129A	AP21	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
6-129C	5928	2	2	CAT 5E	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-129C	(NO ID)	2	2	CAT 5E	CAT 3			WM / SMB	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-129D	XXXX	2	2	CAT 5E	N/A	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-129E	5944	2	2	CAT 5E	N/A	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-133	5947	2	2	CAT 5E	N/A	Phone/Fax	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Equipment
6-135	AP16	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	Yes	N/A
6-137	5930	2	2	CAT 5	N/A	Phone/Equipme	Computer	None	Block	Paint	None	Drop Ceiling	No	Equipment
6-137	5930	2	2	CAT 5	N/A	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-137	5943	2	2	CAT 5	N/A	Phone/Equipme	Printer	None	Block	Paint	None	Drop Ceiling	No	Equipment
6-137	5943	2	2	CAT 5	N/A	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture

Alexandria VA Existing Data Drop Survey
Building 6 - 1st Floor

Room	Tag	#Data Drops (104)	#Voice Drops (81)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
6-137	AP13	1	0	CAT 5	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
C6-1	(NO ID)	0	1	CAT 5E	CAT 3	Phone		WM	Plaster	Paint	None	Drop Ceiling	No	N/A
C6-1	AP01	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
C6-1	AP03	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
C6-1	AP04	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
C6-1	AP05	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
C6-1	AP11	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
C6-1	AP14	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
C6-1	AP17	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A

Alexandria VA Existing Data Drop Survey
Building 6 - 2nd Floor

Room	Tag	#Data Drops (112)	#Voice Drops (90)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
2NS-6	AP11	1	0	CAT 5	N/A		WiFi	None	Block	Paint	Other	Drop Ceiling	No	N/A
2SS-6	AP20	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
6-201	6001	2	2	CAT 5	N/A	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-201	6042	2	2	CAT 5	N/A	Phone/Equipme	Printer/Equipment	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-202	6002	2	2	CAT 5	N/A	Phone	Computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
6-202	6025	2	2	CAT 5	N/A			None	Block	Paint	None	Drop Ceiling	No	N/A
6-202	6052	2	2	CAT 5	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
6-202	AP14	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
6-204	6051	2	2	CAT 5	N/A	Phone		None	Block	Paint	None	Drop Ceiling	No	Furniture
6-206	AP17	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
6-208	6049	2	2	CAT 5E	N/A			WM / SMB	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-209	XXXX	2	2	CAT 5E	CAT 3	Phone	Computer	WM / SMB	Drywall	Paint	1 Hr	Drop Ceiling	No	Furniture
6-210	6006	2	2	CAT 5E	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-210	AP22	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
6-211	6007	2	2	CAT 5E	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-212	6008	2	2	CAT 5E	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-213	6009	2	2	CAT 5	N/A	Phone/Equipme	Printer	None	Block	Paint	None	Drop Ceiling	No	N/A
6-213	AP21	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
6-214	XXXX	2	2	CAT 5	N/A	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-216	6011	2	2	CAT 5	N/A	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-216	6012	2	2	CAT 5	N/A	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-216	AP19	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
6-218	6013	2	2	CAT 5	N/A	Phone		None	Block	Paint	None	Drop Ceiling	No	N/A
6-218	6014	2	2	CAT 5	N/A	Phone		None	Block	Paint	None	Drop Ceiling	No	N/A
6-218	6043	2	2	CAT 5	N/A			None	Block	Paint	None	Drop Ceiling	No	N/A
6-218	6044	2	2	CAT 5	N/A			None	Block	Paint	None	Drop Ceiling	No	N/A
6-218	AP16	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
6-219	6015	2	2	CAT 5	N/A	phone	Computer	None	Drywall	Paint	none	Drop Ceiling	No	Furniture
6-219	6016	2	2	CAT 5	N/A	phone	Computer/Printer	None	Drywall	Paint	none	Drop Ceiling	No	Furniture
6-219	6046	2	2	CAT 5	N/A	phone	Computer	None	Drywall	Paint	none	Drop Ceiling	No	Furniture
6-220	AP14	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	none	Drop Ceiling	No	N/A
6-220	XXXX	2	2	CAT 5	N/A	phone	Computer	None	Block	Paint	none	Drop Ceiling	No	Furniture
6-220	XXXX	2	2	CAT 5	N/A	phone	Computer	None	Block	Paint	none	Drop Ceiling	No	Furniture
6-223	AP09	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
6-223	XXXX	2	2	CAT 5	N/A	phone	Computer	None	Block	Paint	none	Drop Ceiling	No	Furniture
6-223	XXXX	2	2	CAT 5	N/A	phone	Computer	None	Block	Paint	none	Drop Ceiling	No	Furniture
6-225	6022	2	2	CAT 5E	CAT 3	Phone	Computer	WM / SMB	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-225	6022	2	2	CAT 5E	CAT 3	Phone	Computer	WM / SMB	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-225	6033	2	2	CAT 5E	CAT 3	Phone	Computer	WM / SMB	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-225	225-1	2	2	CAT 5E	CAT 3		Computer	WM / SMB	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-225	225-2	2	2	CAT 5E	CAT 3		Computer	WM / SMB	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-227	XXXX	2	2	CAT 5	N/A			None	Drywall	Paint	none	Drop Ceiling	No	N/A
6-228	XXXX	2	2	CAT 5	N/A	Phone	Computer	None	Drywall	Paint	none	Drop Ceiling	No	Furniture
6-228	XXXX	2	2	CAT 5	N/A	Phone	Computer	None	Drywall	Paint	none	Drop Ceiling	No	Furniture
6-228	XXXX	2	2	CAT 5	N/A	Phone	Computer	None	Drywall	Paint	none	Drop Ceiling	No	Furniture
6-229	6087	2	2	CAT 5	N/A	phone		None	Block	Paint	none	Drop Ceiling	No	Furniture
6-229	AP01	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	none	Drop Ceiling	No	N/A
6-229A	6039	2	2	CAT 5	N/A			None	Block	Paint	none	Drop Ceiling	No	N/A
6-229C	XXXX	2	2	CAT 5	N/A			None	Block	Paint	none	Drop Ceiling	No	N/A
6-229D	AP03	2	2	CAT 5	N/A		WiFi	None	Block	Paint	none	Drop Ceiling	No	N/A
6-229D	XXXX	2	2	CAT 5	N/A	phone	computer	None	Block	Paint	none	Drop Ceiling	No	N/A
6-229D	XXXX	2	2	CAT 5	N/A	phone	computer	None	Block	Paint	none	Drop Ceiling	No	N/A
6-233	AP06	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
6-236	6029	2	2	CAT 5	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
6-236	AP24	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	none	Drop Ceiling	No	N/A
6-237	6030	2	2	CAT 5	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture

Alexandria VA Existing Data Drop Survey
Building 6 - 2nd Floor

Room	Tag	#Data Drops (112)	#Voice Drops (90)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
6-237	AP10	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	none	Drop Ceiling	No	N/A
6-237	XXXX	2	2	CAT 5	N/A		Phone/Computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
6-238	XXXX	2	2	CAT 5	N/A			None	Block	Paint	None	Drop Ceiling	No	Furniture
6-2XX (Brk Rm)	AP06	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	none	Drop Ceiling	No	N/A
C6-2	AP04	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
C6-2	AP05	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
C6-2	AP07	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
C6-2	AP12	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	none	Drop Ceiling	No	N/A
C6-2	AP15	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	none	Drop Ceiling	No	N/A
C6-2	AP18	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	none	Drop Ceiling	No	N/A
C6-2	AP23	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	none	Drop Ceiling	No	N/A

Alexandria VA Existing Data Drop Survey
Building 6 - 3rd Floor

Room	Tag	#Data Drops (30)	#Voice Drops (19)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
6-300	6211	2	2	CAT 5	N/A	phone	computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-301	6212	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	N/A
6-301	AP07	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
6-301	XXXX	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	N/A
6-302	6203	2	1	CAT 5	N/A	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-303	6204	2	2	CAT 5	N/A	phone	computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-303	AP06	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
6-304	6207	2	2	CAT 5	N/A	phone	computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-305	6205	2	2	CAT 5	N/A	Phone	Computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
6-305	AP05	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
6-307	AP04	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
6-309	6201	2	2	CAT 5E	N/A	Phone	Computer	None	Block	Paint	None	Drop Ceiling	No	Furniture
6-309	AP09	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
6-310	6209	2	1	CAT 5E	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
6-311	6208	2	1	CAT 5E	CAT 3			WM / SMB	Block	Paint	None	Drop Ceiling	No	Furniture
6-311	AP08	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
6-311	XXXX	2	2	CAT 5E	CAT 3	Phone	Computer	WM / SMB	Block	Paint	None	Drop Ceiling	No	Furniture
C6-3	AP01	1	0	CAT 5	N/A		WiFi	None	Free Hanging	Paint	None	Hard Lid	No	N/A
C6-3	AP03	1	0	CAT 5	N/A		WiFi	None	Free Hanging	Paint	None	Hard Lid	No	N/A

Alexandria VA Existing Data Drop Survey
Building 7 - Basement

Room	Tag	#Data Drops (195)	#Voice Drops (154)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
7-B-001A	AP38	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-B-001B	105	2	2	CAT 5	CAT 3	PHONE	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-B-001B	176	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-B-001B	177	2	2	CAT 5	CAT 3	PHONE	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-B-001B	178	2	2	CAT 5	CAT 3		Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-B-001B	AP13	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-B-001C	(NO ID)	2	0	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-B-001C	AP14	0	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-B-002 (Stairs)	AP40	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Hard Lid	No	N/A
7-B-005	117	2	2	CAT 5	CAT 3	Phone	Computer	WM	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-B-005	153	4	0	CAT 5	CAT 3			WM	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-B-005	173	2	2	CAT 5	CAT 3	Phone	Computer	WM	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-B-005	174	2	2	CAT 5	CAT 3			WM	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-B-005	AP21	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-B-005	AP23	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-B-005A	154	2	2	CAT 5	CAT 5	Phone	Computer	WM	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-B-005A	156	1	2	CAT 5	CAT 5	Phone		WM	Drywall	Paint	None	Drop Ceiling	No	N/A
7-B-005A	(NO ID)	0	3	N/A	CAT 5	Phone		WM	Drywall	Paint	None	Drop Ceiling	No	N/A
7-B-005A	(NO ID)	2	2	CAT 5	CAT 5	Phone	Computer/Printer	WM	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-B-005A	156B	0	3	CAT 5	CAT 5	Phone		WM	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-B-005C	AP22	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-B-006	169	2	2	CAT 5	CAT 5			WM	Drywall	Paint	None	Drop Ceiling	No	N/A
7-B-006	170	2	2	CAT 5	CAT 5			WM	Drywall	Paint	None	Drop Ceiling	No	N/A
7-B-007	177	2	2	CAT 5	CAT 5	Phone	Computer	WM	Brick	Paint	None	None	No	Furniture
7-B-011	(NO ID)	0	1	N/A	CAT 5	Phone		WM	Drywall	Paint	None	Drop Ceiling	No	N/A
7-B-011A	(NO ID)	0	1	N/A	CAT 3			WM	Drywall	Paint	None	Hard Lid	No	N/A
7-B-011A	AP20	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-B-011D	AP18	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Hard Lid	No	N/A
7-B-014	AP16	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	None	Yes	N/A
7-B-015	147	2	2	CAT 5E	CAT 3	Phone		1"	Block	Paint	None	None	No	N/A
7-B-022	142	2	2	CAT 5	CAT 5	Phone/Fax	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-B-023	125	2	2	CAT 5	CAT 3		PRINTER	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-B-023	141	2	2	CAT 5	CAT 3	Fax	Printer/Equipment	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-B-023	184	2	2	CAT 5	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-B-023	(NO ID)	2	2	CAT 5	CAT 3	PHONE	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-B-023	(NO ID)	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-B-023A	(NO ID)	2	2	CAT 5	CAT 3	PHONE	Computer/Equip	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-B-023B	111	2	2	CAT 5	CAT 3	PHONE	Computer/Equip	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-B-023B	(NO ID)	0	1	N/A	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-B-024	110	2	2	CAT 5	CAT 5	Phone/Fax	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-B-024	AP38	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Hard Lid	No	N/A
7-B-030	AP36	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Hard Lid	No	N/A
7-B-045	163	2	2	CAT 5	CAT 3	Phone		None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-B-045	AP07	1	0	CAT 5	N/A		WIFI	None	Ceiling	OTHER	NONE	Drop Ceiling	No	N/A
7-B-047	AP06	1	0	CAT 5	N/A		WIFI	None	Ceiling	OTHER	NONE	Drop Ceiling	No	N/A
7-B-048 (Corr)	AP08	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-B-052	135	2	2	CAT 5	CAT 3	Phone	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-B-052	136	2	2	CAT 5	CAT 3	Phone	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-B-052	(NO ID)	2	2	CAT 5	CAT 3	Phone	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-B-052	(NO ID)	2	2	CAT 5	CAT 3	Phone	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-B-052	AP04	1	0	CAT 5	N/A		WIFI	None	Ceiling	OTHER	NONE	Drop Ceiling	No	N/A
7-B-052	AP05	1	0	CAT 5	N/A		WIFI	None	Ceiling	OTHER	NONE	Drop Ceiling	No	N/A
7-B-054	130	2	2	CAT 5	CAT 3	Phone		None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-B-054	131	2	2	CAT 5	CAT 3		Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-B-055	(NO ID)	1	0	CAT 5	N/A		Equipment	None	Brick	Paint	None	None	No	N/A
7-B-056	180	2	2	CAT 5	CAT 3	Phone	Computer	WM	Block	Paint	Smoke	Drop Ceiling	No	N/A
7-B-056	(NO ID)	1	0	CAT 5	N/A			WM	Block	Paint	Smoke	Drop Ceiling	No	N/A
7-B-057	126	2	2	CAT 5	CAT 3	Phone		None	Drywall	Paint	None	Drop Ceiling	No	N/A

Alexandria VA Existing Data Drop Survey
Building 7 - Basement

Room	Tag	#Data Drops (195)	#Voice Drops (154)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
7-B-057	127	2	2	CAT 5	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-B-057	128	2	2	CAT 5	CAT 3	Phone	Computer	WM	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-B-057	129	0	1	N/A	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-B-057	150	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-B-057	(NO ID)	2	2	CAT 5	CAT 3	Fax	Computer	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-B-057	(NO ID)	1	0	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-B-057	57-2	2	2	CAT 5	CAT 3	Phone	Computer	WM	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-B-057	AP02	1	0	CAT 5	N/A		WIFI	None	Ceiling	OTHER	NONE	Drop Ceiling	No	N/A
7-B-057D	(NO ID)	2	2	CAT 5	CAT 3	PHONE	Computer	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
7-B-057D	AP01	1	0	CAT 5	N/A		WIFI	None	Ceiling	OTHER	NONE	Drop Ceiling	No	N/A
7-B-057E	133	2	2	CAT 5	CAT 3	PHONE	Computer	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
7-B-BM5 (Corr)	AP15	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-B-020	2687	0	1	N/A	CAT 6	Phone		None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-B-021	116	0	1	N/A	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-B-021	144	2	2	CAT 6	CAT 6	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-B-021	168	2	2	CAT 6	CAT 6		Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-B-021	181	2	2	CAT 6	CAT 6	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Equipment
7-B-021	185	2	2	CAT 6	CAT 6	Fax	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	Equipment
7-B-021	221	2	2	CAT 6	CAT 6	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Equipment
7-B-021	222	2	2	CAT 6	CAT 6	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Equipment
7-B-021	(NO ID)	2	2	CAT 6	CAT 6	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Equipment
7-B-021	AP11	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-B-021	AP29	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-B-021	AP32	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-B-021A	182	2	2	CAT 5E	CAT 3	Phone	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-B-025	115	2	2	CAT 5	CAT 5			WM	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-B-025	146	0	1	N/A	CAT 5		PHONE	None	Drywall	Paint	None	Hard Lid	No	Furniture
7-B-025	25B	3	0	CAT 6	N/A		Computer	None	Drywall	Paint	None	Hard Lid	No	N/A
7-B-025	25C	3	0	CAT 6	N/A		Computer/Equip	WM	Drywall	Paint	None	Hard Lid	No	Furniture
7-B-025	25D	3	0	CAT 6	N/A			None	Drywall	Paint	None	Hard Lid	No	Equipment
7-B-025	25E	3	0	CAT 6	N/A			None	Drywall	Paint	None	Hard Lid	No	Furniture
7-B-025	25F	3	0	CAT 6	N/A			None	Drywall	Paint	None	Hard Lid	No	Furniture
7-B-025	AP30	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Hard Lid	No	N/A
7-B-033A	31A	2	1	CAT 6	CAT 5E	Phone		None	Drywall	Paint	None	Hard Lid	No	Furniture
7-B-033A	31B	2	1	CAT 6	CAT 5E			None	Drywall	Paint	None	Hard Lid	No	Furniture
7-B-033A	31C	2	1	CAT 6	CAT 5E		Equipment	None	Drywall	Paint	None	Hard Lid	No	Furniture
7-B-033A	31D	2	1	CAT 6	CAT 5E		Computer/Equip	None	Drywall	Paint	None	Hard Lid	No	Furniture
7-B-034	AP28	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Hard Lid	No	N/A
7-B-035	183	2	2	CAT 6	CAT 6	Phone		WM	Drywall	Paint	None	Hard Lid	No	N/A
7-B-035	35A	2	1	CAT 6	CAT 6	Phone	Phone/Computer/Printer	None	Drywall	Paint	None	Hard Lid	No	N/A
7-B-035	35B	2	1	CAT 6	CAT 6		Computer/Printer	WM	Drywall	Paint	None	Hard Lid	No	Furniture
7-B-035	35C	2	1	CAT 6	CAT 6		Computer/Printer	WM	Drywall	Paint	None	Hard Lid	No	Furniture
7-B-035	35D	2	1	CAT 6	CAT 6	Phone	Phone/Computer/Printer	WM	Drywall	Paint	None	Hard Lid	No	N/A
7-B-035	35E	2	1	CAT 6	CAT 6			WM	Drywall	Paint	None	Hard Lid	No	N/A
7-B-035	AP27	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Hard Lid	No	N/A
7-B-036	(NO ID)	0	1	N/A	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-B-036	AP24	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	Furniture
7-B-036	AP26	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	Furniture
7-B-037	AP25	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	Furniture
7-B-039	103	2	2	CAT 5	CAT 3	Fax	PRINTER	WM	Brick	Paint	None	Drop Ceiling	No	Furniture
7-B-039	104	2	2	CAT 5	CAT 3			WM	Brick	Paint	None	Drop Ceiling	No	Furniture
7-B-039	(NO ID)	0	1	N/A	CAT 3			WM	Brick	Paint	None	Drop Ceiling	No	Furniture
7-B-039	(NO ID)	0	1	N/A	CAT 3			WM	Brick	Paint	None	Drop Ceiling	No	Furniture
7-B-039	(NO ID)	2	2	CAT 5	CAT 3			WM	Brick	Paint	None	Drop Ceiling	No	Furniture
7-B-039	(NO ID)	0	2	N/A	CAT 3			WM	Brick	Paint	None	Drop Ceiling	No	Furniture
7-B-039	(NO ID)	0	2	N/A	CAT 3			WM	Brick	Paint	None	Drop Ceiling	No	Furniture
7-B-039	(NO ID)	2	2	CAT 5	CAT 3	Phone	Computer	WM	Brick	Paint	None	Drop Ceiling	No	Furniture
7-B-039	(NO ID)	2	2	CAT 5	CAT 3			WM	Brick	Paint	None	Drop Ceiling	No	Furniture

Alexandria VA Existing Data Drop Survey
Building 7 - Basement

Room	Tag	#Data Drops (195)	#Voice Drops (154)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
7-B-039	(NO ID)	2	0	CAT 5	N/A			WM	Brick	Paint	None	Drop Ceiling	No	Furniture
7-B-039 (Stairs)	AP39	1	0	CAT 5E	N/A		WiFi	None	Brick	Paint	None	Hard Lid	No	N/A
7-B-040	121	2	2	CAT 5	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-B-040	179	2	2	CAT 5	CAT 3		Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-B-040	(NO ID)	2	2	CAT 5	CAT 3		Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-B-040	(NO ID)	2	0	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-B-040	(NO ID)	0	1	N/A	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-B-041	123	2	2	CAT 5	CAT 3	Phone		None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-B-041	123	2	2	CAT 5	CAT 3	Phone		None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-B-041	AP012	1	0	CAT 5	N/A		WIFI	None	Ceiling	OTHER	NONE	Drop Ceiling	No	N/A
7-B-041A	124	2	2	CAT 5	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-B-042	5034	0	4	N/A	CAT 3	Phone		None	Drywall	Paint	None	Drop Ceiling	No	N/A

Alexandria VA Existing Data Drop Survey
Building 7 - 1st Floor

Room	Tag	#Data Drops (713)	#Voice Drops (535)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
7-103D	485	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	FURNITURE
7-103D	(NO ID)	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	FURNITURE
7-117	(NO ID)	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-118	519	2	2	CAT 5	CAT 3	Phone	COMPUTER	WM	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-119	315	2	2	CAT 5	CAT 3	Phone	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-119	(NO ID)	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-120	482	2	2	CAT 5	CAT 3	Phone	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-120	(NO ID)	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-121	467	2	2	CAT 5E	CAT 5E	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-121	570	2	1	CAT 5E	CAT 5E		Equipment	WM	Drywall	Paint	None	Drop Ceiling	No	Equipment
7-121	(NO ID)	0	1	N/A	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-121	121-1	4	0	CAT 5E	N/A		Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-122	(NO ID)	0	1	N/A	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-123	123	2	2	CAT 5	CAT 5	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-123	(NO ID)	2	2	CAT 5	CAT 5	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-123	(NO ID)	0	2	N/A	CAT 5			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-124	(NO ID)	2	2	CAT 5	CAT 5	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-127	545	2	2	CAT 5	CAT 5	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-127	574	2	2	CAT 5	CAT 5	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-127	(NO ID)	3	0	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-127	128A.574A.547B	3	0	CAT 5	N/A		Equipment	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-127	129B.504A.504B	3	0	CAT 5	N/A		Equipment	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-130A	(NO ID)	2	2	CAT 5	CAT 5			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-133	AP18	1	0	CAT 5	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-134	568	2	2	CAT 5	CAT 5	Phone	COMPUTER	WM	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-134	135B	2	0	CAT 5	N/A		COMPUTER	WM	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-135	327	2	2	CAT 5	CAT 5	Phone	COMPUTER	WM	Drywall	Paint	None	Drop Ceiling	No	N/A
7-135	AP16	1	0	CAT 5	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-135-2	US1	2	0	CAT 5	N/A		Equipment	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-135-2	US2	2	0	CAT 5	N/A		Equipment	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-135-2A	572	2	2	CAT 5	CAT 5	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-139A	541	2	2	CAT 5	CAT 5			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-139B	328	2	2	CAT 5	CAT 5	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-139B	329	2	2	CAT 5	CAT 5	Phone	COMPUTER	WM	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-139B	501	1	2	CAT 5	CAT 5	Phone	COMPUTER	WM	Drywall	Paint	None	Drop Ceiling	No	N/A
7-139B	543	2	2	CAT 5	CAT 5			WM	Drywall	Paint	None	Drop Ceiling	No	N/A
7-139B	139-1	2	0	CAT 5	N/A	Phone	COMPUTER	WM	Drywall	Paint	None	Drop Ceiling	No	N/A
7-139B	139-2	2	1	CAT 5	CAT 5	Phone	PRINTER	WM	Drywall	Paint	None	Drop Ceiling	No	N/A
7-139B	139B	1	0	CAT 5	N/A		COMPUTER	WM	Drywall	Paint	None	Drop Ceiling	No	N/A
7-142	(NO ID)	0	1	N/A	CAT 5			WM	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-147	KIOSK 5	1	0	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-147A	325	2	2	CAT 5	CAT 5	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-147A	326	2	2	CAT 5	CAT 5			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-147A	497	2	2	CAT 5	CAT 5	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-147A	(NO ID)	0	2	N/A	CAT 5			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-147A	AP22	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-153	153	2	2	CAT 5	CAT 5		Equipment	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-153	502	2	2	CAT 5	CAT 5			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-154	498	2	2	CAT 5	CAT 5			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-155	499	2	2	CAT 5	CAT 5			None	Ceiling	Other	None	Drop Ceiling	No	Furniture
7-157	331	2	2	CAT 5	CAT 5			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-157	332	2	2	CAT 5	CAT 5			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-157	555	2	2	CAT 5	CAT 5			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-157	(NO ID)	0	2	N/A	CAT 5			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-157	157-1	2	0	CAT 5	N/A			WM	Drywall	Paint	None	Drop Ceiling	No	N/A
7-157	157-2	2	0	CAT 5	N/A			WM	Drywall	Paint	None	Drop Ceiling	No	N/A

Alexandria VA Existing Data Drop Survey
Building 7 - 1st Floor

Room	Tag	#Data Drops (713)	#Voice Drops (535)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
7-157	330AB	2	1	CAT 5	CAT 5			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-157	AP12	1	0	CAT 5	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-158	333	2	2	CAT 5	CAT 5	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-158	542	2	2	CAT 5	CAT 5		Equipment	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-158	158-1	2	0	CAT 5	N/A			WM	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-158	158-2	2	0	CAT 5	N/A			WM	Drywall	Paint	None	Drop Ceiling	No	N/A
7-158	AP13	1	0	CAT 5	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-159	334	2	2	CAT 5	CAT 5	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-159	159-1	2	0	CAT 5	N/A		PRINTER	WM	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-159	159-2	2	0	CAT 5	N/A			WM	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-159	159-3	2	0	CAT 5	N/A		COMPUTER	WM	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-159	159-4	2	0	CAT 5	N/A			WM	Drywall	Paint	None	Drop Ceiling	No	N/A
7-159	159-5	2	0	CAT 5	N/A		COMPUTER	WM	Drywall	Paint	None	Drop Ceiling	No	N/A
7-160	160	1	0	CAT 5	N/A			WM	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-160	335	2	2	CAT 5	CAT 5	Phone	Computer/Equip	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-162	336	2	2	CAT 5	CAT 5	Phone	Computer/Equip	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-162	(NO ID)	2	2	CAT 5	CAT 5			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-163	163	1	0	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-163	341	2	2	CAT 5	CAT 5			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-164	337	2	2	CAT 5	CAT 5	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-164	535	2	2	CAT 5	CAT 5	FAX	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	EQUIPMENT
7-164	536	2	2	CAT 5	CAT 5		PRINTER	None	Drywall	Paint	None	Drop Ceiling	No	EQUIPMENT
7-164	(NO ID)	0	2	N/A	CAT 5			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-164	(NO ID)	0	2	N/A	CAT 5			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-164	AP60	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-165	338	2	2	CAT 5	CAT 5	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-167	167	2	0	CAT 5	N/A		COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-167	339	2	2	CAT 5	CAT 5	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-169	340	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1A-164	AP06	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-1A-196A	1A-196A1	1	0	CAT 6	N/A		Equipment	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1A-196A	1A-196A2	1	0	CAT 6	N/A		Equipment	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1A-196A	AP55	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-1A-196B	1A196F	2	2	CAT 6E	CAT 6E	Phone		None	Drywall	Paint	None	Drop Ceiling	No	Case/Furn
7-1A-196B	1A196GA	2	0	CAT 6E	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Casework
7-1A-196B	1A196GB	2	0	CAT 6E	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Casework
7-1A-196B	1A196GC	2	0	CAT 6E	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Casework
7-1A-196B	1G127,12A196B,B	4	0	CAT 6E	N/A		Computer/Equip	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-1A-196B	1G127,1A1968,C	4	0	CAT 6E	CAT 5E		Computer/Equip	None	Drywall	Paint	None	Drop Ceiling	No	Equipment
7-1A-196B	1G127.12A196B.A	4	0	CAT 6E	N/A		Computer/Equip	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-1A-196H	1A-196HA	4	0	CAT 6	N/A			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1A-196H	1A-196HB	4	0	CAT 6	N/A			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1A-197B	1A-197A	2	0	CAT 6	N/A			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1A-197B	1A-197B	2	0	CAT 6	N/A			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1A-197B	AP56	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-1A-197B	AP57	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-1A-197C	(NO ID)	4	0	CAT 6	N/A		COMPUTER	None	Drywall	Paint	SMOKE	Drop Ceiling	No	N/A
7-1-C7-1-2	151	1	0	CAT 5	N/A		Equipment	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1-C7-1-2	AP14	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-1-C7-1-4	AP15	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-1-C7-1-9	121	2	0	CAT 6E	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-1-C7-1-9	AP19	1	0	CAT 5	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-1E-101	305	2	2	CAT 5	CAT 3		Equipment	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1E-101	1E-102B	1	0	CAT 5	N/A		Equipment	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1E-101	AP44	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	Yes	N/A
7-1E-102	1E-102	2	2	CAT 6	CAT 6	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture

Alexandria VA Existing Data Drop Survey
Building 7 - 1st Floor

Room	Tag	#Data Drops (713)	#Voice Drops (535)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
7-1E-108	1E-108	2	2	CAT 6	CAT 6	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-1E-109	1E-109	2	1	CAT 6	CAT 6	FAX	PRINTER	None	Drywall	Paint	None	Drop Ceiling	Yes	EQUIPMENT
7-1E-110	1E-110	2	2	CAT 6	CAT 6	PHONE	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1E-111	1E-111A	2	0	CAT 6	N/A			None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1E-111	1E-111B	2	2	CAT 6	CAT 6	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-1E-112	1E-112	2	2	CAT 6	CAT 6	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1E-113	1E-113A	2	2	CAT 6	CAT 6	PHONE	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-1E-113	1E-113B	2	2	CAT 6	CAT 6	Phone/Fax	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-1E-113	1E-113C	2	2	CAT 6	CAT 6	PHONE	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-1E-114	1E-114A	2	2	CAT 6	CAT 6	PHONE	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-1E-114	1E-114B	2	0	CAT 6	N/A			None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-1E-115	1E-115A	2	2	CAT 6	CAT 6	PHONE	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-1E-115	1E-115B	2	0	CAT 6	N/A		Equipment	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1E-118	1E-118A	2	2	CAT 6	CAT 6	Phone	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-1E-118	1E-118B	0	4	CAT 6	CAT 6		Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-1E-118	1E-118C	2	2	CAT 6	CAT 6	Phone/Fax	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-1E-118	1E-118D	2	2	CAT 6	CAT 6		Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-1E-118	1E-118E	2	2	CAT 6	CAT 6	PHONE	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-1E-123	1E-123	2	2	CAT 6	CAT 6			None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1E-123	AP47	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	Yes	N/A
7-1E-124	1E-124A	2	2	CAT 6	CAT 6	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-1E-124	1E-124B	2	0	CAT 6	CAT 6			None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-1E-125	1E-125A	2	0	CAT 6	N/A			None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1E-125	1E-125B	2	2	CAT 6	N/A	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1E-126	1E-126A	2	2	CAT 6	CAT 6	Phone		None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-1E-126	1E-126B	2	2	CAT 6	CAT 6	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-1E-126	1E-126C	2	2	CAT 6	CAT 6	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-1E-126	1E-126D	2	2	CAT 6	CAT 6		COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-1E-126	AP46	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	Yes	N/A
7-1E-134	1E-134	2	2	CAT 6	CAT 6	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-1E-136	1E-136	2	2	CAT 6	CAT 6	Phone	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-1E-137	1E-137A	2	0	CAT 6	N/A			None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-1E-137	1E-137B	2	2	CAT 6	CAT 6	Phone	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-1E-139	AP45	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	Yes	N/A
7-179	343	2	2	CAT 5	CAT 3	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-179	AP11	1	0	CAT 5	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-180A-7	348	2	2	CAT 5E	CAT 5E	Phone	Computer/Equip	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-180A-7	528	2	2	CAT 5E	CAT 5E	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-180B	349	2	2	CAT 5E	CAT 5E	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-180C	566	2	2	CAT 5E	CAT 5E	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-180C	(NO ID)	1	0	CAT 5E	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-180E	(NO ID)	0	1	N/A	CAT 5E	Phone		None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-180F	347	2	2	CAT 5E	CAT 5E	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-180G-7	463	2	2	CAT 5E	CAT 5E	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-180I-7	URL1	1	0	CAT 5E	CAT 5E		Equipment	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-180N	345	2	2	CAT 5E	CAT 5E	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-180N	AP09	1	0	CAT 5E	CAT 5E		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-180P	346	2	2	CAT 5E	CAT 5E	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-180R-7	571	2	2	CAT 5E	CAT 5E			WM	Drywall	Paint	None	Drop Ceiling	No	N/A
7-180R-7	596	2	2	CAT 5E	CAT 5E			WM	Drywall	Paint	None	Drop Ceiling	No	N/A
7-183	350	2	2	CAT 5	CAT 3	Phone	COMPUTER	WM	Drywall	Paint	None	Drop Ceiling	No	N/A
7-186	351	2	2	CAT 5	CAT 3	FAX	PRINTER	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-186	353	2	2	CAT 5	CAT 3	FAX	PRINTER	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-186	354	2	2	CAT 5	CAT 3	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-186	355	2	2	CAT 5	CAT 3	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-186	527	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A

Alexandria VA Existing Data Drop Survey
Building 7 - 1st Floor

Room	Tag	#Data Drops (713)	#Voice Drops (535)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
7-186	534	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-186	AP5	1	0	CAT 5	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-186A	521	2	2	CAT 5	CAT 3	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-186B	526	2	2	CAT 5	CAT 3	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-187	AP3	1	0	CAT 5	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-187	AP4	1	0	CAT 5	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-187	KIOSK 3	1	0	CAT 5E	N/A			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-188	356	2	2	CAT 5	CAT 3	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-188C	492	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-188D	520	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-188F	459	2	2	CAT 5	CAT 3	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-188G	466	2	2	CAT 5	CAT 3	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-188H	461	2	2	CAT 5	CAT 3	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-188J	462	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-188K	352	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-188K	(NO ID)	2	2	CAT 5	CAT 3	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1G-101	1G-101D	4	0	CAT 6	N/A		Equipment	None	Drywall	Paint	Smoke	Drop Ceiling	No	N/A
7-1G-101	1G127.1G101.A	1	0	CAT 6	N/A			None	Drywall	Paint	Smoke	Drop Ceiling	No	N/A
7-1G-101	AP53	1	0	CAT 6	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-1G-102	1G-102	2	2	CAT 6	CAT 5E	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-1G-108	1G-108A	2	2	CAT 6	CAT 5E	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Case/Furn
7-1G-108	1G-108B	2	2	CAT 6	CAT 5E	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Case/Furn
7-1G-108	1G-108C	2	2	CAT 6	CAT 5E	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Case/Furn
7-1G-108	1G127.1G108.D	2	2	CAT 6	CAT 5E	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-1G-109	1G-109	2	2	CAT 6	CAT 5E	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-1G-110	1G-110	2	2	CAT 6	CAT 5E	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-1G-111	1G-111	2	2	CAT 6	CAT 5E	FAX	PRINTER	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1G-112	1G-112	2	2	CAT 6	CAT 5E	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1G-114	1G-127.1G114.A A	0	1	N/A	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-1G-115	1G-115	2	2	CAT 6	CAT 5E	Phone	Computer/Printer	3/4"	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-1G-116	1G-116A	2	2	CAT 6	CAT 5E	Phone	COMPUTER	3/4"	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-1G-116	1G-116B	2	0	CAT 6	N/A			3/4"	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-1G-124	1G-124A	2	2	CAT 6	CAT 5E	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-1G-124	1G-124B	2	0	CAT 6	N/A			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1G-125	1G-125A	2	0	CAT 6	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-1G-125	1G-125B	2	2	CAT 6	CAT 5E	Phone	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-1G-126	1G127.1G126.A	2	2	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1G-126	AP48	1	0	CAT 6	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-1G-132	1G-132A	2	2	CAT 6	CAT 5E	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Equipment
7-1G-132	1G-132B	1	1	CAT 6	CAT 5E	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-1G-133	1G-133A	2	2	CAT 6	CAT 5E	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-1G-133	1G-133B	2	0	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-1G-134	1G-134A	2	0	CAT 6	CAT 5E		PHONE	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1G-134	1G-134B	2	2	CAT 6	CAT 5E		Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-1G-136	1G-127.1G136.D	2	2	CAT 6	CAT 5E	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Case/Furn
7-1G-136	1G-127.1G136.E	2	2	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Case/Furn
7-1G-136	1G-136A	2	2	CAT 6	CAT 5E	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Case/Furn
7-1G-136	1G-136B	2	2	CAT 6	CAT 5E	FAX	PRINTER	None	Drywall	Paint	None	Drop Ceiling	No	Case/Furn
7-1G-136	1G-136B	2	2	CAT 6	CAT 5E	Phone	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	Case/Furn
7-1G-136	AP49	1	0	CAT 6	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-1M13	AP20	1	0	CAT 5	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-1-V	(NO ID)	1	0	CAT 5E	CAT 5E		Equipment	None	Drywall	Paint	None	Drop Ceiling	No	Equipment
7-1-W	AP08	1	0	CAT 5E	CAT 5E		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	Furniture
7-C7-20	AP28	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A

Alexandria VA Existing Data Drop Survey
Building 7 - 1st Floor

Room	Tag	#Data Drops (713)	#Voice Drops (535)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
7-C7-20	AP42	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-ELEV L1	AP58	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-101	486	2	2	CAT 5	cat 3		Equipment	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-101	562	0	2	CAT 5	cat 3		PHONE	None	Drywall	Paint	Smoke	Drop Ceiling	No	N/A
7-103	558	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-103	(NO ID)	2	2	CAT 5	CAT 3	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-103A	540	2	2	CAT 5	CAT 3	phone	printer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-103B	309	2	2	CAT 5	CAT 3	phone	computer	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-103C	310	1	1	CAT 5	CAT 3	PHONE	PRINTER	None	Drywall	Paint	None	Drop Ceiling	No	Equipment
7-103C	AP59	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-103E	313	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-105	452	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-106	451	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-106A	450	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-106A	517	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-106B	529	1	1	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-106B	579	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-107	447	0	1	N/A	CAT 3		PHONE	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-107	449	2	2	CAT 5	CAT 3		COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-107	478	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-108	401	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-108A	395	2	2	CAT 5	CAT 3	PHONE	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-108B	393	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-108C	399	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-109	464	2	2	CAT 5	CAT 3	FAX	Printer/Equipment	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-109	580	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-109	AP27	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-109	AP31	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-109A	366	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-109B	368	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-109C	KIOSK 4/3	2	0	CAT 5	N/A		Equipment	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-110	396	2	2	CAT 5	CAT 3	PHONE	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-110A	397	2	2	CAT 5	CAT 3	PHONE	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-111	392	2	2	CAT 5	CAT 3	PHONE	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-111	394	2	2	CAT 5	CAT 3	PHONE	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-113	388	2	2	CAT 5	CAT 3	FAX	PRINTER	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-113	389	2	2	CAT 5	CAT 3	FAX	PRINTER	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-113	390	2	1	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-113	475	2	2	CAT 5	CAT 3	FAX	PRINTER	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-113	479	2	2	CAT 5	CAT 3	phone	computer	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1134	1G-123A	2	2	CAT 6	CAT 5E	Phone	PRINTER	None	Drywall	Paint	Smoke	Drop Ceiling	No	Case/Furn
7-1134	1G-123B	2	2	CAT 6	CAT 5E	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Case/Furn
7-1134	1G-123C	2	2	CAT 6	CAT 5E	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Case/Furn
7-1134	1G-127.1G123.D	4	0	CAT 6	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Casework
7-1134	1G127.1G123.E	4	0	CAT 6	N/A		Computer	None	Drywall	Paint	None	Drop Ceiling	No	Case/Furn
7-1134	AP50	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-114	376	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-114	379	2	1	CAT 5	CAT 3	phone		None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-114	471	2	1	CAT 5	CAT 3	phone		None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-114	472	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-114	473	2	2	CAT 5	CAT 3		COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-114	508	2	1	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-114	514	2	2	CAT 5	CAT 3		COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-114	AP24	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A

Alexandria VA Existing Data Drop Survey
Building 7 - 1st Floor

Room	Tag	#Data Drops (713)	#Voice Drops (535)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
7-114	AP25	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-114A	385	2	2	CAT 5	CAT 3		COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-114A	386	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-114A	AP26	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-114A	XXXX	2	1	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-114A	XXXX	2	1	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-114A	XXXX	2	1	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-114A	XXXX	2	1	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-114B	387	2	1	CAT 5	CAT 3	PHONE	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1-A05	367	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1-A07	369	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1-A08	370	2	2	CAT 5	CAT 3	PHONE	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-1-A09	371	2	2	CAT 5	CAT 3	PHONE	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1-A09	448	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1-A09	512	2	2	CAT 5	CAT 3	PHONE	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1-A09	573	2	2	CAT 5	CAT 3	FAX	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-1-A09	577	2	2	CAT 5	CAT 3		Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1-A09	580	2	2	CAT 5	CAT 3	PHONE	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1-A09	(NO ID)	0	3	N/A	CAT 3			None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1-A09	(NO ID)	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1-A09	ETA 1A1 B	2	0	CAT 5	N/A		Equipment	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1-A09-1	374	0	1	N/A	CAT 3			None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1-A09-2	ETU 2A2B	2	0	CAT 5	N/A		Equipment	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1-A09-3	(NO ID)	0	1	N/A	CAT 3			None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1-A09-3	ALXMEDAP-B7F1-001	1	0	CAT 5	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-1-A09-3	AP33	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-1-A09-3	ETU 3A3B	2	0	CAT 5	N/A		Equipment	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1-A10	447	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1-A11	544	2	2	CAT 5	CAT 3	PHONE	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1-A12	434	2	2	CAT 5	CAT 3	PHONE	Computer	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1-A12	435	2	2	CAT 5	CAT 3	PHONE	Computer	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1-A12	437	2	2	CAT 5	CAT 3	PHONE	Computer/Equip	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1-A12	438	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1-A12	439	2	2	CAT 5	CAT 3		PRINTER	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1-A12	441	2	2	CAT 5	CAT 3	Phone/Equipme	Computer/Equip	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1-A12	465	2	2	CAT 5	CAT 3		Equipment	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1-A12	509	2	2	CAT 5	CAT 3	Phone/Fax		None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1-A12	510	2	2	CAT 5	CAT 3	Phone/Fax	PRINTER	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1-A12	515	2	1	CAT 5	CAT 3	PHONE	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1-A12	546	2	2	CAT 5	CAT 3	PHONE	Computer	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1-A12	548	2	1	CAT 5	CAT 3	PHONE	Computer	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1-A12	549	2	2	CAT 5	CAT 3	Phone/Equipme	Computer/Equip	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1-A12C	443	2	1	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1-A12C	(NO ID)	2	2	CAT 5	CAT 3	Phone/Fax	PRINTER	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1-A13	XXXX	2	2	CAT 6	CAT 6	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-1-A14	XXXX	2	2	CAT 6	CAT 6	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-1-A15	550	2	2	CAT 6	CAT 6	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-1-A15	AP41	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-1-A18	453	2	2	CAT 6	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-1-A18A	420	2	2	CAT 6	CAT 6			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1-A18A	422	2	2	CAT 6	CAT 6	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1-A18A	496	2	2	CAT 6	CAT 6			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1-A18A	530	2	2	CAT 6	CAT 6			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1-A18A	531	2	2	CAT 6	CAT 6	PHONE	PRINTER	None	Drywall	Paint	None	Drop Ceiling	No	N/A

Alexandria VA Existing Data Drop Survey
Building 7 - 1st Floor

Room	Tag	#Data Drops (713)	#Voice Drops (535)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
7-1-A18A	AP40	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-1-A18A	KIOSK 2	1	0	CAT 6	N/A		Equipment	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1-A19	428	2	2	CAT 6	CAT 6	PHONE	Computer	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1-A21	429	2	2	CAT 6	CAT 6	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1-A31	418	2	2	CAT 6	CAT 6	PHONE	Computer/Equip	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1-A33	419	2	2	CAT 6	CAT 6	PHONE	Computer/Equip	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1-A34	584	2	2	CAT 6	CAT 6	PHONE	COMPUTER	None	Drywall	Paint	None	Hard Lid	No	N/A
7-1-A35	XXX	2	2	CAT 6	CAT 6	PHONE	COMPUTER	None	Drywall	Paint	None	Hard Lid	No	N/A
7-1-A36	423	2	2	CAT 6	CAT 6	PHONE	Printer/Equipment	None	Drywall	Paint	None	Hard Lid	No	N/A
7-1-A36A	525	2	2	CAT 6	CAT 6			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1-A37	522	2	2	CAT 6	CAT 6			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1-A37A	424	2	1	CAT 6	CAT 6			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-1-A38	425	2	2	CAT 6	CAT 6	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1-A38	A38	2	2	CAT 6	CAT 6		Equipment	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-1-A38	AP35	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-1-A39	426	2	2	CAT 6	CAT 6	PHONE	Computer/Equip	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1-A39	476	2	2	CAT 6	CAT 6		Computer/Equip	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1-A39	(NO ID)	0	1	N/A	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1-A41	430	2	2	CAT 6	CAT 6	PHONE	Computer/Equip	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1-A7	433	2	2	CAT 5	CAT 3	PHONE		WM	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1-A7	566	2	2	CAT 5	CAT 3		COMPUTER	WM	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1B-102	404	2	2	CAT 6	CAT 6		computer	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1B-102	405	2	2	CAT 6	CAT 6	PHONE	computer	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1B-102	406	2	2	CAT 6	CAT 6		computer	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1B-102	407	2	2	CAT 6	CAT 6		computer	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1B-102	408	2	2	CAT 6	CAT 6		computer	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1B-102	488	2	2	CAT 6	CAT 6	PHONE	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1B-102	491	2	2	CAT 6	CAT 6	PHONE	Computer/Equip	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1B-102	553	2	2	CAT 6	CAT 6	PHONE	Computer/Equip	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1B-102	561	2	2	CAT 6	CAT 6	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1B-102	578	2	2	CAT 6	CAT 6			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1B-102	580	2	2	CAT 6	CAT 6	PHONE	computer	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1B-102	583	2	2	CAT 6	CAT 6		COMPUTER/PRINTER	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1B-102	583	2	2	CAT 6	CAT 6		COMPUTER/PRINTER	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1B-102	590	2	2	CAT 6	CAT 6	PHONE/FAX	computer	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1B-102	591	2	2	CAT 6	CAT 6	PHONE/FAX	computer	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1B-102	592	2	2	CAT 6	CAT 6	PHONE/FAX	COMPUTER/PRINTER	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1B-102	593	2	2	CAT 6	CAT 6	PHONE	COMPUTER/PRINTER	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1B-102	594	2	2	CAT 6	CAT 6	PHONE/FAX	COMPUTER/PRINTER	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1B-102	595	2	2	CAT 6	CAT 6	PHONE/FAX	COMPUTER/PRINTER	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1B-102	AP36	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-1B-102	AP37	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-1B-102	AP38	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-1B-102	AP39	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-1B-102	AP43	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-1B-102B	XXXX	2	2	CAT 6	CAT 6		COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Other
7-1B-102B	XXXX	2	2	CAT 6	CAT 6		COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Other
7-1B-102B	XXXX	2	2	CAT 6	CAT 6		COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Other
7-1B-103	XXXX	2	2	CAT 6	CAT 6	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-1B-104	1B104	2	2	CAT 6	CAT 6	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-1B-104A	403	2	2	CAT 6	CAT 6	PHONE	computer	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-1B-105	1B105.1	2	1	CAT 6	CAT 6	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-1B-105	1B105.2	2	1	CAT 6	CAT 6	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-1B-106	1B106	2	2	CAT 6	CAT 6	PHONE		None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-1B-107	1B107	2	1	CAT 6	CAT 6	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-1B-108	1B108	2	1	CAT 6	CAT 6	FAX	PRINTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture

Alexandria VA Existing Data Drop Survey
Building 7 - 1st Floor

Room	Tag	#Data Drops (713)	#Voice Drops (535)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
7-1B-109	1B109	2	1	CAT 6	CAT 6	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-1B-109	RTLS	1	0	CAT 6	N/A		COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-1-B7	432	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1-B7	505	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1-B7	(NO ID)	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1C-140	AP30	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-1C-140	AP32	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-1-C7-1-10	589	2	2	CAT 5	CAT 3		Equipment	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1-C7-1-10	AP23	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-1-C7-1-11	436	2	2	CAT 5	CAT 3	Phone	Equipment	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-1-C7-1-12	KIOSK 1	1	0	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	Yes	N/A

Alexandria VA Existing Data Drop Survey
Building 7 - 2nd Floor

Room	Tag	#Data Drops (313)	#Voice Drops (211)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
7-257	918	0	1	CAT 5	CAT 3			None	Block	Paint	None	Drop Ceiling	Yes	Furniture
7-257	AP18	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-257A	922	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Block	Paint	None	Drop Ceiling	Yes	Furniture
7-260	929	2	2	CAT 5	CAT 3	PHONE	Computer/Printer	WM	Block	Paint	None	Drop Ceiling	Yes	Furniture
7-260	AP14	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-265	906	2	2	CAT 5	CAT 3			WM	Block	Paint	None	Drop Ceiling	Yes	Furniture
7-265	916	2	2	CAT 5	CAT 3	PHONE	COMPUTER	WM	Block	Paint	None	Drop Ceiling	Yes	Furniture
7-265	AP13	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-265	XXXX	2	2	CAT 5	CAT 3	Phone/Fax	Computer/Printer	WM	Block	Paint	None	Drop Ceiling	Yes	Furniture
7-266	910	2	2	CAT 5	CAT 3	Phone/Fax	Computer/Printer	WM	Block	Paint	None	Drop Ceiling	Yes	Furniture
7-268	911	2	2	CAT 5	CAT 3	PHONE	COMPUTER	WM	Block	Paint	None	Drop Ceiling	Yes	Furniture
7-268	AP11	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-271	885	2	2	CAT 5	CAT 3	PHONE	COMPUTER	WM	Block	Paint	None	Drop Ceiling	Yes	Furniture
7-271A	873	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-271A	874	2	2	CAT 5	CAT 3		PRINTER	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-272	884	2	2	CAT 5	CAT 3	PHONE	COMPUTER	WM	Block	Paint	None	Drop Ceiling	Yes	Furniture
7-272	1270	2	2	CAT 5	CAT 3		COMPUTER	WM	Block	Paint	None	Drop Ceiling	Yes	Furniture
7-273	883	2	2	CAT 5	CAT 3	PHONE	COMPUTER	WM	Block	Paint	None	Drop Ceiling	Yes	Furniture
7-273	AP07	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-274	882	2	2	CAT 5	CAT 3	PHONE	COMPUTER	WM	Block	Paint	None	Drop Ceiling	Yes	Furniture
7-275	881	2	2	CAT 5	CAT 3		Computer/Printer	WM	Block	Paint	None	Drop Ceiling	Yes	Furniture
7-276	880	2	2	CAT 5	CAT 3			WM	Block	Paint	None	Drop Ceiling	Yes	Furniture
7-277	879	2	2	CAT 5	CAT 3	PHONE	COMPUTER	WM	Block	Paint	None	Drop Ceiling	Yes	Furniture
7-278	878	2	2	CAT 5	CAT 3	PHONE	Computer/Printer	WM	Block	Paint	None	Drop Ceiling	Yes	Furniture
7-278	AP08	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-279	877	2	2	CAT 5	CAT 3	PHONE	COMPUTER	WM	Block	Paint	None	Drop Ceiling	Yes	Furniture
7-280	XXXX	2	2	CAT 5	CAT 3	PHONE	COMPUTER	WM	Block	Paint	None	Drop Ceiling	Yes	Furniture
7-283	869	2	2	CAT 5	CAT 3	FAX	Computer/Printer	WM	Block	Paint	None	Drop Ceiling	Yes	N/A
7-283	870	2	2	CAT 5	CAT 3		EQUIPMENT	WM	Block	Paint	None	Drop Ceiling	Yes	N/A
7-283	AP04	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-285	868	2	2	CAT 5	CAT 3		EQUIPMENT	WM	Block	Paint	None	Drop Ceiling	Yes	N/A
7-286	867	2	2	CAT 5	CAT 3	PHONE	COMPUTER	WM	Block	Paint	None	Drop Ceiling	Yes	N/A
7-287	866	2	2	CAT 5	CAT 3	PHONE	COMPUTER	WM	Block	Paint	None	Drop Ceiling	Yes	N/A
7-288	863	2	2	CAT 5	CAT 3	PHONE	COMPUTER	WM	Block	Paint	None	Drop Ceiling	Yes	N/A
7-289	864	2	2	CAT 5	CAT 3	PHONE	COMPUTER	WM	Block	Paint	None	Drop Ceiling	No	Furniture
7-289	AP01	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-290	863	2	2	CAT 5	CAT 3	PHONE	COMPUTER	WM	Block	Paint	None	Drop Ceiling	Yes	Furniture
7-290	AP02	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-291	862	2	2	CAT 5	CAT 3	PHONE	COMPUTER	WM	Block	Paint	None	Drop Ceiling	Yes	N/A
7-292	861	2	2	CAT 5	CAT 3	PHONE	COMPUTER	WM	Block	Paint	None	Drop Ceiling	Yes	N/A
7-293	860	2	2	CAT 5	CAT 3	PHONE	COMPUTER	WM	Block	Paint	None	Drop Ceiling	Yes	Furniture
7-295	858	2	2	CAT 5	CAT 3	Phone		WM	Block	Paint	None	Drop Ceiling	Yes	N/A
7-297	972	2	2	CAT 5	CAT 3			WM	Block	Paint	None	Drop Ceiling	Yes	Furniture
7-297	AP05	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
C2-8	895	0	1	N/A	CAT 3	Phone		None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
C2-8	896	0	1	N/A	CAT 3	Phone		WM	Drywall	Paint	None	Drop Ceiling	Yes	N/A
C2-8	ALXMEDAP-B7F7-001	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
C2-8	ALXMEDAP-B7F7-002	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
C2-8	ALXMEDAP-B7F7-003	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
C2-8	ALXMEDAP-B7F7-004	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
C2-8	AP03	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
C2-8	AP06	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
C2-8	AP09	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
C2-8	AP10	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
C2-8	AP15	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
C2-8	AP26	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Hard Lid	No	N/A

Alexandria VA Existing Data Drop Survey
Building 7 - 2nd Floor

Room	Tag	#Data Drops (313)	#Voice Drops (211)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
C2-8	AP32	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
C2-8	AP40	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Hard Lid	No	N/A
S-1	AP12	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
S-2	AP39	1	0	CAT 5E	N/A		WiFi	None	Brick	Paint	None	Drop Ceiling	No	N/A
S-3	AP24	1	0	CAT 5E	N/A		WiFi	None	Brick	PAINT	None	Hard Lid	No	N/A
S-4	AP54	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-200A	AP20	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-200B	2M4200B A	4	0	CAT 6	N/A			None	Drywall	Paint	None	Drop Ceiling	Yes	Casework
7-200B	2M4200B B	4	0	CAT 6	N/A	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	Casework
7-200B	2M4200B C	4	0	CAT 6	N/A	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	Casework
7-200B	2M4200B D	4	0	CAT 6	N/A		PRINTER	None	Drywall	Paint	None	Drop Ceiling	Yes	Casework
7-200D	2M4200D A	4	0	CAT 6	N/A	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	Casework
7-200F	2M4200F A	4	0	CAT 6	N/A	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	Casework
7-200F	AP19	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-200H	2M4200H A	4	0	CAT 6	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	Casework
7-200I	2M4200I A	4	0	CAT 6	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	Casework
7-200I	2M4200I B	0	4	CAT 6	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	Casework
7-200I	AP20	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-200J	2M4200JA	4	0	CAT 6	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	Casework
7-200K	2M4200KA	4	0	CAT 6	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	Casework
7-201	802	2	2	CAT 5	CAT 3	PHONE	Computer/Printer	WM	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-202	926	2	2	CAT 5	CAT 3	PHONE	COMPUTER	WM	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-202	AP33	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-202	XXXX	2	2	CAT 5	CAT 3	PHONE	COMPUTER	WM	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-203	203	0	1	N/A	CAT 3			WM	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-203	804	2	2	CAT 5	CAT 3		COMPUTER	WM	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-203	901	2	2	CAT 5	CAT 3			WM	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-203	AP34	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-204	844	2	2	CAT 5	CAT 3			3/4"	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-204	AP35	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	Furniture
7-205	XXXX	2	2	CAT 5	CAT 3			WM	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-207	806	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-208	208.1	1	0	CAT 6	N/A			None	Ceiling	Other	None	Drop Ceiling	Yes	N/A
7-208	841	2	2	CAT 5	CAT 3	PHONE		WM	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-208	842	2	2	CAT 5	CAT 3	PHONE		WM	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-209	209.1	1	0	CAT 6	N/A			None	Ceiling	Other	None	Drop Ceiling	Yes	N/A
7-209	807	2	2	CAT 5	CAT 3	PHONE		WM	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-209	AP37	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	Furniture
7-209	R209	0	1	N/A	CAT 3			None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-210	AP36	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	Furniture
7-210	R210	0	1	N/A	CAT 3			None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-211	211.1	1	0	CAT 6	N/A			None	Ceiling	Other	None	Drop Ceiling	Yes	N/A
7-211	808	2	2	CAT 5	CAT 3	PHONE		WM	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-211	R208	0	1	N/A	CAT 3			None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-211	R211	0	1	N/A	CAT 3			None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-212	840	2	2	CAT 5	CAT 3	PHONE		WM	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-212	R212	0	1	CAT 6	N/A			None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-217	915	2	2	CAT 5	CAT 3	PHONE	EQUIPMENT	WM	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-218	218.1	1	0	CAT 6	N/A			None	Ceiling	Other	None	Drop Ceiling	Yes	N/A
7-218	811	2	2	CAT 5	CAT 3	PHONE		None	Other	Paint	None	Drop Ceiling	Yes	Furniture
7-218	AP43	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-218	R218	1	0	CAT 6	N/A		EQUIPMENT	None	Other	Paint	None	Drop Ceiling	Yes	N/A
7-218	R235	1	0	CAT 6	N/A		EQUIPMENT	None	Other	Paint	None	Drop Ceiling	Yes	N/A
7-219	812	2	2	CAT 5	CAT 3	PHONE		None	Other	Paint	None	Drop Ceiling	Yes	N/A
7-219	R219	1	0	CAT 6	N/A		EQUIPMENT	None	Other	Paint	None	Drop Ceiling	Yes	N/A
7-219	R226	1	0	CAT 6	N/A			None	Other	Paint	None	Drop Ceiling	Yes	N/A

Alexandria VA Existing Data Drop Survey
Building 7 - 2nd Floor

Room	Tag	#Data Drops (313)	#Voice Drops (211)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
7-221	813	2	2	CAT 5	CAT 3	PHONE		None	Other	Paint	None	Drop Ceiling	Yes	N/A
7-221	(NO ID)	0	1	N/A	CAT 3			None	Other	Paint	None	Drop Ceiling	Yes	N/A
7-221	AP42	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-224	AP41	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-226	815	2	2	CAT 5	CAT 3	PHONE		None	Other	Paint	None	Drop Ceiling	Yes	N/A
7-227	818	2	2	CAT 5	CAT 3	PHONE		None	Other	Paint	None	Drop Ceiling	Yes	N/A
7-227	AP44	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-227	R227	1	0	CAT 6	N/A		EQUIPMENT	None	Other	Paint	None	Drop Ceiling	Yes	N/A
7-231	819	2	2	CAT 5	CAT 3		Computer/Equip	WM	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-231	822	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-231	823	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-231	AP45	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-231	XXXX	2	2	CAT 5	CAT 3	FAX	PRINTER	None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-231	XXXX	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-231B	819	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-231B	(NO ID)	2	0	CAT 5	N/A		EQUIPMENT	None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-231B	2M4-31	4	0	CAT 5	N/A		Printer/Equipment	None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-232	824	2	2	CAT 5	CAT 3			WM	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-233	AP46	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-234	234.1	1	0	CAT 6	CAT 3			None	Ceiling	Other	None	Drop Ceiling	Yes	N/A
7-234	826	2	2	CAT 5	CAT 3	PHONE		WM	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-234	R234	1	0	CAT 6	CAT 3			WM	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-235	827	2	2	CAT 5	CAT 3			WM	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-236	RXXX	1	0	CAT 6	CAT 3			WM	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-236	XXX	2	2	CAT 5	CAT 3	PHONE		WM	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-236	XXX.X	1	0	CAT 6	CAT 3			None	Ceiling	Other	None	Drop Ceiling	Yes	N/A
7-237	RXXX	1	0	CAT 6	CAT 3			WM	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-237	XXX	2	2	CAT 5	CAT 3	PHONE		WM	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-237	XXX.X	1	0	CAT 6	CAT 3			None	Ceiling	Other	None	Drop Ceiling	Yes	N/A
7-238	RXXX	1	0	CAT 6	CAT 3			WM	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-238	XXX	2	2	CAT 5	CAT 3	PHONE		WM	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-238	XXX.X	1	0	CAT 6	CAT 3			None	Ceiling	Other	None	Drop Ceiling	Yes	N/A
7-239	RXXX	1	0	CAT 6	CAT 3			WM	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-239	XXX	2	2	CAT 5	CAT 3	PHONE		WM	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-239	XXX.X	1	0	CAT 6	CAT 3			None	Ceiling	Other	None	Drop Ceiling	Yes	N/A
7-240	RXXX	1	0	CAT 6	CAT 3			WM	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-240	XXX	2	2	CAT 5	CAT 3	PHONE		WM	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-240	XXX.X	1	0	CAT 6	CAT 3			None	Ceiling	Other	None	Drop Ceiling	Yes	N/A
7-241	RXXX	1	0	CAT 6	CAT 3			WM	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-241	XXX	2	2	CAT 5	CAT 3	PHONE		WM	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-241	XXX.X	1	0	CAT 6	CAT 3			None	Ceiling	Other	None	Drop Ceiling	Yes	N/A
7-242	RXXX	1	0	CAT 6	CAT 3			WM	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-242	XXX	2	2	CAT 5	CAT 3	PHONE		WM	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-242	XXX.X	1	0	CAT 6	CAT 3			None	Ceiling	Other	None	Drop Ceiling	Yes	N/A
7-243	837	2	2	CAT 5	CAT 3	PHONE	Computer/Printer	WM	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-243	838	2	2	CAT 5	CAT 3	PHONE		WM	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-243	AP47	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-244	839	2	2	CAT 5	CAT 3			WM	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-244	R244	1	0	CAT 6	N/A			WM	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-246	857	0	1	N/A	CAT 3			None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-246	898	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-251	848	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-251	849	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-251	850	2	2	CAT 5	CAT 3		PRINTER	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-251	891	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-251A	914	2	2	CAT 5	CAT 3		PRINTER	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A

Alexandria VA Existing Data Drop Survey
Building 7 - 2nd Floor

Room	Tag	#Data Drops (313)	#Voice Drops (211)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
7-252	904	0	1	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-252	0934	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-252	939	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-252	940	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-252	941	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-252	AP30	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-253	AP28	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-253	AP29	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-253A	XXXX	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-253B	932	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-253B	253C	2	2	CAT 5	CAT 3		PRINTER	None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-253C	899	2	2	CAT 5	CAT 3		EQUIPMENT	None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-253C	(NO ID)	0	0	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-253C	AP25	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Hard Lid	No	N/A
7-253C	AP27	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-253E	XXXX	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-253F	0936	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-253F	XXXX	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-254	2M4254A942	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-254	2M4254B943	2	2	CAT 5	CAT 3	PHONE		None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-254	XXXX	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-255	905	0	1	CAT 5	CAT 3	PHONE		None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-255	255-1	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-255	255-2	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-255A	933	2	2	CAT 5	CAT 3		PRINTER	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-255A	AP23	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Other	None	Drop Ceiling	No	N/A
7-255A	XXXX	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	Yes	Furniture
7-256	925	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-256	931	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	Yes	N/A

Alexandria VA Existing Data Drop Survey
Building 7 - 3rd Floor

Room	Tag	#Data Drops (440)	#Voice Drops (323)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
7-2-381 (Corr)	ALXMEDAP-B7F7-005	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-2-381 (Corr)	AP47	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-347	1347-1 3M3	4	0	CAT 6	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Other
7-347	347-1 3M3	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-347	AP30	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-349	1248	2	2	CAT 5	CAT 3	Phone	Computer/Equip	None	Drywall	Paint	None	Drop Ceiling	No	Case/Furn
7-349	1315	2	2	CAT 5	CAT 3	Phone	Computer/Equip	None	Drywall	Paint	None	Drop Ceiling	No	Furn/Equip
7-349	1388	2	2	CAT 5	CAT 3			None	Furniture	Paint	None	Drop Ceiling	No	Furniture
7-349	348-3 3M3	4	0	CAT 6	N/A		Printer	None	Drywall	Paint	None	Drop Ceiling	No	Case/Furn
7-350	1250	2	2	CAT 5	CAT 3		Equipment	None	Drywall	Paint	None	Drop Ceiling	No	Furn/Equip
7-350	1253	2	2	CAT 5	CAT 3		Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	Other
7-350	1254	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Equipment
7-350	1255	2	2	CAT 5	CAT 3		Equipment	None	Drywall	Paint	None	Drop Ceiling	No	Equipment
7-350	1256	2	2	CAT 5	CAT 3		Computer/Equip	None	Furniture	Paint	None	Drop Ceiling	No	Equipment
7-350	1257	2	2	CAT 5	CAT 3		Equipment	None	Drywall	Paint	None	Drop Ceiling	No	Equipment
7-350	1257	0	2	N/A	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Equipment
7-350	1316	2	2	CAT 5	CAT 3	Phone	Computer/Equip	None	Furred Column	Paint	None	Drop Ceiling	No	N/A
7-350	1317	2	2	CAT 5	CAT 3	Phone	Computer	None	Furred Column	Paint	None	Drop Ceiling	No	Furniture
7-350	1319	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Hard Lid	No	N/A
7-350	1320	2	2	CAT 5	CAT 3			None	Furred Column	Paint	None	Drop Ceiling	No	Furniture
7-350	1321	2	2	CAT 5	CAT 3			None	Furred Column	Paint	None	Drop Ceiling	No	Equipment
7-350	1322	2	2	CAT 5	CAT 3	Phone/Fax	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	Furn/Equip
7-350	1324	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-350	1325	2	2	CAT 5	CAT 3	Phone	Computer/Equip	None	Furred Column	Paint	None	Drop Ceiling	No	Furn/Equip
7-350	1356	2	2	CAT 5	CAT 3		Computer	None	Drywall	Paint	None	Drop Ceiling	No	Other
7-350	1357	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-350	1365	2	2	CAT 5	CAT 3	Phone		None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-350	1368	2	1	CAT 5	CAT 3			None	Furniture	Paint	None	Drop Ceiling	No	N/A
7-350	1373	2	2	CAT 5	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Casework
7-350	(NO ID)	1	0	N/A	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furn/Equip
7-350	(NO ID)	0	2	N/A	CAT 3			None	Furniture	Paint	None	Drop Ceiling	No	Equipment
7-350	350C1	4	0	CAT 6	N/A		Equipment	None	Concrete Column	Paint	None	Drop Ceiling	No	Equipment
7-350	AP 29	1	0	CAT 6	N/A		WIFI	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-350	AP27	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	Equipment
7-350	AP28	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	Casework
7-350	C1	1	0	CAT 5	N/A			None	Furniture	Paint	None	Drop Ceiling	No	Furniture
7-350	C4	1	0	CAT 5	N/A			None	Furniture	Paint	None	Drop Ceiling	No	Furn/Equip
7-350	DATA 1	1	0	CAT 5	N/A			WM / SMB	Drywall	Paint	None	Drop Ceiling	No	Casework
7-350	L-1, L-2	2	0	CAT 5	N/A			None	Furred Column	Paint	None	Drop Ceiling	No	Case/Furn
7-350A	1327	2	2	CAT 5	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Case/Furn
7-350B	1258	2	2	CAT 5	CAT 3	Phone	Computer/Equip	None	Drywall	Paint	None	Drop Ceiling	No	Case/Furn
7-350C	(NO ID)	0	1	N/A	CAT 3	Phone		None	Furred Column	Paint	None	Drop Ceiling	No	Equipment
7-350C	350C	4	0	CAT 6	N/A		Computer/Printer/Equipment	None	Drywall	Paint	None	Drop Ceiling	No	Other
7-350D	1252	0	1	N/A	CAT 3	Phone		None	Furred Column	Paint	None	Drop Ceiling	No	N/A
7-350D	1326	2	2	CAT 5	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furn/Equip
7-350D	350D-1 3M3	4	0	CAT 6	N/A		Computer	None	Furred Column	Paint	None	Drop Ceiling	No	Furniture
7-350D	AP26	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	Equipment
7-350E	1328	2	2	CAT 5	CAT 3	Phone		None	Drywall	Paint	None	Drop Ceiling	No	Casework
7-350E	1380	2	2	CAT 5	CAT 3		Computer	None	Drywall	Paint	None	Drop Ceiling	No	Equipment
7-350F	1J1, P1	0	2	N/A	CAT 3			None	Furred Column	Paint	None	Drop Ceiling	No	Casework
7-350F	2J0	0	2	N/A	CAT 3			None	Furred Column	Paint	None	Drop Ceiling	No	Casework
7-350F	2J1	0	2	N/A	CAT 3			None	Furred Column	Paint	None	Drop Ceiling	No	Casework
7-350F	2J2, 1J0	0	2	N/A	CAT 3			None	Furred Column	Paint	None	Drop Ceiling	No	Casework
7-350F	AP25	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
7-350F	P-1	0	1	N/A	CAT 3			None	Furred Column	Paint	None	Drop Ceiling	No	Casework
7-350F	P2, 1J2	0	2	N/A	CAT 3			None	Furred Column	Paint	None	Drop Ceiling	No	Casework

Alexandria VA Existing Data Drop Survey
Building 7 - 3rd Floor

Room	Tag	#Data Drops (440)	#Voice Drops (323)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
7-353	1247	2	2	CAT 5	CAT 3	Phone		None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-353	1401	2	2	CAT 5	CAT 3		Computer	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-357	39	0	2	N/A	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-357	1246	2	2	CAT 5	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-358	1243	2	2	CAT 5	CAT 3	Phone		None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-358	1244	2	2	CAT 5	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-358	1245	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-358	1310	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-360	1242	2	2	CAT 5	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-362	AP53	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-363	1293	1	0	N/A	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furn/Equip
7-363	1308	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-363	1376	2	2	CAT 5	CAT 3			3/4"	Drywall	Paint	None	Drop Ceiling	No	N/A
7-363	1377	2	2	CAT 5	CAT 3	Phone	Computer	3/4"	Drywall	Paint	None	Drop Ceiling	No	Furn/Equip
7-363	1381	1	2	CAT 5	CAT 2			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-363	AP52	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
7-363 (Corr)	(NO ID)	0	1	N/A	CAT 3	Phone		None	Cast in Place Concrete	Paint	Smoke	Drop Ceiling	No	N/A
7-364	1249	0	1	N/A	CAT 3			None	Cast in Place Concrete	Paint	None	Drop Ceiling	No	Equipment
7-365	1378	2	2	CAT 5	CAT 3		Computer	3/4"	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-365	1379	2	2	CAT 5	CAT 3	Phone	Computer/Printer	3/4"	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-366	1355	0	2	N/A	CAT 3			None	Drywall	Paint	Smoke	Drop Ceiling	No	Casework
7-366	366-1	4	0	CAT 6	N/A			None	Drywall	Paint	Smoke/Fire	Drop Ceiling	No	Casework
7-366	366-2	4	0	CAT 6	N/A		Computer	None	Drywall	Paint	Smoke/Fire	Drop Ceiling	No	Casework
7-366	AP51	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-366 (Corr)	ALXMEDAP-B7F7-003	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-367	367.1	1	0	CAT 6	N/A			None	Ceiling	Paint	None	Drop Ceiling	No	Equipment
7-367	1292	2	2	CAT 5	CAT 3			None	Other	Paint	None	Drop Ceiling	No	Equipment
7-367	1348	2	2	CAT 5	CAT 3			None	Other	Paint	None	Drop Ceiling	No	Equipment
7-367	E14	1	0	CAT 5E	N/A		Equipment	WM / SMB	Other	Paint	None	Drop Ceiling	No	Equipment
7-368	1259	2	2	CAT 5	CAT 3			None	Other	Paint	None	Drop Ceiling	No	Furniture
7-368	1349	2	2	CAT 5	CAT 3	Phone	Computer/Printer	None	Other	Paint	None	Drop Ceiling	No	Furniture
7-368	(NO ID)	1	0	CAT 6	N/A			None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-368	E13	1	0	CAT 5E	N/A			None	Other	Paint	None	Drop Ceiling	No	Furniture
7-369	369.1	1	0	CAT 6	N/A			None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-369	1290	2	2	CAT 5	CAT 3		Computer	WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	No	Equipment
7-369	1291	2	2	CAT 5	CAT 3	Phone	Equipment	WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	No	Equipment
7-369	AP 50	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-370	370.1	1	0	CAT 6	N/A			None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-370	1260	2	2	CAT 5	CAT 3			None	Other	Paint	None	Drop Ceiling	No	Furniture
7-370	1360	2	2	CAT 5	CAT 3	Phone	Computer	None	Other	Paint	None	Drop Ceiling	No	Furniture
7-370	E12	1	0	CAT 5E	N/A			WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	No	Furniture
7-371 (Corr)	1301	0	1	N/A	CAT 3	Phone		WM	Cast in Place Concrete	Paint	Smoke	Drop Ceiling	No	N/A
7-372	1261	2	2	CAT 5	CAT 3	Phone	Computer/Equip	WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	No	Furniture
7-372	AP49	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-372	E11	1	0	CAT 5E	N/A			WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	No	Furniture
7-374	1262	2	2	CAT 5	CAT 3	Phone	Computer/Printer	WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	No	Furniture
7-374	E10	1	0	CAT 5E	N/A			WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	No	Furniture
7-375	AP48	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-375A	AP49	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-377	1369	1	2	CAT 5	CAT 3		EQUIPMENT	WM	Block	Paint	None	Drop Ceiling	No	Furniture
7-377 (Corr)	AP40	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-378	378.1	1	0	CAT 6	N/A			None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-378	1289	2	2	CAT 5	CAT 3	Phone	Computer/Equip	WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	No	Furniture
7-378	AP43	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-378	E9	1	0	CAT 5E	N/A			WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	No	Furniture
7-379	379.1	1	0	CAT 6	N/A			None	Ceiling	Paint	None	Drop Ceiling	No	N/A

Alexandria VA Existing Data Drop Survey
Building 7 - 3rd Floor

Room	Tag	#Data Drops (440)	#Voice Drops (323)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
7-379	1288	2	2	CAT 5	CAT 3	Phone	Computer	WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	No	Furniture
7-379	E8	1	0	CAT 5E	N/A		Equipment	WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	No	Furniture
7-380	1287	2	2	CAT 5	CAT 3	Phone	Computer	WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	No	Furniture
7-380	E6	1	0	CAT 5E	N/A			WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	No	Furniture
7-381	380.1	1	0	CAT 6	N/A			None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-381	1286	2	2	CAT 5	CAT 3	Phone	Computer/Printer	WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	No	Furniture
7-381	E4	1	0	CAT 5E	N/A			WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	No	Furniture
7-382	1285	2	2	CAT 5	CAT 3	Phone	Computer	WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	No	Furniture
7-382	(NO ID)	1	0	CAT 6	N/A			None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-382	AP46	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-382	E3	1	0	CAT 5E	N/A			WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	No	Furniture
7-383	383.1	1	0	CAT 6	N/A			None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-383	1284	2	2	CAT 5	CAT 3	Phone	Computer	WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	No	Furniture
7-383	AP45	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-383	E1	1	0	CAT 5E	N/A			WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	No	Furniture
7-384	1283	2	2	CAT 5	CAT 3	Phone	Computer	WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	No	Furniture
7-384	E3	1	0	CAT 5E	N/A			WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	No	Furniture
7-385	385.1	1	0	CAT 6	N/A			None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-385	1282	2	2	CAT 5	CAT 3	Phone	Computer/Equip	WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	No	Equipment
7-385	E5	1	0	CAT 5E	N/A			WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	No	Equipment
7-386	386.1	1	0	CAT 6	N/A			None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-386	1281	2	2	CAT 5	CAT 3	Phone		WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	No	Furniture
7-386	E7	1	0	CAT 5E	N/A			WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	No	Furniture
7-387	1280	2	2	CAT 5	CAT 3			WM / SMB	Cast in Place Concrete	Paint	Smoke	Drop Ceiling	No	N/A
7-387	AP44	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-390	1275	2	2	CAT 5	CAT 3		Equipment	None	Drywall	Paint	Smoke	Drop Ceiling	No	Equipment
7-390	1279	2	2	CAT 5	CAT 3			1/2"	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-390	1371	2	2	CAT 5	CAT 3			WM / SMB	Concrete Masonary Unit	Paint	None	Drop Ceiling	No	N/A
7-390	ALXMEDAP-B7F7-002	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-390	AP42	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-390	XXXX	2	2	CAT 5	CAT 3			1"	Concrete Masonary Unit	Paint	None	Drop Ceiling	No	Furniture
7-390	XXXX	2	0	CAT 5E	N/A			1/2"	Cast in Place Concrete	Paint	None	Drop Ceiling	No	Furniture
7-390	XXXX	2	0	CAT 5E	N/A			WM / SMB	Drywall	Paint	Smoke	Drop Ceiling	No	Furniture
7-390	XXXX	2	2	CAT 5	CAT 3			3/4"	Drywall	Paint	Smoke	Drop Ceiling	No	Furniture
7-391	1274	2	2	CAT 5	CAT 3		Printer	None	Drywall	Paint	None	Drop Ceiling	No	Equipment
7-391	1391	2	2	CAT 5	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-391	(NO ID)	2	2	CAT 5	CAT 3			None	Concrete Masonary Unit	Paint	None	Drop Ceiling	No	Furniture
7-391	AP41	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-393	1263	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-394	1271	2	2	CAT 5	CAT 3			None	Furred Column	Paint	None	Drop Ceiling	No	Equipment
7-394	1300	2	2	CAT 5	CAT 3		Computer/Printer	None	Furred Column	Paint	None	Drop Ceiling	No	Equipment
7-394	1385	2	2	CAT 5	CAT 3		Computer	None	Furniture	Paint	None	Drop Ceiling	No	Furniture
7-394	1386	2	2	CAT 5	CAT 3		Computer	None	Furniture	Paint	None	Drop Ceiling	No	Furniture
7-394	1387	2	2	CAT 5	CAT 3	Phone		None	Furniture	Paint	None	Drop Ceiling	No	Furniture
7-394	1389	2	2	CAT 5	CAT 3	Phone	Printer	None	Furniture	Paint	None	Drop Ceiling	No	Equipment
7-394	ALXMEDAP-B7F7-001	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-394 (Corr)	AP38	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-394A	1273	2	2	CAT 5	CAT 3	Phone		1"	Cast in Place Concrete	Paint	Smoke	Drop Ceiling	Yes	Equipment
7-394A	1A; 1B	2	0	CAT 5	N/A		Equipment	None	Other	Paint	Smoke	Drop Ceiling	No	Equipment
7-394A	AP37	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-394B	1272	2	2	CAT 5	CAT 3	Phone		1"	Cast in Place Concrete	Paint	Smoke	Drop Ceiling	Yes	Equipment
7-394B	2A; 2B	2	0	CAT 5E	N/A		Equipment	None	Other	Paint	None	Drop Ceiling	No	Equipment
7-394C	1268	2	2	CAT 5	CAT 3	Phone		None	Cast in Place Concrete	Paint	Smoke	Drop Ceiling	No	Equipment
7-394C	3A; 3B	2	0	CAT 5	N/A		Equipment	None	Other	Paint	None	Drop Ceiling	No	Equipment
7-394D	1390	2	2	CAT 5E	CAT 3	Phone		None	Cast in Place Concrete	Paint	Smoke	Drop Ceiling	No	Equipment
7-394D	4A; 4B	2	0	CAT 5E	N/A		Equipment	None	Other	Paint	None	Drop Ceiling	No	Equipment

Alexandria VA Existing Data Drop Survey
Building 7 - 3rd Floor

Room	Tag	#Data Drops (440)	#Voice Drops (323)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
7-394D	AP35	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Equipment
7-394E	1267	2	2	CAT 5	CAT 3	Phone		1"	Cast in Place Concrete	Paint	Smoke	Drop Ceiling	Yes	N/A
7-394E	5A; 5B	2	0	CAT 5	N/A		Equipment	1"	Other	Paint	None	Drop Ceiling	Yes	N/A
7-394F	1266	2	2	CAT 5	CAT 3			1"	Cast in Place Concrete	Paint	Smoke	Drop Ceiling	Yes	Equipment
7-394F	6A; 6B	2	0	CAT 5	N/A		Equipment	None	Cast in Place Concrete	Paint	None	Drop Ceiling	No	Equipment
7-394G	1265	2	2	CAT 5	CAT 3	Phone		1"	Cast in Place Concrete	Paint	Smoke	Drop Ceiling	Yes	Equipment
7-394G	7A; 7B	2	0	CAT 5E	N/A		Equipment	None	Other	Paint	None	Drop Ceiling	No	Equipment
7-394G	AP36	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-395	1264	0	1	N/A	CAT 3	PHONE		None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-395	1370	3	1	CAT 5	CAT 3		EQUIPMENT	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-397	AP37	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-398	AP39	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
C7-2	AP23	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-300	AP19	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-300B	1304	2	2	CAT 5	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-300B	(NO ID)	1	1	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-300B	AP22	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
7-300C	1305	2	2	CAT 5	CAT 3	Phone/Fax	Printer	None	Drywall	Paint	None	Drop Ceiling	No	Furn/Equip
7-300D	1294	2	2	CAT 5	CAT 3		computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-300D	(NO ID)	0	1	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-300E	1295	2	2	CAT 5	CAT 3	Phone		None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-300E	AP21	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-300F	XXXX	2	2	CAT 5	CAT 3	Phone	Computer	WM / SMB	Cast in Place Concrete	Paint	Smoke	Drop Ceiling	No	Furniture
7-300F	XXXX	2	2	CAT 5	CAT 3		Computer	WM / SMB	Cast in Place Concrete	Paint	Smoke	Drop Ceiling	No	Furniture
7-300G	1298	2	2	CAT 5	CAT 3	phone	computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-300G	1299	2	2	CAT 5	CAT 3	Phone	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-300G	1303	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-300G	AP20	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
7-301	1203	2	2	CAT 5	CAT 3	Phone	Computer/Printer	WM / SMB	Cast in Place Concrete	Paint	Smoke	Drop Ceiling	No	Furniture
7-301	1203	2	2	CAT 5	CAT 3	Phone	Computer	WM	Block	Paint	None	Drop Ceiling	No	Furniture
7-303	303	2	2	CAT 5	CAT 3	PHONE	COMPUTER/PRINTER	WM	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-303	1202	2	2	CAT 5	CAT 3	PHONE	COMPUTER/PRINTER	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-303	1395	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-304	1331	2	2	CAT 5	CAT 3	Phone	Computer	WM / SMB	Cast in Place Concrete	Paint	Smoke	Drop Ceiling	No	Furniture
7-304	1331	2	2	CAT 5	CAT 3	PHONE	COMPUTER	WM	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-304	1400	2	2	CAT 5	CAT 3		Computer	WM / SMB	Cast in Place Concrete	Paint	Smoke	Drop Ceiling	No	Furniture
7-304	1400	2	2	CAT 5	CAT 3			WM	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-305	1204	2	2	CAT 5	CAT 3			3/4"	Cast in Place Concrete	Paint	Smoke	Drop Ceiling	No	Furniture
7-305	1306	2	2	CAT 5	CAT 3			WM / SMB	Cast in Place Concrete	Paint	Smoke	Drop Ceiling	No	Furniture
7-305	AP18	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-306	1359	2	2	CAT 5	CAT 3	Phone	Computer/Equip	WM / SMB	Other	Paint	None	Drop Ceiling	No	Equipment
7-306	1374	2	2	CAT 5	CAT 3			WM / SMB	Other	Paint	None	Drop Ceiling	No	Equipment
7-306	AP16	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-307	1333	2	2	CAT 5E	N/A	Phone	COMPUTER/PRINTER	WM	Block	Paint	None	Drop Ceiling	No	N/A
7-307	1353	2	2	CAT 5E	N/A		COMPUTER	WM	Block	Paint	None	Drop Ceiling	No	N/A
7-307	(NO ID)	2	2	CAT 5E	N/A		COMPUTER	WM	Block	Paint	None	Drop Ceiling	No	N/A
7-307 (Corr)	AP17	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-309	1398	2	2	CAT 5	CAT 3	Phone	Computer/Printer	3/4"	Cast in Place Concrete	Paint	None	Drop Ceiling	No	Case/Furn
7-309	1399	2	2	CAT 5	CAT 3			3/4"	Cast in Place Concrete	Paint	None	Drop Ceiling	No	Case/Furn
7-309a	1205	2	2	CAT 5	CAT 3	Phone	Computer	3/4" Flex	Cast in Place Concrete	Paint	Smoke	Drop Ceiling	No	Case/Furn
7-309a	1206	2	2	CAT 5	CAT 3		Computer	None	Cast in Place Concrete	Paint	None	Drop Ceiling	No	Case/Furn
7-312	1234	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-312	1396	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-312	1397	2	2	CAT 5	CAT 3	PHONE		None	Drywall	Paint	None	Drop Ceiling	No	Furniture

Alexandria VA Existing Data Drop Survey
Building 7 - 3rd Floor

Room	Tag	#Data Drops (440)	#Voice Drops (323)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
7-312	AP15	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-315	1233	3	1	CAT 5	CAT 3		Computer/Equip	3/4"	Drywall	Paint	None	Drop Ceiling	No	Equipment
7-315	1347	2	2	CAT 5	CAT 3	Phone	Computer	3/4"	Drywall	Paint	None	Drop Ceiling	No	Case/Equip
7-315	AP05	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	Equipment
7-316	1346	2	2	CAT 5	CAT 3	Phone	Computer	3/4"	Drywall	Paint	None	Drop Ceiling	No	Case/Equip
7-317	1340	2	2	CAT 5	CAT 3	Phone	Phone/Computer	3/4"	Drywall	Paint	None	Drop Ceiling	No	Case/Equip
7-318	1226	2	2	CAT 5	CAT 3	Phone	Computer	3/4"	Drywall	Paint	None	Drop Ceiling	No	Case/Equip
7-319	1354	2	2	CAT 5	CAT 3	Phone	Computer	3/4"	Drywall	Paint	None	Drop Ceiling	No	Case/Equip
7-319	1384	2	2	CAT 5	CAT 3		Computer	3/4"	Drywall	Paint	None	Drop Ceiling	No	Case/Equip
7-319A	AP02	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	Equipment
7-320	1229	2	2	CAT 5	CAT 3	Phone	Phone/Computer	3/4"	Drywall	Paint	None	Drop Ceiling	No	Case/Equip
7-320a	AP01	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-321	1341	2	2	CAT 5	CAT 3	Phone	Computer	3/4"	Drywall	Paint	None	Drop Ceiling	No	Case/Equip
7-321	1383	2	2	CAT 5	CAT 3	Phone	Computer	3/4"	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-322	1225	2	2	CAT 5	CAT 3	Phone	Computer	3/4"	Drywall	Paint	None	Drop Ceiling	No	Case/Equip
7-322a	AP04	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
7-325	1222	2	2	CAT 5	CAT 3	Phone	Computer	3/4"	Cast in Place Concrete	Paint	None	Drop Ceiling	No	Furniture
7-325	AP06	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-326	1218	2	2	CAT 5	CAT 3		Computer	1/2"	Drywall	Paint	Smoke	Drop Ceiling	No	Case/Equip
7-326	1219	2	2	CAT 5	CAT 3	Phone		1/2"	Drywall	Paint	Smoke	Drop Ceiling	No	Case/Equip
7-326	1220	2	2	CAT 5	CAT 3	Phone		None	Cast in Place Concrete	Paint	Smoke	Drop Ceiling	No	Other
7-326	1367	2	2	CAT 5	CAT 3	Fax	Printer	1"	Drywall	Paint	Smoke	Drop Ceiling	No	Casework
7-326	(NO ID)	0	1	N/A	CAT 3	Phone		None	Drywall	Paint	Smoke	Drop Ceiling	No	Case/Equip
7-329	AP09	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-331	1213	2	2	CAT 5	CAT 3	Phone	Computer/Equip	3/4"	Drywall	Paint	None	Drop Ceiling	No	Equipment
7-331	AP11	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-333	1342	2	2	CAT 5	CAT 3			WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	No	Furniture
7-333	AP13	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
7-334	1228	2	2	CAT 5	CAT 3			WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	No	N/A
7-334	AP12	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
7-336	1209	2	2	CAT 5	CAT 3	Phone		None	Drywall	Paint	None	Drop Ceiling	No	Equipment
7-336	AP10	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
7-338	AP08	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-338 (Corr)	AP07	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-339C	AP14	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
7-339D	(NO ID)	0	1	N/A	CAT 3	Equipment		3/4" Flex	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-348	AP31	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-351	1239	2	2	CAT 5	CAT 3	Phone	Computer/Equip	None	Drywall	Paint	None	Drop Ceiling	No	Casework
7-351	1311	2	2	CAT 5	CAT 3		Computer	None	Drywall	Paint	None	Drop Ceiling	No	Casework
7-351	1312	2	2	CAT 5	CAT 3	Phone	Computer	None	Furniture	Paint	None	Drop Ceiling	No	Casework
7-351	1313	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Casework
7-351	1314	2	2	CAT 5	CAT 3		Printer/Equipment	None	Drywall	Paint	None	Drop Ceiling	No	Furn/Equip
7-351	1375	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-351	(NO ID)	0	1	N/A	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Casework
7-351	351-1	3	0	CAT 6	N/A		Equipment	None	Drywall	Paint	None	Drop Ceiling	No	Equipment
7-351	AP32	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-351	AP33	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	Casework
7-351	AP34	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	Casework
7-351A	351A-1	4	0	CAT 6	N/A		Computer/Equip	None	Drywall	Paint	None	Drop Ceiling	No	Casework
7-351B	1238	2	2	CAT 5	CAT 3		Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-354	XXXX	2	2	CAT 5	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-359	1366	2	2	CAT 5	CAT 3		Printer	None	Drywall	Paint	None	Drop Ceiling	No	Equipment
7-361	1241	2	2	CAT 5	CAT 3	Phone		None	Furred Column	Paint	None	Drop Ceiling	No	Furniture
7-361	AP27	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	Other

Alexandria VA Existing Data Drop Survey
Building 7 - 4th Floor

Room	Tag	#Data Drops (417)	#Voice Drops (271)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
7-400	2067	2	2	CAT 5	CAT 3	Fax	Printer	WM / SMB	Cast in Place Concrete	Paint	2 hr	Drop Ceiling	No	Equipment
7-400	2086	3	0	CAT 6	N/A		Equipment	WM / SMB	Cast in Place Concrete	Paint	2 hr	Drop Ceiling	No	Equipment
7-400	AP36	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-400A	2000	2	2	CAT 5	CAT 3	Phone	Computer/Printer	None	Cast in Place Concrete	Paint	2 hr	Drop Ceiling	No	Furniture
7-400A	2069	2	2	CAT 5	CAT 3			None	Cast in Place Concrete	Paint	2 hr	Drop Ceiling	No	Furniture
7-400B	2009	2	2	CAT 5	CAT 3	Phone	Computer/Equip	3/4"	Cast in Place Concrete	Paint	2 hr	Drop Ceiling	No	Equipment
7-400B	AP34	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
7-400C	2001	2	2	CAT 5	CAT 3	Phone		WM / SMB	Cast in Place Concrete	Paint	2 hr	Drop Ceiling	No	Furniture
7-400D	2002	2	2	CAT 5	CAT 3	Phone	Computer	WM / SMB	Cast in Place Concrete	Paint	2 hr	Drop Ceiling	No	Furniture
7-400D	AP35	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
7-400E	2003	2	2	CAT 5	CAT 3	Phone/Fax	Computer/Printer	None	Cast in Place Concrete	Paint	2 hr	Drop Ceiling	No	Furniture
7-401	1902	2	2	CAT 5	CAT 3	Phone	Computer/Printer	WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	No	Furniture
7-401	2041	2	2	CAT 5	CAT 3			WM / SMB	Cast in Place Concrete	Paint	2 hr	Drop Ceiling	No	Equipment
7-402	1901	2	2	CAT 5	CAT 3		Other	None	Drywall	Paint	Smoke	Drop Ceiling	No	Equipment
7-402	2084	4	0	CAT 5	N/A	Phone		None	Drywall	Paint	Smoke	Drop Ceiling	No	Equipment
7-403	2058	2	1	CAT 5E	CAT 3			1"	Drywall	Paint	Smoke	Drop Ceiling	No	Case/Equip
7-403	2087	2	1	CAT 5E	CAT 3		Equipment	3/4"	Drywall	Paint	None	Drop Ceiling	No	Furn/Equip
7-403	(NO ID)	2	1	CAT 5	CAT 3			1"	Drywall	Paint	None	Drop Ceiling	No	Case/Equip
7-403	(NO ID)	2	1	CAT 5E	CAT 3			1"	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-403	AP32	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
7-403	NC #1	1	0	CAT 6	N/A			3/4"	Drywall	Paint	Smoke	Drop Ceiling	No	Case/Equip
7-403	NC #2	1	0	CAT 6	N/A			3/4"	Drywall	Paint	None	Drop Ceiling	No	Equipment
7-403	NC #3	1	0	CAT 6	N/A			3/4"	Drywall	Paint	None	Drop Ceiling	No	Equipment
7-403	NC #4	1	0	CAT 6	N/A			3/4"	Drywall	Paint	None	Drop Ceiling	No	Equipment
7-403	NC #5	1	0	CAT 6	N/A			3/4"	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-404	AP40	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-405A	1906	2	2	CAT 5	CAT 3		Computer	3/4"	Drywall	Paint	None	Drop Ceiling	No	Case/Equip
7-405C	1907	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Equipment
7-405E	2038	2	2	CAT 5	N/A			3/4"	Drywall	Paint	None	Drop Ceiling	No	N/A
7-405E	2045	2	2	CAT 5	CAT 3	Phone	Computer	3/4"	Drywall	Paint	Smoke	Drop Ceiling	No	Casework
7-405F	2039	2	2	CAT 5	N/A	Phone/Fax	Computer/Printer	3/4"	Drywall	Paint	None	Drop Ceiling	No	Casework
7-405H	2046	2	2	CAT 5	CAT 3		Computer	3/4"	Drywall	Paint	None	Drop Ceiling	No	Case/Equip
7-405H	AP31	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	Other
7-406B	1940	2	2	CAT 5	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Equipment
7-406B	1941	0	1	N/A	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Equipment
7-406B	1942	2	2	CAT 5	CAT 3		Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	Furn/Equip
7-406B	(NO ID)	2	0	CAT 5E	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Equipment
7-406B	6C 6D	3	0	CAT 6	N/A		Equipment	None	Drywall	Paint	None	Drop Ceiling	No	Equipment
7-406C	1943	2	2	CAT 5	CAT 3	Phone	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	Furn/Equip
7-406D	(NO ID)	1	1	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Equipment
7-406F	2073	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-408	1939	2	2	CAT 5	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-408	(NO ID)	1	1	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Other
7-408	AP33	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-410	XXXX	2	2	CAT 5	N/A			3/4"	Drywall	Paint	None	Drop Ceiling	No	N/A
7-410	XXXX	2	2	CAT 5	CAT 3	Phone	Computer	3/4"	Drywall	Paint	Smoke	Drop Ceiling	No	Casework
7-412	2068	2	2	CAT 5	CAT 3	Phone		None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-414	1938	2	2	CAT 5	CAT 3	Phone	Printer	1"	Other	Paint	None	Drop Ceiling	Yes	Furniture
7-414	2028	2	2	CAT 5	CAT 3		Computer	1"	Other	Paint	None	Drop Ceiling	Yes	N/A
7-415A	AP28	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Hard Lid	No	Equipment
7-416	1937	2	2	CAT 5	CAT 3			1"	Other	Paint	None	Drop Ceiling	Yes	Furniture
7-416	2040	2	2	CAT 5	CAT 3	Phone	Computer	1"	Other	Paint	None	Drop Ceiling	Yes	Equipment
7-416	AP30	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
7-417	2060	2	2	CAT 5	CAT 3		Equipment	WM	Drywall	Cerami	None	Drop Ceiling	No	N/A
7-418	1936	2	2	CAT 5	CAT 3			3/4"	Drywall	Paint	Smoke	Drop Ceiling	No	N/A
7-420	1935	2	2	CAT 5	CAT 3	Phone	Computer	1"	Drywall	Paint	Smoke	Drop Ceiling	No	Furn/Equip

Alexandria VA Existing Data Drop Survey
Building 7 - 4th Floor

Room	Tag	#Data Drops (417)	#Voice Drops (271)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
7-420	AP29	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
7-423	1909	2	2	CAT 5	CAT 3	Phone	Phone/Computer	WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	Yes	Furn/Equip
7-423	AP27	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
7-424	1910	2	2	CAT 5	CAT 3	Phone	Computer/Printer	WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	Yes	Furniture
7-425	1911	2	2	CAT 5	CAT 3	Phone	Computer	WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	Yes	Furn/Equip
7-425	1912	2	2	CAT 5	CAT 3	Phone	Computer	WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	Yes	Furn/Equip
7-426	AP24	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	Yes	Furniture
7-427	1913	2	2	CAT 5	CAT 3	Phone	Computer/Printer	WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	Yes	Furn/Equip
7-428	1914	2	2	CAT 5	CAT 3	Phone	Computer/Printer	WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	Yes	Furniture
7-429	1915	2	2	CAT 5	CAT 3	Phone	Computer	WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	Yes	Furniture
7-429	AP25	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-430	1916	2	2	CAT 5	N/A	Phone	Computer/Printer	WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	Yes	Furniture
7-431	1917	2	2	CAT 5	CAT 3	Phone	Computer/Printer	WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	Yes	Furniture
7-432	1918	2	2	CAT 5	CAT 3	Phone	Computer	WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	Yes	Furniture
7-432	AP26	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
7-436	1921	2	2	CAT 5	CAT 3		Printer	None	Other	Paint	None	Drop Ceiling	No	Furniture
7-436	1922	2	2	CAT 5	CAT 3			None	Drywall	Paint	Smoke	Drop Ceiling	No	Casework
7-436	1923	2	2	CAT 5	CAT 3			None	Drywall	Paint	Smoke	Drop Ceiling	No	Casework
7-436	2007	2	2	CAT 5	N/A	Phone	Computer	None	Other	Paint	None	Drop Ceiling	No	Furniture
7-436	AP21	1	0	CAT 5E	CAT 3		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	Casework
7-436A	1920	2	2	CAT 5	CAT 3			None	Drywall	Paint	Smoke	Drop Ceiling	No	Casework
7-437	1924	2	2	CAT 5	CAT 3	Phone	Computer/Equip	WM / SMB	Cast in Place Concrete	Paint	Smoke	Drop Ceiling	No	Furniture
7-437	(NO ID)	0	1	N/A	CAT 3			None	Cast in Place Concrete	Paint	Smoke	Drop Ceiling	No	Furniture
7-437	AP19	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
7-438	1925	2	2	CAT 5	CAT 3			3/4"	Drywall	Paint	None	Drop Ceiling	Yes	N/A
7-439	1931	2	2	CAT 5	CAT 3	FAX	PRINTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-439	4M8.439A	2	1	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-439	4M8.439B	2	1	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-439	4M8.439C	2	1	CAT 5	CAT 3		COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-439	4M8.439D	2	1	CAT 5	CAT 3	PHONE		None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-439	4M8.439E	2	1	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-439	AP16	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-439A	4M8.439A.A	2	1	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-439C	1927	3	0	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-439C	4M8.439C.A	3	0	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-439C	4M8.439C.B	3	0	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-439D	439D	3	0	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-439D	4M8.439D	2	1	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-439E	2005	3	0	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-439E	2078	2	1	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-439E	AP15	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-439F	4M8.439F	2	1	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-439G	AP17	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-439H	4M8.439H.A	2	1	CAT 5	CAT 3		PRINTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-439H	4M8.439H.B	2	1	CAT 5	CAT 3		COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-440	2017	2	2	CAT 5	CAT 3	Phone	Computer	None	Drywall	Paint	Smoke	Drop Ceiling	No	Furniture
7-440	2079	2	2	CAT 5	CAT 3			None	Drywall	Paint	Smoke	Drop Ceiling	No	Furniture
7-441	2077	2	2	CAT 5	CAT 3			None	Drywall	Paint	1 Hr	Drop Ceiling	No	Furniture
7-442	1934	2	2	CAT 5	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-444A	2008	2	2	CAT 5	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Other
7-458	1945	0	1	N/A	CAT 3	Phone		None	Furred Column	Paint	None	Drop Ceiling	No	Equipment
7-458	1946	2	3	CAT 5	CAT 3	Phone/Fax	Computer/Equip	None	Furred Column	Paint	None	Drop Ceiling	No	Equipment
7-458	1947	2	2	CAT 5	CAT 3	Phone	Computer/Printer	None	Furniture	Paint	None	Drop Ceiling	No	Casework
7-458	1A 1B DR9	3	0	CAT 6	N/A		Computer/Equip	None	Drywall	Paint	None	Drop Ceiling	No	Case/Equip
7-458	2A 2B DR2	3	0	CAT 6	N/A		Computer/Equip	None	Drywall	Paint	None	Drop Ceiling	No	Case/Equip
7-458	3A 3B DR3	3	0	CAT 6	N/A		Computer/Equip	None	Drywall	Paint	None	Drop Ceiling	No	Case/Equip

Alexandria VA Existing Data Drop Survey
Building 7 - 4th Floor

Room	Tag	#Data Drops (417)	#Voice Drops (271)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
7-458	4A 4B DR8	3	0	CAT 6	N/A		Computer/Equip	None	Drywall	Paint	None	Drop Ceiling	No	Case/Equip
7-458	5A 5B DR2	3	0	CAT 6	N/A		Computer/Equip	None	Drywall	Paint	None	Drop Ceiling	No	Case/Equip
7-458	6A 6B DR6	3	0	CAT 6	N/A		Computer/Equip	None	Drywall	Paint	None	Drop Ceiling	No	Case/Equip
7-458	ALXMEDAP-B7F7-006	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-458	AP41	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	Equipment
7-458	AP42	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	Equipment
7-458	AP43	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-458F	7A 7B DR5	3	0	CAT 6	N/A		Computer/Equip	None	Drywall	Paint	None	Drop Ceiling	No	Equipment
C7-19	2020	0	1	N/A	CAT 3	PHONE		WM	Cast in Place Concrete	Paint	None	Drop Ceiling	Yes	N/A
C7-19	ALXMEDAP-B7F4-002	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
C7-19	ALXMEDAP-B7F4-004	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
C7-19	AP18	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
C7-19	AP23	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-445	1952	2	2	CAT 5	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Equipment
7-445	2074	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-445	(NO ID)	1	1	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-446	466	4	0	CAT 6	N/A		Equipment	None	Drywall	Paint	Smoke	Drop Ceiling	No	Equipment
7-446	2071	2	2	CAT 5	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Other
7-446	AP51	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	Casework
7-448	1959	2	2	CAT 5	CAT 3		Computer/Printer	None	Drywall	Paint	Smoke	Drop Ceiling	No	Furn/Equip
7-448	2057	2	2	CAT 5	CAT 3	Phone	Computer	None	Drywall	Paint	Smoke	Drop Ceiling	No	Equipment
7-448	(NO ID)	1	1	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Equipment
7-448	(NO ID)	1	1	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-449	1953	2	2	CAT 5	CAT 3	Phone	Computer/Equip	None	Drywall	Paint	None	Hard Lid	No	Furn/Equip
7-449	AP44	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Hard Lid	No	N/A
7-449A	1958	2	2	CAT 5	CAT 3	Phone		None	Drywall	Paint	None	Drop Ceiling	No	Furn/Equip
7-449A	(NO ID)	1	1	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Equipment
7-450	1957	0	1	N/A	CAT 3	Phone		None	Drywall	Paint	None	Hard Lid	No	Equipment
7-450	2011	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Hard Lid	No	Equipment
7-450	1A 1B	2	0	CAT 5E	N/A			None	Other	Paint	None	Hard Lid	No	Equipment
7-451	451	1	0	CAT 6	N/A			None	Cast in Place Concrete	Paint	None	Hard Lid	No	Equipment
7-451	1956	2	2	CAT 5	CAT 3		Computer	None	Cast in Place Concrete	Paint	None	Hard Lid	No	Equipment
7-451	1956	0	1	N/A	CAT 3	Phone		None	Cast in Place Concrete	Paint	None	Hard Lid	No	Equipment
7-451	2C 2D	2	0	CAT 5E	N/A			None	Other	Paint	None	Hard Lid	No	Equipment
7-454	1950	2	2	CAT 5	CAT 3		Equipment	None	Drywall	Paint	None	Hard Lid	No	Equipment
7-454	2059	3	0	CAT 5E	N/A			None	Drywall	Paint	None	Hard Lid	No	Equipment
7-454	AP46	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Hard Lid	No	N/A
7-457	1949	0	1	N/A	CAT 3	Phone		None	Drywall	Paint	None	Hard Lid	No	Equipment
7-457	1949	2	2	CAT 5	CAT 3		Computer	None	Drywall	Paint	None	Hard Lid	No	Equipment
7-457	2014	3	0	CAT 6	N/A		Equipment	None	Drywall	Paint	None	Hard Lid	No	Equipment
7-457	(NO ID)	4	0	CAT 6	N/A			None	Other	Paint	None	Hard Lid	No	Equipment
7-459	2010	2	2	CAT 5	CAT 3	Phone	Computer/Equip	None	Drywall	Paint	None	Hard Lid	No	Equipment
7-459	(NO ID)	2	0	CAT 6	N/A		Equipment	None	Drywall	Paint	None	Hard Lid	No	Equipment
7-459	4A 4B	2	0	CAT 5E	N/A			None	Other	Paint	None	Hard Lid	No	Equipment
7-459	AP45	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Hard Lid	No	Equipment
7-459B	459B	2	0	CAT 6	N/A		Equipment	None	Drywall	Paint	None	Hard Lid	No	Equipment
7-460	1951	2	2	CAT 5	CAT 3		Equipment	None	Drywall	Paint	None	Hard Lid	No	Equipment
7-460	(NO ID)	0	2	N/A	CAT 3			None	Drywall	Paint	None	Hard Lid	No	Equipment
7-460	5A 5B D10	3	0	CAT 6	N/A			None	Drywall	Paint	None	Hard Lid	No	Equipment
7-460	OR-5	4	0	CAT 6	N/A	Phone	Computer/Equip	None	Drywall	Paint	None	Hard Lid	No	Furniture
7-461	1999	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-461	2080	2	2	CAT 5	CAT 3	PHONE	Computer/Printer	None	BLOCK	Paint	None	Drop Ceiling	No	Furniture
7-461	2081	2	2	CAT 5	CAT 3	PHONE	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-461	(NO ID)	2	2	CAT 5	CAT 3			WM	Drywall	Paint	None	Drop Ceiling	No	N/A
7-461	AP37	1	0	CAT 5E	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	N/A
7-463	1997	2	2	CAT 5	CAT 3			1/2"	Drywall	Paint	Smoke	Drop Ceiling	No	N/A

Alexandria VA Existing Data Drop Survey
Building 7 - 4th Floor

Room	Tag	#Data Drops (417)	#Voice Drops (271)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
7-463	2082	2	2	CAT 5	CAT 3			None	Drywall	Paint	Smoke	Drop Ceiling	No	N/A
7-464A	2029	2	2	CAT 5	CAT 3			3/4"	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-464B	1960	2	2	CAT 5	CAT 3	Phone	Computer	3/4"	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-464B	1962	2	2	CAT 5	CAT 3	Phone	Computer	3/4"	Furred Column	Paint	None	Drop Ceiling	No	Furniture
7-464B	AP39	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-465	1996	2	2	CAT 5	CAT 3	Phone	Computer	WM / SMB	Cast in Place Concrete	Paint	Smoke	Drop Ceiling	Yes	Furniture
7-465	AP38	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-467	1995	2	2	CAT 5	CAT 3	Phone	Computer/Printer	WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	No	Furniture
7-469	1994	2	2	CAT 5	CAT 3	Phone	Computer	WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	Yes	Furn/Equip
7-470	1963	2	2	CAT 5	CAT 3	Phone	Computer	WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	Yes	Furn/Equip
7-470	AP14	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	Equipment
7-471	2052	2	2	CAT 5	CAT 3	Phone	Computer	3/4"	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-471	2053	2	2	CAT 5	CAT 3	Phone	Computer	3/4"	Drywall	Paint	None	Drop Ceiling	No	Other
7-471	2054	2	2	CAT 5	CAT 3	Fax	Printer	3/4"	Drywall	Paint	None	Drop Ceiling	No	Other
7-471	2055	2	2	CAT 5	CAT 3	Phone	Computer	3/4"	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-471	2056	2	2	CAT 5	CAT 3	Phone	Computer	3/4"	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-471	AP13	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
7-472	2672	2	2	CAT 5	CAT 3			None	Furred Column	Paint	None	Drop Ceiling	No	Furniture
7-472	AP12	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-474	1989	2	2	CAT 5	CAT 3	Phone	Computer	WM / SMB	Cast in Place Concrete	Paint	Smoke	Drop Ceiling	No	Furniture
7-474	1992	2	2	CAT 5	CAT 3			WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	Yes	Furniture
7-475	1985	2	2	CAT 5	CAT 3	Phone	Computer	WM / SMB	CASt in Place Concrete	Paint	None	Drop Ceiling	No	Furn/Equip
7-475	1991	2	2	CAT 5	CAT 3			WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	No	Furniture
7-476A	476-A	1	0	CAT 6	N/A		Computer	None	Other	Paint	None	Hard Lid	No	N/A
7-476B	2050	2	2	CAT 5	CAT 3		Computer	None	Other	Other	None	Hard Lid	No	N/A
7-478	2049	2	2	CAT 5	CAT 3	Phone	Computer	3/4"	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-479	2047	2	2	CAT 5	CAT 3	Phone	Computer	3/4"	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-480	1987	2	2	CAT 5	CAT 3	Phone	Computer	3/4"	Cast in Place Concrete	Paint	None	Drop Ceiling	No	Furniture
7-480	2065	2	2	CAT 5	CAT 3			WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	No	Furniture
7-482 (Corr)	2051	2	2	CAT 5	CAT 3	Phone	Printer	WM / SMB	Other	Paint	None	Drop Ceiling	No	Equipment
7-482A	2066	2	2	CAT 5	CAT 3		Computer	None	Other	Other	None	Hard Lid	No	N/A
7-482B	482-A	1	0	CAT 6	N/A		Computer	None	Other	Other	None	Hard Lid	No	N/A
7-483	1983	2	2	CAT 5	CAT 3			3/4"	Drywall	Paint	None	Drop Ceiling	No	Other
7-483	1990	2	2	CAT 5	CAT 3		Computer	3/4"	Drywall	Paint	None	Drop Ceiling	No	Furn/Equip
7-483	AP09	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	Equipment
7-484	1986	2	2	CAT 5	CAT 3	Phone	Computer	3/4"	Cast in Place Concrete	Paint	Smoke	Drop Ceiling	No	Furniture
7-484 (Corr)	AP03	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-484 (Corr)	AP10	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-485	1984	2	2	CAT 5	CAT 3	Phone	Computer	3/4"	Drywall	Paint	Smoke	Drop Ceiling	No	Casework
7-486	AP11	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-487	1978	2	2	CAT 5	CAT 3	Phone	Computer	WM / SMB	Cast in Place Concrete	Paint	Smoke	Drop Ceiling	No	Furniture
7-488	1977	2	2	CAT 5	CAT 3			3/4"	Cast in Place Concrete	Paint	None	Drop Ceiling	Yes	N/A
7-488	AP04	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-489	1976	2	2	CAT 5	CAT 3	Phone	Computer	1"	Cast in Place Concrete	Paint	None	Drop Ceiling	Yes	Furniture
7-489	488B	4	0	CAT 6	N/A		Phone/Computer	WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	No	Furniture
7-490	2062	2	2	CAT 5	CAT 3		Equipment	WM / SMB	Cast in Place Concrete	Paint	Smoke	Drop Ceiling	No	Equipment
7-490	1971A	2	2	CAT 5	CAT 3	Phone	Computer	3/4"	Cast in Place Concrete	Paint	None	Drop Ceiling	Yes	Equipment
7-491	2063	2	2	CAT 5	CAT 3	Phone	Computer/Equip	WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	No	Equipment
7-491A	2043	2	2	CAT 5	CAT 3	Phone	Computer	3/4"	Furred Column	Paint	None	Drop Ceiling	Yes	Equipment
7-491A	AP01	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-492	1970	2	2	CAT 5	CAT 3			3/4"	Drywall	Paint	None	Drop Ceiling	No	Furniture
7-492	2042	2	2	CAT 5	CAT 3	Phone	Computer	3/4"	Furred Column	Paint	None	Drop Ceiling	Yes	N/A
7-492	AP02	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
7-492A	2064	2	2	CAT 5	CAT 3	Phone	Computer	3/4"	Drywall	Paint	None	Drop Ceiling	No	N/A

Alexandria VA Existing Data Drop Survey
Building 7 - 4th Floor

Room	Tag	#Data Drops (417)	#Voice Drops (271)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
7-493	493	2	0	CAT 5E	N/A			WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	No	Equipment
7-493	1968	2	2	CAT 5	CAT 3			1"	Other	Paint	None	Drop Ceiling	Yes	Equipment
7-493	2034	2	2	CAT 5	CAT 3			1"	Other	Paint	None	Drop Ceiling	Yes	Equipment
7-494	1972	2	2	CAT 5	CAT 3	Phone	Computer	3/4"	Furred Column	Paint	None	Drop Ceiling	Yes	Equipment
7-495	1965	2	2	CAT 5	CAT 3	Phone	Computer/Printer	WM / SMB	Cast in Place Concrete	Paint	None	Drop Ceiling	No	Furn/Equip
7-495	1966	2	2	CAT 5	CAT 3	Phone	Computer	3/4"	Cast in Place Concrete	Paint	None	Drop Ceiling	Yes	Furn/Equip
7-499D	1954	2	2	CAT 5	CAT 3		Computer	None	Drywall	Paint	None	Drop Ceiling	No	Casework
7-499D	1955	2	2	CAT 5	CAT 3	Phone		None	Drywall	Paint	None	Drop Ceiling	No	Casework
7-C4-9	AP48	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	2 hr	Drop Ceiling	No	N/A
7-S-3	AP50	1	0	CAT 5E	N/A		WiFi	None	Block	Paint	2 hr	None	No	N/A
7-S-4	AP22	1	0	CAT 5E	N/A		WiFi	None	Drywall	Paint	None	Hard Lid	No	N/A
C7-14	ALXMEDAP-B7F4-001	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A

Alexandria VA Existing Data Drop Survey
Building 8

Room	Tag	#Data Drops (21)	#Voice Drops (11)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
8-102	AP04	1	0	CAT 5E	N/A		WiFi	WM	Block	Paint	None	Hard Lid	No	N/A
8-104	2621	2	2	CAT 5E	CAT 3	Phone	Computer	None	Drywall	Paint	None	None	No	Furniture
8-104	AP02	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	None	No	N/A
8-105A	(NO ID)	2	2	CAT 5E	CAT 3	Phone	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
8-113	AP07	1	0	CAT 5E	N/A		WiFi	WM	Block	Paint	None	Hard Lid	No	N/A
8-115	2304	2	2	CAT 5	N/A		Phone	None	Drywall	Paint	None	Drop Ceiling	No	N/A
8-115	(NO ID)	0	1	N/A	CAT 3	Phone		None	Furniture	Paint	None	Drop Ceiling	No	Furniture
8-115	(NO ID)	4	0	CAT 6	N/A		Equipment	None	Furred Column	Paint	None	Drop Ceiling	No	Furniture
8-115	(NO ID)	0	1	N/A	CAT 3	Phone		None	Furniture	Paint	None	Drop Ceiling	No	Furniture
8-115	AP03	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
8-116	2305	0	1	CAT 5	CAT 3	Phone		None	Plaster	Paint	None	Drop Ceiling	No	N/A
8-116	AP05	1	0	CAT 5	N/A		WiFi	None	Plaster	Paint	None	Drop Ceiling	No	N/A
8A-1	AP03	1	0	CAT 5E	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
8A-1	AP04	1	0	CAT 5E	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
8A-2	2617	2	2	CAT 5E	CAT 3	Phone	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
8A-2	AP01	1	0	CAT 5E	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
8A-2	AP02	1	0	CAT 5E	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture

Alexandria VA Existing Data Drop Survey
Building 9 - 1st Floor

Room	Tag	#Data Drops (128)	#Voice Drops (103)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
9-1 (Corr)	AP15	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
9-107	XXXX	2	2	CAT 5	CAT 3	PHONE	Computer/Printer	None	Drywall	Paint	NONE	Hard Lid	No	Furniture
9-108	5033	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
9-108	AP06	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
9-109	109	2	2	CAT 5	CAT 3	Phone	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
9-109	5020	2	2	CAT 5	CAT 3	Phone	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
9-110	AP03	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
9-110	XXXX	2	2	CAT 5	CAT 3		Printer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
9-110A	110A	2	2	CAT 5	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
9-111	AP01	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
9-111A	5022	2	2	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
9-112	APXX	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Hard Lid	No	N/A
9-115	AP04	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
9-116	AP05	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	Furniture
9-118	5023	2	2	CAT 5	CAT 3	Phone	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
9-121D	XXXX	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
9-121E	5047	2	2	CAT 5	N/A	FAX	PRINTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Equipment
9-121E	5048	2	2	CAT 5	N/A			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
9-121F	5043	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
9-121F	5044	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
9-121G	5045	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
9-121G	5046	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
9-121H	5049	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
9-121H	5050	2	2	CAT 5	CAT 3		COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
9-121J	5054	2	2	CAT 5	N/A	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
9-121J	5055	2	2	CAT 5	N/A			None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
9-121K	5035	2	2	CAT 5	CAT 3		COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
9-121K	5056	2	2	CAT 5	CAT 3	PHONE		None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
9-121N	AP07	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
9-121N	XXXX	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
9-122	AP09	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
9-122	AP11	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
9-122	AP21	1	0	CAT 5	N/A		WIFI	None	Block	Paint	NONE	None	No	N/A
9-122A	AP08	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	Yes	Furniture
9-123	5036	2	2	CAT 5	CAT 3	Phone	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
9-123(Lobby)	AP12	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
9-124A	5002	2	2	CAT 5	CAT 3	Phone	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	N/A
9-124B	5030	2	2	CAT 5	CAT 3	Phone	Computer/Equip	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
9-124C	5003	2	2	CAT 5	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
9-124C	AP14	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	Yes	Furniture
9-124D	6317	2	2	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
9-125	5006	2	2	CAT 5	CAT 3			None	Furniture	Paint	None	Drop Ceiling	No	Furniture
9-125	5026	2	2	CAT 5	CAT 3	Phone	Computer	None	Furniture	Paint	None	Drop Ceiling	No	Furniture
9-125	5027	2	2	CAT 5	CAT 3	Phone	Computer/Printer	None	Furniture	Paint	None	Drop Ceiling	No	Furniture
9-125	5032	0	1	N/A	CAT 3			None	Furred Column	Paint	None	Drop Ceiling	No	N/A
9-125	125KIOSK-1	1	0	CAT 5E	N/A		Other	None	Furred Column	Paint	None	Drop Ceiling	No	Furniture
9-125D	5007	2	2	CAT 5	CAT 3	Phone	Computer	None	Furred Block	Paint	None	Drop Ceiling	No	Furniture
9-125D	AP17	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	Yes	Furniture
9-125E	5008	2	2	CAT 5	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
9-125F	6317	2	2	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
9-125G	(NO ID)	4	0	CAT 5	N/A		Computer/Equip	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
9-125G	AP16	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	Yes	Furniture
9-127A	5028	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
9-127A	5058	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
9-127B	5029	2	2	CAT 5	N/A			None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
9-127B	XXXX	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture

Alexandria VA Existing Data Drop Survey
Building 9 - 1st Floor

Room	Tag	#Data Drops (128)	#Voice Drops (103)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
9-127C	5012	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
9-127D	5013	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
9-127D	5034	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
9-127D	5061	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
9-127D	5062	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
9-127D	AP18	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
9-128	XXXX	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
9-130	XXXX	2	2	CAT 5	N/A	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
9-131	5015	2	2	CAT 5	CAT 3	Phone	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
9-132	XXXX	2	2	CAT 5	CAT 3	Phone	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
9-133	XXXX	2	2	CAT 5	CAT 3	Phone	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
9-134	5018	2	2	CAT 5	CAT 3	Phone	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
9-134	AP13	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	Yes	Furniture
9-135	5019	2	2	CAT 5	CAT 3	PHONE	Computer/Printer	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
9-136	5041	2	2	CAT 5	N/A	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
9-137	5042	2	2	CAT 5	CAT 3	Phone	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
9-S-1	AP22	1	0	CAT 5E	N/A		WiFi	None	Block	Paint	2 hr	None	No	N/A
9-S-2	AP21	1	0	CAT 5E	N/A		WiFi	None	Block	Paint	2 hr	None	No	N/A
9-S-3	AP20	1	0	CAT 5E	N/A		WiFi	None	Block	Paint	2 hr	None	No	N/A

Alexandria VA Existing Data Drop Survey
Building 9 - 2nd Floor

Room	Tag	#Data Drops (45)	#Voice Drops (34)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
9-2 (Corr)	AP08	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	NONE	Hard Lid	No	N/A
9-2 (Corr)	AP13	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
9-200	AP15	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
9-200A	5101	2	2	CAT 5	CAT 3		Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	N/A
9-200A	5103	2	2	CAT 5	CAT 3	Phone	Computer/Equip	None	Furniture	Paint	None	Drop Ceiling	No	Furniture
9-200A	5104	2	2	CAT 5	CAT 3	Phone	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
9-200A	5110	2	2	CAT 5	CAT 3		Equipment	None	Furniture	Paint	None	Drop Ceiling	No	Furniture
9-200A	5135	2	2	CAT 5	CAT 3	Phone	Computer/Equip	None	Furniture	Paint	None	Drop Ceiling	No	Furniture
9-200A	(NO ID)	2	1	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
9-200A	(NO ID)	0	1	N/A	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
9-200A	(NO ID)	2	1	CAT 5	CAT 3		Equipment	None	Drywall	Paint	None	Drop Ceiling	No	N/A
9-200A	ALXMEDAPB9F2-001	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
9-200A	AP06	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
9-200B	5136	0	1	N/A	CAT 3	Phone		None	Drywall	Paint	None	Drop Ceiling	No	N/A
9-206	AP11	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
9-216	5127	2	2	CAT 5	CAT 3	PHONE	Computer/Printer	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
9-216	AP10	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
9-217	5119A	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
9-217	5128A	2	2	CAT 5	CAT 3	PHONE	Computer/Printer	None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
9-218	5105	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
9-218	(NO ID) (AP)	1	0	CAT 5E	N/A		WIFI	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
9-221	5106	2	2	CAT 5	N/A	Phone	Computer/Printer	None	Drywall	Paint	None	Hard Lid	No	Furniture
9-222	(NO ID) (AP)	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Hard Lid	No	N/A
9-222	XXXX	2	2	CAT 5	CAT 3	Phone	Computer	None	Drywall	Paint	None	Hard Lid	No	Furniture
9-222	XXXX	2	2	CAT 5	CAT 3	Phone	Computer/Printer	None	Drywall	Paint	None	Hard Lid	No	Furniture
9-230 (Corr)	AP02	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	Smoke	Hard Lid	No	N/A
9-231	5118	2	2	CAT 5	CAT 3	Phone	Computer/Printer	None	Drywall	Paint	None	Hard Lid	No	Furniture
9-233	(NO ID) (AP)	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	Smoke	Hard Lid	No	N/A
9-233	XXXX	2	2	CAT 5	CAT 3	Phone	Computer	None	Drywall	Paint	None	Hard Lid	No	Furniture
9-233	XXXX	2	2	CAT 5	CAT 3	Phone	Computer/Printer	None	Drywall	Paint	None	Hard Lid	No	Furniture

Alexandria VA Existing Data Drop Survey
Building 9 - 3rd Floor

Room	Tag	#Data Drops (53)	#Voice Drops (35)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
9-3 (Corr)	AP03	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	NONE	Hard Lid	No	N/A
9-3 (Corr)	AP13	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	NONE	Hard Lid	No	N/A
9-3 (Corr)	AP15	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	NONE	Hard Lid	No	N/A
9-300	(NO ID)	0	1	N/A	CAT 3	Phone		None	Drywall	Paint	None	Drop Ceiling	No	N/A
9-300	AP10	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
9-300	AP9	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
9-300A	5201	2	2	CAT 5	CAT 3			None	Furniture	Paint	None	Drop Ceiling	No	Furniture
9-300A	5202	2	2	CAT 5	CAT 3			None	Furniture	Paint	None	Drop Ceiling	No	Furniture
9-300A	5203	2	2	CAT 5	CAT 3			None	Furniture	Paint	None	Drop Ceiling	No	Furniture
9-300A	5204	2	2	CAT 5	CAT 3			None	Furniture	Paint	None	Drop Ceiling	No	Furniture
9-300A	5210	2	2	CAT 5	CAT 3			None	Furniture	Paint	None	Drop Ceiling	No	Furniture
9-300A	5235	2	2	CAT 5	CAT 3			None	Furniture	Paint	None	Drop Ceiling	No	Furniture
9-300A	(NO ID)	2	2	CAT 5	CAT 3			None	Furniture	Paint	None	Drop Ceiling	No	Furniture
9-300A	AP8	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
9-300B	5237	2	0	CAT 5	N/A			None	Drywall	Paint	None	Drop Ceiling	No	N/A
9-301	5205	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
9-302C	AP11	1	0	CAT 5	N/A		WIFI	None	Ceiling	Other	NONE	Drop Ceiling	No	N/A
9-303	5206	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
9-304	AP12	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
9-305	5225	2	2	CAT 5	N/A			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
9-308	5223	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
9-312	AP14	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
9-313	5224	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
9-315	5207	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
9-318	5208	2	2	CAT 5	CAT 3			None	Furred Block	Paint	None	Drop Ceiling	No	N/A
9-318	AP05	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
9-321	AP02	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
9-325	5234	2	2	CAT 5	CAT 3			None	Furred Block	Paint	None	Drop Ceiling	No	N/A
9-325	AP01	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
9-326	5232	2	2	CAT 5	CAT 3			None	Furred Column	Paint	None	Hard Lid	No	N/A
9-328	AP16	1	0	CAT 5E	N/A		WiFi	None	Other	Paint	2 hr	Drop Ceiling	No	N/A
9-331	5209	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
9-337 (Corr)	AP06	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Hard Lid	No	N/A
9-S-1	AP16	1	0	CAT 5E	N/A		WiFi	None	Other	Paint	2 hr	Drop Ceiling	No	N/A
9-S-2	AP17	1	0	CAT 5E	N/A		WiFi	None	Other	Paint	2 hr	Drop Ceiling	No	N/A
9-S-3	AP18	1	0	CAT 5E	N/A		WiFi	None	Other	Paint	2 hr	Drop Ceiling	No	N/A

Alexandria VA Existing Data Drop Survey
Building 13

Room	Tag	#Data Drops (12)	#Voice Drops (8)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
13-1	7001	2	2	CAT 5E	CAT 3	Phone		None	Brick	Paint	None	Drop Ceiling	No	N/A
13-1	AP03	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
13-1A	AP05	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
13-2	AP02	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
13-4	7005	2	2	CAT 5E	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
13-4	AP04	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
13-6	7002	2	2	CAT 5E	CAT 5E			WM	Drywall	Paint	None	Drop Ceiling	No	Furniture
13-6	7006	2	2	CAT 5E	CAT 5E	Phone	Computer/Printer	WM	Block	Paint	None	Drop Ceiling	No	Furniture

Alexandria VA Existing Data Drop Survey
Building 14

Room	Tag	#Data Drops (0)	#Voice Drops (0)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
14-2				CAT 5	N/A			None	Drywall	Paint		Drop Ceiling	No	Furniture
14-3				CAT 5	N/A			None	Drywall	Paint		Drop Ceiling	No	Furniture

Alexandria VA Existing Data Drop Survey
Building 15

Room	Tag	#Data Drops (28)	#Voice Drops (23)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
15-1	7201	2	2	CAT 5E	CAT 3		Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
15-1	7206	2	2	CAT 5E	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
15-1	7207	2	2	CAT 5E	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
15-1A	(NO ID)	2	2	CAT 5E	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
15-1A	AP08	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
15-2	(NO ID)	2	2	CAT 5E	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
15-2A	(NO ID)	2	2	CAT 5E	CAT 3	Phone	Computer	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
15-2A	AP09	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
15-4	(NO ID)	0	1	N/A	CAT 3	Phone		WM	Block	Paint	None	None	No	N/A
15-5	7211	2	2	CAT 5E	CAT 5E	Phone		WM	Drywall	Paint	None	Drop Ceiling	No	Furniture
15-5	7212	2	2	CAT 5E	N/A			WM	Drywall	Paint	None	Drop Ceiling	No	Furniture
15-5	AP06	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
15-6	AP04	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	None	Yes	N/A
15-7	AP03	1	0	CAT 5E	N/A		WiFi	None	Brick	Paint	None	None	No	N/A
15-7A	7209	2	2	CAT 5E	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
15-7C	7210	2	2	CAT 5E	N/A		Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
15-7C	AP02	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
15-7F	60.IPZX.157406 SMART JACK - 11	2	2	CAT 5E	N/A	Phone	Equipment	None	Drywall	Paint	None	Drop Ceiling	No	Furniture

Alexandria VA Existing Data Drop Survey
Building 16

Room	Tag	#Data Drops (0)	#Voice Drops (0)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
16-101				CAT 5	N/A			None	Drywall	Paint		Drop Ceiling	No	Furniture
16-102				CAT 5	N/A			None	Drywall	Paint		Drop Ceiling	No	Furniture
16-103				CAT 5	N/A			None	Drywall	Paint		Drop Ceiling	No	Furniture
16-104				CAT 5	N/A			None	Drywall	Paint		Drop Ceiling	No	Furniture
16-104A				CAT 5	N/A			None	Drywall	Paint		Drop Ceiling	No	Furniture
16-105				CAT 5	N/A			None	Drywall	Paint		Drop Ceiling	No	Furniture
16-105A				CAT 5	N/A			None	Drywall	Paint		Drop Ceiling	No	Furniture
16-106				CAT 5	N/A			None	Drywall	Paint		Drop Ceiling	No	Furniture
16-107				CAT 5	N/A			None	Drywall	Paint		Drop Ceiling	No	Furniture
16-109				CAT 5	N/A			None	Drywall	Paint		Drop Ceiling	No	Furniture
16-110				CAT 5	N/A			None	Drywall	Paint		Drop Ceiling	No	Furniture
16-111				CAT 5	N/A			None	Drywall	Paint		Drop Ceiling	No	Furniture
16-112				CAT 5	N/A			None	Drywall	Paint		Drop Ceiling	No	Furniture

Alexandria VA Existing Data Drop Survey
Building 45 - 1st Floor

Room	Tag	#Data Drops (232)	#Voice Drops (142)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
45-131	131.1	1	0	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-131	6327	2	2	CAT 6	CAT 1			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-132	6317	2	2	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-133	6317	2	2	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-134	6317	2	2	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-135	6317	2	2	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-136	6317	2	2	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-137	XXXX	2	2	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-138	138.1	1	0	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-138	138.2	1	0	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-138	6332	2	2	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-139	XXXX	2	2	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-142	106	2	0	CAT 6	N/A			None	Furniture	Paint	None	Drop Ceiling	No	Furniture
45-142	106	2	0	CAT 6	N/A			None	Furniture	Paint	None	Drop Ceiling	No	Furniture
45-142	142.1	1	0	CAT 6	N/A			None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-142	142.2	1	0	CAT 6	N/A			None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-142	AP25	1	0	CAT 6	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
45-143	143.1	1	0	CAT 6	N/A			None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-143	143.2	1	0	CAT 6	N/A			None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-143	(NO ID)	2	0	CAT 6	N/A			None	Furniture	Paint	None	Drop Ceiling	No	Furniture
45-143	(NO ID)	2	0	CAT 6	N/A			None	Furniture	Paint	None	Drop Ceiling	No	Furniture
45-143	AP26	1	0	CAT 6	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
45-144	108	2	0	CAT 6	N/A			None	Furniture	Paint	None	Drop Ceiling	No	Furniture
45-144	108	2	0	CAT 6	N/A			None	Furniture	Paint	None	Drop Ceiling	No	Furniture
45-144	144.1	1	0	CAT 6	N/A			None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-144	144.2	1	0	CAT 6	N/A			None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-145	105	2	0	CAT 6	N/A			None	Furniture	Paint	None	Drop Ceiling	No	Furniture
45-145	105	2	0	CAT 6	N/A			None	Furniture	Paint	None	Drop Ceiling	No	Furniture
45-145	145.1	1	0	CAT 6	N/A			None	Ceiling	Other	None	Drop Ceiling	No	N/A
45-145	145.2	1	0	CAT 6	N/A			None	Ceiling	Other	None	Drop Ceiling	No	N/A
45-149	AP28	1	0	CAT 6	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
45-151	119	2	2	CAT 6	CAT 5E	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
45-152	118	2	2	CAT 6	CAT 5E	PHONE	PRINTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
45-152	AP29	1	0	CAT 6	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
45-155	121A	2	2	CAT 6	CAT 5E		Computer/Printer	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
45-155	121B	2	2	CAT 6	CAT 5E	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
45-155	121C	2	2	CAT 6	CAT 5E		COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
45-155	121D	2	2	CAT 6	CAT 5E	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
45-156	124A	2	2	CAT 6	CAT 5E		EQUIPMENT	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
45-156	124B	2	2	CAT 6	CAT 5E		EQUIPMENT	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
45-156	124C	2	2	CAT 6	CAT 5E		EQUIPMENT	None	Drywall	Paint	NONE	Drop Ceiling	No	Casework
45-157	AP30	1	0	CAT 6	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
45-160	132	2	0	CAT 6	N/A			None	Furniture	Paint	None	Drop Ceiling	No	Furniture
45-160	132	2	0	CAT 6	N/A			None	Furniture	Paint	None	Drop Ceiling	No	Furniture
45-160	160.1	1	0	CAT 6	N/A			None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-160	160.2	1	0	CAT 6	N/A			None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-161	127	2	0	CAT 6	N/A			None	Furniture	Paint	None	Drop Ceiling	No	Furniture
45-161	127	2	0	CAT 6	N/A			None	Furniture	Paint	None	Drop Ceiling	No	Furniture
45-161	161.1	1	0	CAT 6	N/A			None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-161	161.2	1	0	CAT 6	N/A			None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-162	130	2	0	CAT 6	N/A			None	Furniture	Paint	None	Drop Ceiling	No	Furniture
45-162	130	2	0	CAT 6	N/A			None	Furniture	Paint	None	Drop Ceiling	No	Furniture
45-162	162.1	1	0	CAT 6	N/A			None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-162	162.2	1	0	CAT 6	N/A			None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-163	129	2	0	CAT 6	N/A			None	Furniture	Paint	None	Drop Ceiling	No	Furniture
45-163	129	2	0	CAT 6	N/A			None	Furniture	Paint	None	Drop Ceiling	No	Furniture

Alexandria VA Existing Data Drop Survey
Building 45 - 1st Floor

Room	Tag	#Data Drops (232)	#Voice Drops (142)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
45-163	163.1	1	0	CAT 6	N/A			None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-163	163.2	1	0	CAT 6	N/A			None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-163	AP32	1	0	CAT 6	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
45-164	136	2	2	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-164A	175	2	2	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-164A	AP33	1	0	CAT 6	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
45-165	130	2	0	CAT 6	N/A			None	Furniture	Paint	None	Drop Ceiling	No	Furniture
45-165	130	2	0	CAT 6	N/A			None	Furniture	Paint	None	Drop Ceiling	No	Furniture
45-165	165.1	1	0	CAT 6	N/A			None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-165	165.2	1	0	CAT 6	N/A			None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-166	XXXX	2	2	CAT 5	N/A	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
45-166A	XXXX	2	2	CAT 6	CAT 5E	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
45-169	XXXX	2	2	CAT 6	CAT 5E	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
45-170	XXXX	2	2	CAT 6	CAT 5E	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-1-STAIR 5	AP36	1	0	CAT 6	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
45-1 (Corr)	003 (AP)	1	0	CAT 6	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
45-1 (Corr)	01_10 (AP)	1	0	CAT 6	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
45-1 (Corr)	AP15	1	0	CAT 6	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
45-100	(NO ID)	0	1	N/A	CAT 5E	Phone		None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-100	01_13 (AP)	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
45-100	AP11	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
45-100	AP12	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	None	Hard Lid	No	N/A
45-100C	6364	2	2	CAT 6	CAT 5E	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-100D	6311	2	2	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-100D	(NO ID)	0	1	N/A	CAT 5E	Phone		None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-104	6310	2	2	CAT 6	CAT 5E	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-106	6325	2	2	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-107	AP07	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
45-112	6313	2	2	CAT 6	CAT 5E	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-112	AP05	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
45-113	6314	2	2	CAT 6	CAT 5E	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-113 (Corr)	01_01 (AP)	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
45-113 (Corr)	AP06	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
45-116	6315	2	2	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-116 (Corr)	6356	0	0	N/A	CAT 5E	Phone		None	Ceiling	Paint	None	Drop Ceiling	No	N/A
45-116 (Corr)	001 (AP)	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
45-116 (Corr)	01_02 (AP)	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
45-116 (Corr)	AP03	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
45-117	01_03 (AP)	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
45-117	AP08	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
45-117B	6324	2	2	CAT 6	CAT 5E	Phone		None	Drywall	Paint	None	Drop Ceiling	No	Case/Furn
45-118	6316	2	2	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-119	6358	0	1	N/A	CAT 5E	Phone		None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-119	105A/B	2	0	CAT 6	N/A			None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-119	AP09	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
45-120	6317	2	2	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-121	6322	2	2	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-122	6318	2	2	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-123	6321	2	2	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-123	AP02	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
45-124	6319	2	2	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-125	6320	2	2	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-171	6306	2	2	CAT 6	CAT 5E	PHONE	Computer/Printer	None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-171	6307	2	2	CAT 6	CAT 5E	PHONE	Computer/Printer	None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-171	6308	2	2	CAT 6	CAT 5E	PHONE		None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-171	6361	2	2	CAT 6	CAT 5E		Computer/Printer	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture

Alexandria VA Existing Data Drop Survey
Building 45 - 1st Floor

Room	Tag	#Data Drops (232)	#Voice Drops (142)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
45-171	(NO ID)	2	0	CAT 6	CAT 5E		COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-172	XXXX	2	1	CAT 5	N/A	PHONE	EQUIPMENT	None	Drywall	Paint	NONE	Drop Ceiling	No	Equipment
45-173	6357	2	2	CAT 6	CAT 5E			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-173	RTLS	1	0	CAT 6	N/A		COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-174	XXXX	2	2	CAT 6	CAT 5E	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
45-176	6338	2	2	CAT 6	CAT 5E	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
45-178	XXXX	2	2	CAT 6	CAT 5E		COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
45-184	6351	2	2	CAT 6	CAT 5E	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-185	6350	2	2	CAT 6	CAT 5E	PHONE		None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-187	6349	2	2	CAT 6	CAT 5E			None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
45-188	6340	2	2	CAT 6	CAT 5E	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
45-189	6348	2	2	CAT 6	CAT 5E			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-189	AP19	1	0	CAT 6	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
45-190	6341	2	2	CAT 6	CAT 5E			None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
45-191	6347	2	2	CAT 6	CAT 5E			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-192	6342	2	2	CAT 5	N/A	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-193	6346	2	2	CAT 6	CAT 5E	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-194	6343	2	2	CAT 6	CAT 5E	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
45-194	AP21	1	0	CAT 6	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
45-195	6344	2	2	CAT 5	N/A	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
45-196	6345	2	2	CAT 6	CAT 5E			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-197	6367	2	2	CAT 6	CAT 5E	FAX	PRINTER	None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-198	6362	2	2	CAT 6	CAT 5E	PHONE		None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
45-198	(NO ID)	0	1	N/A	CAT 5E	PHONE		None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
45-199	1173	0	2	N/A	CAT 5E			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-199	6304	2	2	CAT 6	CAT 5E			None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
45-199	6366	2	2	CAT 6	CAT 5E			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-199A	XXXX	2	2	CAT 6	CAT 5E	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-199B	6303	2	2	CAT 6	CAT 5E	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
45-199C	6301	2	2	CAT 6	CAT 5E			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-199C	6302	2	2	CAT 6	CAT 5E	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-199C	(NO ID)	0	1	N/A	CAT 5E			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-199C	AP01_11	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
45-199C	AP14	1	0	CAT 6	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
45-1-STAIR 1	AP39	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	None	None	No	N/A
45-1-STAIR 2	AP40	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	None	None	No	N/A
45-1-STAIR 2 (Cor	AP40	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
45-1-STAIR 4	AP38	1	0	CAT 6	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
45-C1-1	AP13	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	None	Hard Lid	No	N/A

Alexandria VA Existing Data Drop Survey
Building 45 - 2nd Floor

Room	Tag	#Data Drops (219)	#Voice Drops (155)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
45-240	XXXX	2	2	CAT 6	CAT 5E	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-241	XXXX	2	2	CAT 6	CAT 5E	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-242	XXXX	2	2	CAT 6	CAT 5E	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-243	XXXX	2	2	CAT 6	CAT 5E	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-245	AP27	1	0	CAT 6	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
45-249	AP28	1	0	CAT 6	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
45-250	219	2	2	CAT 5	N/A	PHONE	Printer/Equipment	None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-253	(NO ID)	0	1	N/A	CAT 5E		PHONE	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
45-253	221A	2	2	CAT 6	CAT 5E		COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-253	221B	2	2	CAT 6	CAT 5E	PHONE	Computer/Printer	None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-253	221C	2	2	CAT 6	CAT 5E		Computer/Printer	None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-253	221D	2	2	CAT 6	CAT 5E	PHONE	Computer/Printer	None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-253	AP30	1	0	CAT 6	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
45-254	224C	2	2	CAT 6	CAT 5E			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-258	XXXX	2	2	CAT 6	CAT 5E	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-259	259.1	1	0	CAT 6	N/A			None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-259	259.2	1	0	CAT 6	N/A			None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-259	(NO ID)	2	0	CAT 6	N/A			None	Furniture	Paint	None	Drop Ceiling	No	Furniture
45-259	(NO ID)	2	0	CAT 6	N/A			None	Furniture	Paint	None	Drop Ceiling	No	Furniture
45-260	236	1	2	CAT 6	CAT 5E			None	Other	Paint	NONE	Drop Ceiling	No	Furniture
45-260	236.1	1	2	CAT 6	CAT 5E			None	Other	Paint	NONE	Drop Ceiling	No	Furniture
45-260	260.1	0	1	N/A	CAT 5E			None	Other	Paint	NONE	Drop Ceiling	No	Furniture
45-260	260.2	0	1	N/A	CAT 5E			None	Other	Paint	NONE	Drop Ceiling	No	Furniture
45-260	AP32	1	0	CAT 6	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
45-261	XXXX	2	2	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-262	237	2	0	CAT 6	N/A			None	Furniture	Paint	None	Drop Ceiling	No	Furniture
45-262	237	2	0	CAT 6	N/A			None	Furniture	Paint	None	Drop Ceiling	No	Furniture
45-262	262.1	1	0	CAT 6	N/A			None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-262	262.2	1	0	CAT 6	N/A			None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-263	231	2	0	CAT 6	N/A			None	Furniture	Paint	None	Drop Ceiling	No	Furniture
45-263	231	2	0	CAT 6	N/A			None	Furniture	Paint	None	Drop Ceiling	No	Furniture
45-263	263.1	1	0	CAT 6	N/A			None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-263	263.2	1	0	CAT 6	N/A			None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-263	AP33	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
45-264	264	0	2	N/A	CAT 5E	Phone		None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-264	AP34	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
45-264	AP35	1	0	CAT 6	N/A		WiFi	None	Block	Paint	None	Drop Ceiling	No	N/A
45-265	233	1	1	CAT 6	CAT 5E			None	Furniture	Paint	None	Drop Ceiling	No	Furniture
45-265	233	1	1	CAT 6	CAT 5E			None	Furniture	Paint	None	Drop Ceiling	No	Furniture
45-265	265.1	1	0	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-265	265.2	1	0	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-267 (Corr)	AP02_10	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
45-268	241	2	2	CAT 6	CAT 5E	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-2-STAIR 5	APXX	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	None	None	No	N/A
45-2 (Corr)	6557	2	2	CAT 6	CAT 5E	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
45-2 (Corr)	6558	2	2	CAT 6	CAT 5E	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
45-2 (Corr)	AP003	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
45-2 (Corr)	AP02_12	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
45-200	6504	0	1	N/A	CAT 3	Phone		None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-200A	6505	2	2	CAT 6	CAT 5E	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-200C	6506	2	2	CAT 6	CAT 5E	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-200C	6507	2	2	CAT 6	CAT 5E	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-203	6556	2	2	CAT 6	CAT 5E	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-203	(NO ID)	0	1	N/A	CAT 5E	Phone		None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-203	AP10	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	None	Hard Lid	No	N/A
45-204	6521	2	2	CAT 6	CAT 5E	Phone		None	Drywall	Paint	None	Drop Ceiling	No	Furniture

Alexandria VA Existing Data Drop Survey
Building 45 - 2nd Floor

Room	Tag	#Data Drops (219)	#Voice Drops (155)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
45-204 (Corr)	AP02_04	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	None	Hard Lid	No	N/A
45-204 (Corr)	AP09	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	None	Hard Lid	No	N/A
45-205	XXXX	2	2	CAT 6	CAT 5E	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-206	2100C	0	1	N/A	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-206	AP02_16	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	None	Hard Lid	No	N/A
45-209	AP08	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
45-209	XXXX	2	2	CAT 6	CAT 5E	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-210	6509	2	2	CAT 6	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-210	AP07	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
45-211	6510	2	2	CAT 6	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-214	6511	2	2	CAT 6	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-214 (Corr)	AP001	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
45-215	6520	2	2	CAT 6	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-215	AP05	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
45-215 (Corr)	6549	0	1	N/A	CAT 5E	Phone		None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-216	6512	2	2	CAT 6	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-217	6519	2	2	CAT 6	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-218	6513	2	2	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-219	6518	2	2	CAT 6	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-219	AP03	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
45-220	6514	2	2	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-220	AP02	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
45-221	6517	2	2	CAT 6	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-222	6516	2	2	CAT 6	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-222	(NO ID) (AP)	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
45-223	6515	2	2	CAT 6	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
45-229	XXXX	2	2	CAT 6	CAT 5E	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-230	6530	2	2	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-231	231.1	1	0	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-231	231.2	1	0	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-231	6523	2	2	CAT 6	CAT 5E			None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
45-232	232.1	1	0	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-232	232.2	1	0	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-232	6529	2	2	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-233	233.1	1	0	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-233	233.2	1	0	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-233	6524	2	2	CAT 6	CAT 5E			None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
45-234	234.1	1	0	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-234	234.2	1	0	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-234	6528	2	2	CAT 6	CAT 5E			None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
45-235	235.1	1	0	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-235	235.2	1	0	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-235	6525	2	2	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-236	236.1	1	0	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-236	236.2	1	0	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-236	6527	2	2	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-237	237.1	1	0	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-237	237.2	1	0	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-237	6526	2	2	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-238	AP26	1	0	CAT 6	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
45-269	269	2	2	CAT 6	CAT 5E		Computer/Printer	None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-269	6501	2	2	CAT 6	CAT 5E	PHONE	Computer/Printer	None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-269	6502	2	2	CAT 6	CAT 5E	PHONE	Computer/Printer	None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-269	6503	2	2	CAT 6	CAT 5E		Computer/Printer	None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-269	6555	2	2	CAT 6	CAT 5E	PHONE	Computer/Printer	None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-269	(NO ID)	2	0	CAT 6	CAT 5E		Computer/Printer	None	Drywall	Paint	NONE	Drop Ceiling	No	N/A

Alexandria VA Existing Data Drop Survey
Building 45 - 2nd Floor

Room	Tag	#Data Drops (219)	#Voice Drops (155)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
45-269	M218-267A	2	2	CAT 6	CAT 5E	FAX	PRINTER	None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-269 (Lobby)	AP12	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
45-270	(NO ID)	0	3	N/A	CAT 5E	PHONE		None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-272	6563	2	2	CAT 6	CAT 5E	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
45-274	XXXX	2	1	CAT 6	CAT 5E	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
45-276	6547	2	2	CAT 6	CAT 5E	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
45-282	6546	2	2	CAT 6	CAT 5E			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-282	AP16	1	0	CAT 6	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
45-283	6546	2	2	CAT 6	CAT 5E	PHONE		None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
45-285	6544	2	2	CAT 6	CAT 5E			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-286	6535	2	2	CAT 6	CAT 5E			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-286	AP17	1	0	CAT 6	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
45-286	AP18	1	0	CAT 6	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
45-287	287.1	1	0	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-287	6543	2	2	CAT 6	CAT 5E			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-288	288.1	1	0	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-288	6536	2	2	CAT 6	CAT 5E	PHONE		None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-289	289.1	1	0	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-289	6542	2	2	CAT 6	CAT 5E			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-290	290.1	1	0	CAT 6	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
45-290	6537	2	2	CAT 6	CAT 5E			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-290	AP19	1	0	CAT 6	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
45-291	6541	2	2	CAT 6	CAT 5E			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-291	AP20	1	0	CAT 6	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
45-292	6538	2	2	CAT 6	CAT 5E			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-293	6561	2	2	CAT 6	CAT 5E	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
45-293	AP21	1	0	CAT 6	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
45-293	XXXX	2	2	CAT 6	CAT 5E	PHONE	Computer/Printer	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
45-294	6540	2	2	CAT 6	CAT 5E	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-294	6560	2	2	CAT 6	CAT 5E	FAX	PRINTER	None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-296	6551	0	2	N/A	CAT 5E	PHONE		None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
45-297	6554	2	2	CAT 6	CAT 5E			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-297	6557	2	2	CAT 6	CAT 5E	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
45-297	AP11	1	0	CAT 6	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
45-298	AP13	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	None	None	No	N/A
45-299	AP 02_15	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	None	None	No	N/A
45-299	AP008	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	None	None	No	N/A
45-299	AP14	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	None	None	No	N/A
45-2-STAIR 1	APXX	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	None	None	No	N/A
45-2-STAIR 2	APXX	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	None	None	No	N/A
45-2-STAIR 3	APXX	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	None	None	No	N/A
45-2-STAIR 4	APXX	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	None	None	No	N/A

Alexandria VA Existing Data Drop Survey
Building 46

Room	Tag	#Data Drops (6)	#Voice Drops (7)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
46-106	XXXX	2	2	CAT 5E	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
46-109	6909	2	2	CAT 5E	N/A	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
46-109	AP05	0	1	CAT 5E	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
46-110	6903	2	2	CAT 5E	N/A	Phone	Computer/Equip	None	Drywall	Paint	None	Drop Ceiling	No	Furniture

Alexandria VA Existing Data Drop Survey
Building 49

Room	Tag	#Data Drops (279)	#Voice Drops (270)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
49-100	100 K-1	1	0	CAT 5	N/A		EQUIPMENT	None	Drywall	Paint	NONE	Hard Lid	No	Furniture
49-100	100 K-2	1	0	CAT 5	N/A		EQUIPMENT	None	Drywall	Paint	NONE	Hard Lid	No	Furniture
49-101A	101A-1	1	0	CAT 5	N/A			None	Drywall	Paint	NONE	Hard Lid	No	Furniture
49-101A	101B-1	1	0	CAT 5	N/A		EQUIPMENT	None	Drywall	Paint	NONE	Hard Lid	No	Furniture
49-106	106.1	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	CASEWORK
49-106	106.2	2	2	CAT 5	CAT 3		PHONE	None	Drywall	Paint	NONE	Drop Ceiling	No	CASEWORK
49-106	106.3	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	CASEWORK
49-106	106.4	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	CASEWORK
49-106	106.5	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	CASEWORK
49-106	106.6	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	CASEWORK
49-106	AP07	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
49-109	109.1	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
49-109	109.2	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-109	109.3	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
49-109	109.4	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
49-110B	110.1	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
49-110B	110.2	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
49-110B	110.3	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
49-110B	110.4	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
49-110B	110.2A	1	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
49-110B	110.2B	0	1	N/A	CAT 3		EQUIPMENT	None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
49-111	111.1	2	2	CAT 5	N/A		EQUIPMENT	None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
49-111	111.2	2	2	CAT 5	N/A			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
49-111	111.3	2	2	CAT 5	N/A	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
49-111	111.4	2	2	CAT 5	N/A			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
49-112	112.1	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-112	112.1	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-112	112.2	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-112	112.3	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-113	113.1	2	2	CAT 5	N/A	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-113	113.2	2	2	CAT 5	N/A		EQUIPMENT	None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
49-113	113.3	2	2	CAT 5	N/A			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
49-113	113.4	2	2	CAT 5	N/A			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
49-115	115.1	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
49-115	115.2	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
49-115	115.3	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
49-115	115.4	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
49-116	116.1	2	2	CAT 5	N/A			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
49-116	116.2	2	2	CAT 5	N/A	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-116	116.3	2	2	CAT 5	N/A			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
49-116	116.4	2	2	CAT 5	N/A			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
49-117	XXX.X	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
49-117	XXX.X	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
49-117	XXX.X	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
49-117	XXX.X	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
49-118	118	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-120	XXX.X	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
49-120	XXX.X	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
49-120	XXX.X	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
49-120	XXX.X	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
49-121	XXX.X	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
49-121	XXX.X	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
49-121	XXX.X	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
49-121	XXX.X	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
49-123	124.1	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
49-123	124.2	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	N/A

Alexandria VA Existing Data Drop Survey
Building 49

Room	Tag	#Data Drops (279)	#Voice Drops (270)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
49-123	124.3	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
49-123	124.4	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
49-124	124.1	2	2	CAT 5	CAT 3	PHONE		None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-124	124.2	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
49-124	124.3	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-124	124.4	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
49-125	125	2	2	CAT 5	CAT 3		EQUIPMENT	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-126	126.1	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-126	126.2	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-126	126.3	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-126	126.4	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-129A	129	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-130	XXX.X	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
49-130	XXX.X	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
49-130	XXX.X	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
49-130	XXX.X	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
49-131	131.1	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-131	131.2	2	2	CAT 5	CAT 3	PHONE	Computer/Printer	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-131	AP08	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
49-131	AP10	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
49-131	AP12	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
49-132	132.1	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
49-132	132.2	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-132	132.3	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
49-132	132.4	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
49-134	133.1	2	2	CAT 5	N/A	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-135	135.2	2	2	CAT 5	CAT 3	FAX	PRINTER	None	Drywall	Paint	NONE	Drop Ceiling	No	EQUIPMENT
49-135	135.2	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	CASEWORK
49-136	136.1	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-136	136.2	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-136	136.3	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-136	136.4	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-136	136.5	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-138	138	2	2	CAT 5	CAT 3	PHONE		None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-149	XXX.X	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
49-149	XXX.X	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
49-149	XXX.X	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
49-149	XXX.X	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
49-150	XXX.X	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
49-150	XXX.X	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
49-150	XXX.X	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
49-150	XXX.X	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
49-151	151.1	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-151	151.2	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-151	151.3	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-152	152.1	2	2	CAT 5	CAT 3	FAX	PRINTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-152	152.2	2	2	CAT 5	CAT 3	PHONE		None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-152	152.3	2	2	CAT 5	CAT 3	PHONE		None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-152	152.4	2	2	CAT 5	CAT 3		COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-153A	153.1	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
49-153A	153.2	2	2	CAT 5	CAT 3		EQUIPMENT	None	Drywall	Paint	NONE	Drop Ceiling	No	EQUIPMENT
49-153A	AP02	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
49-153A	AP06	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
49-154	154.1	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-154	154.2	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-154	154.3	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture

Alexandria VA Existing Data Drop Survey
Building 49

Room	Tag	#Data Drops (279)	#Voice Drops (270)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
49-155	155.1	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-155	155.2	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-155	AP01	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
49-156	156.1	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-156	156.2	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-156	156.3	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-157	XXX.X	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
49-157	XXX.X	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
49-157	XXX.X	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
49-157	XXX.X	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
49-160	160	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	CASEWORK
49-161	XXX.X	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
49-161	XXX.X	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
49-161	XXX.X	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
49-161	XXX.X	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
49-162	XXX.X	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
49-162	XXX.X	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
49-162	XXX.X	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
49-162	XXX.X	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
49-164	164.1	1	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
49-164	164.2	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	EQUIPMENT
49-164	164.3	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
49-164	164.4	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
49-164	164.5	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
49-164	AP03	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
49-164	N	0	1	N/A	CAT 3		EQUIPMENT	None	Drywall	Paint	NONE	Drop Ceiling	No	N/A
49-167	XXX.X	2	2	CAT 5	CAT 3	PHONE	COMPUTER	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
49-167	XXX.X	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
49-167	XXX.X	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
49-167	XXX.X	2	2	CAT 5	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
49-168	168.1	2	2	CAT 5	CAT 3	PHONE		None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-168	168.2	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-168	168.3	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-168	168.4	2	2	CAT 5	CAT 3			None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-168	AP04	1	0	CAT 5	N/A		WIFI	None	Ceiling	Paint	NONE	Drop Ceiling	No	N/A
49-169	169.1	2	2	CAT 5	N/A	PHONE	COMPUTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture
49-169	169.2	2	2	CAT 5	N/A	FAX	PRINTER	None	Drywall	Paint	NONE	Drop Ceiling	No	Furniture

Alexandria VA Existing Data Drop Survey
Building 136

Room	Tag	#Data Drops (40)	#Voice Drops (24)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
136-1	7614	2	1	CAT 5	CAT 3			1"	Concrete Column	Paint	None	None	No	Furniture
136-1	7615	2	1	CAT 5	CAT 3		Computer/Equip	1"	Concrete Column	Paint	None	None	No	Furniture
136-1	7616	2	1	CAT 5	CAT 3	Phone	Computer/Equip	1"	Concrete Column	Paint	None	None	No	Furniture
136-1	7617	2	1	CAT 5	CAT 3	Phone	Computer/Equip	1"	Concrete Column	Paint	None	None	No	Furniture
136-1	AP4	1	0	CAT 5	N/A		WiFi	None	Block	Paint	None	None	No	N/A
136-1	AP6	1	0	CAT 5	N/A		WiFi	None	Block	Paint	None	None	No	N/A
136-1A	AP01	1	0	CAT 5	N/A		WiFi	1"	Ceiling	Other	None	None	No	N/A
136-1A	AP02	1	0	CAT 5	N/A		WiFi	1"	Ceiling	Other	None	None	No	N/A
136-1B	AP05	1	0	CAT 5	N/A		WiFi	None	Block	Paint	None	None	No	N/A
136-1C	7612	2	2	CAT 5	CAT 3	Phone	Computer	None	Drywall	Paint	None	None	No	Furniture
136-1C	AP3	1	0	CAT 5	N/A		WiFi	None	Drywall	Paint	None	None	No	N/A
136-1D	2127613	2	2	CAT 5	CAT 3	Phone	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
136-2	7611	2	2	CAT 5	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
136-2	AP9	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	Yes	N/A
136-3A	ALXAP04-B136TF01	1	0	CAT 5	N/A		WiFi	None	Other	Paint	None	None	No	N/A
136-6	AP8	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	None	No	N/A
136-6	AP8	1	0	CAT 5	N/A		WiFi	None	Plaster	Paint	None	Drop Ceiling	No	N/A
136-8	7602	2	2	CAT 5	CAT 3	Phone		1"	Block	Paint	None	None	Yes	N/A
136-8	AP7	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	None	Yes	N/A
136-9	1610	0	1	CAT 5	CAT 3	Phone		None	Acoustic Metal	Plastic	None	None	No	N/A
136-9	7604	2	2	CAT 5	CAT 3	Phone	Computer	1"	Other	Other	None	Other	No	N/A
136-9	7605	2	2	CAT 5	CAT 3	Phone	Computer	1"	Other	Other	None	Other	No	N/A
136-9	7606	2	2	CAT 5	CAT 3	Phone	Computer	1"	Other	Other	None	Other	No	N/A
136-9	7607	2	2	CAT 5	CAT 3	Phone	Computer	1"	Other	Other	None	Other	No	N/A
136-9	7608	0	1	N/A	CAT 3	Phone		1"	Drywall	Paint	None	Other	No	N/A
136-9	(NO ID)	0	1	N/A	CAT 3	Phone		None	Other	Other	None	Other	No	N/A
136-9	(NO ID)	0	1	CAT 5	CAT 3			None	Acoustic Metal	Plastic	None	None	No	N/A
136-9	AP01	1	0	CAT 5	N/A		WiFi	None	Ceiling	Plastic	None	Other	No	N/A
136-9	AP02	1	0	CAT 5	N/A		WiFi	None	Ceiling	Plastic	None	Other	No	N/A
136-9	AP04	1	0	CAT 5	N/A		WiFi	None	Ceiling	Plastic	None	Other	No	N/A
136-9	AP3	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Other	No	N/A
136-9	APXX	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	Other	No	N/A

Alexandria VA Existing Data Drop Survey
Building 142

Room	Tag	#Data Drops (68)	#Voice Drops (68)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
142T-1	7702	2	2	CAT 5E	CAT 3	Phone	Computer/Equip	None	Drywall	Paint	None	Drop Ceiling	No	N/A
142T-1	7733	2	2	CAT 5E	CAT 3		Equipment	None	Drywall	Paint	None	Drop Ceiling	No	N/A
142T-1	7734	2	2	CAT 5E	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
142T-1	7735	2	2	CAT 5E	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
142T-1	(NO ID)	2	2	CAT 5E	CAT 3		Computer	WM	Drywall	Paint	None	Drop Ceiling	No	N/A
142T-1	AP01	1	0	CAT 5	N/A		WiFi	None	Ceiling	Paint	None	None	Yes	N/A
142T-10	7726	2	2	CAT 5E	N/A	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
142T-10	7727	2	2	CAT 5E	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
142T-10	(NO ID)	0	1	CAT 5E	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
142T-10	AP08	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
142T-11	(NO ID)	0	1	N/A	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
142T-11	XXXX	2	2	CAT 5E	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
142T-13	7708	1	0	CAT 5E	N/A			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
142T-13	AP06	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	Furniture
142T-15	(NO ID)	0	1	N/A	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
142T-15	XXXX	2	2	CAT 5E	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
142T-17	AP04	1	0	CAT 5E	N/A		WiFi	None	Drywall	Paint	None	Drop Ceiling	No	N/A
142T-17	XXXX	2	2	CAT 5E	CAT 3	Phone	Computer/Printer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
142T-18	7705	2	2	CAT 5E	CAT 3		Computer	Raceway	Drywall	Paint	None	Drop Ceiling	No	N/A
142T-18	7710	2	2	CAT 5E	CAT 3	Fax	Printer	None	Drywall	Paint	None	Drop Ceiling	No	N/A
142T-18	7710	2	2	CAT 5E	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
142T-18	7711	2	1	CAT 5E	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	N/A
142T-18	7717	2	2	CAT 5E	CAT 3			WM	Drywall	Paint	None	Drop Ceiling	No	N/A
142T-18	7725	2	2	CAT 5E	CAT 3	Phone		WM	Drywall	Paint	None	Drop Ceiling	No	N/A
142T-18	(NO ID)	0	2	N/A	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
142T-18	(NO ID)	0	2	N/A	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
142T-18A	AP03	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
142T-19	7706	2	2	CAT 5E	CAT 3		Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
142T-1B	7701	2	2	CAT 5E	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
142T-2	7703	2	2	CAT 5E	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
142T-2	(NO ID)	0	1	CAT 5E	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
142T-2 (Corr)	AP02	1	0	CAT 5E	CAT 3		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
142T-3	7718	2	2	CAT 5E	CAT 3	Phone		None	Drywall	Paint	None	Drop Ceiling	No	Furniture
142T-3	7718	2	2	CAT 5E	CAT 3		Phone	None	Drywall	Paint	None	Drop Ceiling	No	N/A
142T-3	AP03	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
142T-3	AP05	1	0	CAT 5E	CAT 3		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
142T-4A (Corr)	7709	0	1	N/A	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	N/A
142T-6	7731	2	2	CAT 5E	N/A			WM	Drywall	Paint	None	Drop Ceiling	No	Furniture
142T-7	7721	2	2	CAT 5E	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
142T-7	7722	2	2	CAT 5E	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
142T-7	7723	2	2	CAT 5E	CAT 3	Phone	Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
142T-7	(NO ID)	0	1	CAT 5E	CAT 3	Phone		None	Drywall	Paint	None	Drop Ceiling	No	N/A
142T-7	AP07	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
142T-8	7714	2	1	CAT 5E	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
142T-8	7724	2	2	CAT 5E	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
142T-8	7728	2	2	CAT 5E	CAT 5E	Phone	Printer	WM	Drywall	Paint	None	Drop Ceiling	No	Furniture
142T-8	7729	2	2	CAT 5E	CAT 5E		Computer	WM	Drywall	Paint	None	Drop Ceiling	No	Furniture
142T-8 (Corr)	(NO ID)	0	2	N/A	CAT 5E			None	Drywall	Paint	None	Drop Ceiling	No	Furniture

Alexandria VA Existing Data Drop Survey
Building 147

Room	Tag	#Data Drops (5)	#Voice Drops (2)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
147 (Office)	(NO ID)	2	2	CAT 5E	N/A	Phone		1"	Block	Paint	None	Other	Yes	Furniture
147 (Office)	(NO ID)	1	0	CAT 5E	N/A		Computer	WM	Block	Paint	None	Other	Yes	Furniture
147 (Office)	(NO ID)	1	0	CAT 5E	N/A			None	Block	Paint	None	Other	Yes	Furniture
147 (Office)	AP01	1	0	CAT 5E	N/A		WiFi	None	Ceiling	Paint	None	Other	Yes	Furniture

Alexandria VA Existing Data Drop Survey
Building 171

Room	Tag	#Data Drops (27)	#Voice Drops (13)	Data Cable Type	Voice Cable Type	Voice Device	Computer Device	Conduit	Wall Type	Wall Finish	Fire Rating	Ceiling Type	Conduit to Corridor	Blocked By
171-101	171-101-1	2	1	CAT 6	CAT 6		Phone/Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
171-101	171-101-2	2	1	CAT 6	CAT 6		Phone/Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
171-106	171-106-1	2	1	CAT 6	CAT 6			None	Drywall	Paint	None	Drop Ceiling	No	N/A
171-106	171-106-2	2	1	CAT 6	CAT 6		Phone/Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
171-107	1711071	2	1	CAT 6	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
171-107	1711072	2	1	CAT 6	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
171-107	1711073	2	1	CAT 6	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
171-107	1711074	2	1	CAT 6	CAT 3			None	Drywall	Paint	None	Drop Ceiling	No	N/A
171-108	AP02	1	0	CAT 6	N/A		WiFi	None	Ceiling	Paint	None	Drop Ceiling	No	N/A
171-110	171-110-1	2	1	CAT 6	CAT 6		Printer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
171-110	171-110-2	2	1	CAT 6	CAT 6		Phone/Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture
171-110	171-110-3	2	1	CAT 6	CAT 6			None	Drywall	Paint	None	Drop Ceiling	No	Furniture
171-110	171-110-4	2	1	CAT 6	CAT 6	Phone		None	Drywall	Paint	None	Drop Ceiling	No	Furniture
171-110	171-110-5	2	1	CAT 6	CAT 6		Computer	None	Drywall	Paint	None	Drop Ceiling	No	Furniture

Alexandria VA New Data Drop Distribution By TR

Room (1-1st Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 103			
1-101 (Corr)	0	0	1
1-103	2	0	0
1-104	2	0	1
1-105	2	0	0
1-106	2	0	0
1-108	7	2	0
1-109A	2	0	0
1-109B	2	0	0
1-111	2	0	0
1-112	2	0	1
1-117	2	0	1
1-119	2	0	0
1-119A	2	0	0
1-119B	2	0	1
1-119C	2	0	0
1-120	2	0	0
1-120A	2	0	1
1-120B	2	0	0
1-121	2	0	1
1-122	1	0	1
1-B-1	1	0	0
1-B-2	1	0	0
1-B-2A	1	0	0
1-B-3	1	0	1
1-B-3A	1	0	0
1-B-8A	0	0	1
1-C-1	0	0	1
1-C-2	0	0	1
Totals	47	2	12

Alexandria VA New Data Drop Distribution By TR

Room (1-2nd Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 202			
1-201	1	0	0
1-202	2	0	0
1-203	2	0	1
1-203A	2	0	0
1-204	0	0	2
1-204B	2	0	0
1-204C	2	0	1
1-204D	2	0	0
1-204E	2	0	0
1-204F	2	0	1
1-205	2	0	0
1-206	0	0	1
1-210	2	0	1
1-211	1	0	0
1-212	2	0	1
1-212A	2	0	1
1-213	2	0	1
1-213A	2	0	1
1-214	2	0	0
1-215	2	0	0
1-215A	1	0	0
Totals	35	0	11

Alexandria VA New Data Drop Distribution By TR

Room (2-1st Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 133			
2-100	0	0	2
2-101A	1	0	0
2-102	1	0	0
2-103	3	1	1
2-106	2	0	1
2-107	1	0	0
2-108	2	0	1
2-109	2	0	0
2-110	0	0	1
2-114	6	1	1
2-116	2	0	0
2-116A	2	0	1
2-117	2	0	1
2-117A	2	0	0
2-117B	2	0	0
2-117C	2	0	1
2-117D	2	0	0
2-117E	2	0	1
2-117F	2	0	1
2-117G	2	0	0
2-117H	0	0	2
2-117K	1	0	0
2-118	1	0	0
2-120	2	0	1
2-121	2	0	0
2-122	2	0	1
2-123	2	0	1
2-124	2	0	0
2-125	1	0	0
2-126	0	0	1
2-126B	1	0	1
2-126D	0	0	1
2-126E	2	0	0
2-127	0	0	1
2-127A	2	0	1
2-128A	1	0	0
2-128B	1	0	0
2-128E	1	0	1
2-128F	1	0	1
2-128G	2	0	1
2-128H	1	0	1
2-129	1	0	0
2-131	1	0	0

Alexandria VA New Data Drop Distribution By TR

Room (2-1st Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 133			
2-133	1	0	1
2-134	1	0	1
2-C-1	0	0	2
2-SW -1	0	0	4
Totals	67	2	34

Alexandria VA New Data Drop Distribution By TR

Room (2-2nd Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 256			
1-SS-2	0	0	1
2-200	0	0	3
2-200 (Corr)	0	0	1
2-201	2	0	0
2-201B	2	0	1
2-201C	2	0	0
2-203	2	0	2
2-203A	1	0	0
2-204 (Corr)	0	0	1
2-205	1	0	0
2-206	0	0	1
2-209	2	0	0
2-210	3	1	1
2-211	2	0	1
2-212	3	1	0
2-213	2	0	0
2-214	2	0	0
2-217	2	0	2
2-217B	1	0	1
2-217C	2	0	0
2-217D	0	0	1
2-219	2	0	0
2-220	2	0	1
2-221	2	0	1
2-222	2	0	0
2-223	1	1	0
2-226	2	0	0
2-227	2	0	0
2-228	1	0	1
2-229	2	0	0
2-230	2	0	0
2-231	2	0	1
2-232	2	0	1
2-233	2	0	0
2-234	2	0	0
2-235	2	0	0
2-236	2	0	1
2-238	1	0	1
2-239	1	0	0
2-240	2	0	1
2-241	2	0	1
2-241A	0	0	1
2-242	1	0	0

Alexandria VA New Data Drop Distribution By TR

Room (2-2nd Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 256			
2-242A	1	0	0
2-242B	1	0	0
2-242C	1	0	0
2-242D	1	0	0
2-243 (Corr)	1	0	0
2-245	1	0	1
2-246	1	0	0
2-247A	1	0	0
2-248	1	0	1
2-249	1	0	1
2-250	2	0	0
2-251	2	0	0
2-255	0	0	1
2-255B	1	0	0
2-256	2	0	0
2-257 (Corr)	0	0	1
2-C-2	1	0	3
Totals	84	3	34

Alexandria VA New Data Drop Distribution By TR

Room (2-3rd Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 359			
2-301	1	0	1
2-301B	1	0	0
2-301C	2	0	0
2-303	1	0	1
2-305	1	0	0
2-306	1	0	1
2-308	1	0	1
2-309	2	0	0
2-310	2	0	1
2-311	2	0	1
2-312	2	0	0
2-313	2	0	0
2-314	1	0	0
2-316	2	0	2
2-316A	0	0	1
2-316B	0	0	1
2-320	3	0	0
2-321	1	0	0
2-322	1	0	1
2-323	1	0	1
2-324	1	0	0
2-325	2	0	0
2-326	1	0	0
2-330	1	0	0
2-331	1	0	0
2-332	2	0	0
2-333	1	0	1
2-334	1	0	1
2-335	2	0	0
2-336	1	0	0
2-337	1	0	0
2-339	1	0	1
2-340	1	0	1
2-341	1	0	0
2-342	1	0	1
2-342A	1	0	1
2-343	1	1	2
2-345	1	0	1
2-346	1	0	0
2-347	1	0	1
2-348	1	0	1
2-349	1	0	1
2-350	2	0	0

Alexandria VA New Data Drop Distribution By TR

Room (2-3rd Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 359			
2-351	2	0	0
2-352	2	0	0
2-353	1	0	1
2-355	0	0	1
2-357	1	0	0
2-358	1	0	0
2-359	1	0	1
2-C-3	1	0	5
Totals	63	1	32

Alexandria VA New Data Drop Distribution By TR

Room (2-4th Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 424			
2-402	2	0	0
2-403	1	0	0
2-404	0	0	9
2-418	1	0	0
2-420	2	0	0
2-421	2	0	0
2-423	1	0	0
2-424	4	0	0
2-425	2	0	0
2-427	1	0	0
Totals	16	0	9

Alexandria VA New Data Drop Distribution By TR

Room (3-1st Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 105			
3-102	0	0	1
3-105	1	0	0
3-106	1	0	1
3-107	0	0	1
3-108	2	0	0
3-111	1	0	0
3-112	2	0	0
3-112A	0	0	1
3-113	0	0	1
3-114	1	0	0
3-114A	2	0	0
3-115	2	0	0
3-115A	0	0	1
3-116	0	0	1
3-117	1	0	0
3-118	1	0	0
3-118A	1	0	1
3-119	0	0	1
3-120	2	0	0
3-121	1	0	1
3-121A	0	0	1
3-124	1	0	1
3-1B3 TO 1B2 (Corr)	0	0	1
3-1B3 TO 1B4 (Corr)	0	0	2
C31-1	0	0	2
C31-2	0	0	1
Totals	19	0	18

Alexandria VA New Data Drop Distribution By TR

Room (3-2nd Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 205			
3-205	2	0	0
3-206	2	0	0
3-207	2	0	0
3-208	2	0	0
3-209	2	0	0
3-210	2	0	0
3-211	2	0	0
3-214	2	0	2
3-216	0	0	1
3-219	2	0	1
3-220	2	0	0
3-220A	1	0	0
3-221	2	0	1
3-222	2	0	0
3-223	1	0	0
3-224	1	0	2
C3-2	0	0	2
Totals	27	0	9

Alexandria VA New Data Drop Distribution By TR

Room (3-3rd Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 305			
3-305	2	0	1
3-306	2	0	0
3-308	2	0	1
3-309	2	0	1
3-310A	2	0	0
3-310B	2	0	0
3-311	2	0	0
3-314A	2	0	0
3-314B	2	0	0
3-314C	2	0	1
3-314D	2	0	1
3-314E	2	0	0
3-315	1	0	0
3-317	1	0	1
3-317A	1	0	0
3-319	2	0	0
3-320	2	0	1
3-320 (Corr)	0	0	1
3-320A	2	0	0
3-321	2	0	0
3-322	1	0	0
3-323	1	0	1
3-324	2	0	1
C3-3	0	0	1
C33-1	0	0	1
Totals	39	0	12

Alexandria VA New Data Drop Distribution By TR

Room (Building 4)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 102E			
4-100 (Corr)	0	0	1
4-101	1	0	2
4-101 (Corr)	0	0	1
4-102	2	0	0
4-102A	2	0	0
4-102B	2	0	1
4-102C	2	0	0
4-102D	2	0	0
4-102E	2	0	0
4-104	0	0	1
4-106	0	0	1
4-108	0	0	1
4-111 (Corr)	0	0	1
4-115 (Corr)	0	0	1
4-117 (Corr)	0	0	1
4-118	0	0	1
4-119 (Corr)	0	0	1
4-120	1	0	0
4-2- (Kitchen)	1	0	9
4-202	1	0	0
4-203	1	0	0
4-214	3	1	1
4-215	3	1	0
4-216	1	0	0
4-219	1	0	1
4-CORR TO B3	0	0	1
4-CORR TO B5	0	0	2
Totals	25	2	27

Alexandria VA New Data Drop Distribution By TR

Room (5-Basement)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm G06A			
5-G- (Corr)	0	0	4
5-G03	1	0	1
5-G03A	2	0	0
5-G03B	2	0	0
5-G04	0	0	1
5-G06	0	0	2
5-G09	2	0	1
5-G09A	2	0	0
5-G14	0	0	1
5-G15A	2	0	1
5-G16	2	0	1
5-G16A	0	0	1
5-G18	2	0	1
5-G18A	2	0	0
5-GS1	0	0	1
C-5-6	0	0	1
Totals	17	0	16

Alexandria VA New Data Drop Distribution By TR

Room (5-1st Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 110A			
5-102	2	0	1
5-104	2	0	1
5-106	0	0	1
5-108	2	0	1
5-109	2	0	1
5-109A	2	0	0
5-109B	2	0	1
5-109C	0	0	1
5-110	3	1	1
5-110A	2	0	0
5-110B	1	0	0
5-112	1	0	1
5-112A	2	0	0
5-112B	3	1	1
5-112C	2	0	1
5-112D	2	0	0
5-113	2	0	1
5-115	5	1	1
5-116	2	0	0
5-117	2	0	0
5-120	1	0	1
5-122	2	0	0
5-123	2	0	1
5-124	1	0	0
C-5-1	0	0	7
Totals	45	3	22

Alexandria VA New Data Drop Distribution By TR

Room (5-2nd Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 212C			
5-201	3	1	1
5-202	1	0	1
5-204	1	0	0
5-208	0	0	1
5-210	2	0	0
5-211	2	0	0
5-211A	2	0	1
5-212	4	1	1
5-212A	2	0	0
5-212B	2	0	0
5-218	3	1	1
5-219	2	0	1
5-220	1	0	0
5-223	5	1	1
5-224	1	0	1
5-225	4	1	0
5-226	1	0	0
5-226A	2	0	0
5-226B	2	0	1
5-226C	2	0	0
5-227	1	0	0
5-228	3	1	1
5-229	1	0	0
5-232	1	0	0
5-233	1	0	0
C-5-2	0	0	5
Totals	49	6	16

Alexandria VA New Data Drop Distribution By TR

Room (6-Basement)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm B-Temp			
6-001	3	1	2
6-004	0	0	1
6-006	0	0	1
6-007	0	0	1
6-009	0	0	1
6-010	1	0	0
6-014	0	0	1
6-015	2	0	2
6-016	2	0	1
6-017	1	0	1
6-018	2	0	1
6-020	1	0	0
C6-B	0	0	7
Totals	12	1	19

Alexandria VA New Data Drop Distribution By TR

Room (6-1st Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 101			
1NS-6	0	0	1
6-101	2	0	1
6-104	0	0	1
6-109	2	0	1
6-110	2	0	0
6-111	2	0	0
6-112	2	0	1
6-113	2	0	0
6-114	2	0	1
6-116	4	1	0
6-118	2	0	1
6-119	3	1	1
6-120A	2	0	0
6-123	1	0	1
6-124	2	0	0
6-125	1	0	1
6-126	3	1	0
6-128	2	0	1
6-129	1	0	2
6-129A	0	0	1
6-129C	2	0	0
6-129D	2	0	0
6-129E	2	0	0
6-133	1	0	0
6-135	0	0	1
6-137	4	1	1
C6-1	1	0	7
Totals	47	4	23

Alexandria VA New Data Drop Distribution By TR

Room (6-2nd Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 201			
2NS-6	0	0	1
2SS-6	0	0	1
6-201	2	0	0
6-202	1	0	1
6-204	1	0	0
6-206	0	0	1
6-208	1	0	0
6-209	1	0	0
6-210	1	0	1
6-211	1	0	0
6-212	1	0	0
6-213	1	0	1
6-214	1	0	0
6-216	2	0	1
6-218	1	0	1
6-219	3	1	0
6-220	2	0	1
6-223	2	0	1
6-225	5	1	0
6-227	2	0	0
6-228	3	1	0
6-229	1	0	1
6-229A	2	0	0
6-229C	2	0	0
6-229D	2	0	1
6-233	0	0	1
6-236	2	0	1
6-237	2	0	1
6-238	2	0	0
6-2XX (Brk Rm)	0	0	1
C6-2	0	0	7
Totals	44	3	23

Alexandria VA New Data Drop Distribution By TR

Room (6-3rd Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 310			
6-300	1	0	0
6-301	2	0	1
6-302	1	0	0
6-303	1	0	1
6-304	1	0	0
6-305	1	0	1
6-307	0	0	1
6-309	1	0	1
6-310	1	0	0
6-311	2	0	1
C6-3	0	0	2
Totals	11	0	8

Alexandria VA New Data Drop Distribution By TR

Room (7-Basement)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 17			
7-B-001A	0	0	1
7-B-001B	3	1	1
7-B-001C	2	2	1
7-B-002 (Stairs)	0	0	1
7-B-005	3	0	2
7-B-005A	2	1	0
7-B-005C	0	0	1
7-B-006	1	0	0
7-B-007	1	0	0
7-B-011	1	0	0
7-B-011A	1	0	1
7-B-011D	0	0	1
7-B-014	0	0	1
7-B-015	1	0	0
7-B-022	1	0	0
7-B-023	4	1	0
7-B-023A	2	0	0
7-B-023B	2	0	0
7-B-024	1	0	1
7-B-030	0	0	1
Totals	25	5	12

Alexandria VA New Data Drop Distribution By TR

Room (7-Basement)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 45A			
7-B-045	2	2	1
7-B-047	0	0	1
7-B-048 (Corr)	0	0	1
7-B-052	4	2	2
7-B-054	2	0	0
7-B-055	1	0	0
7-B-056	1	0	0
7-B-057	4	1	1
7-B-057D	2	0	1
7-B-057E	2	0	0
7-B-BM5 (Corr)	0	0	1
Totals	18	5	8

Alexandria VA New Data Drop Distribution By TR

Room (7-Basement)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 45B			
7-B-020	1	0	0
7-B-021	7	1	3
7-B-021A	1	0	0
7-B-025	3	1	1
7-B-033A	2	0	0
7-B-034	0	0	1
7-B-035	4	1	1
7-B-036	2	0	2
7-B-037	0	0	1
7-B-039	2	0	0
7-B-039 (Stairs)	0	0	1
7-B-040	3	0	0
7-B-041	2	0	1
7-B-041A	2	0	0
7-B-042	0	0	0
Totals	29	3	11

Alexandria VA New Data Drop Distribution By TR

Room (7-1st Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 1A-10X			
7-103D	2	0	0
7-117	2	0	0
7-118	2	0	0
7-119	2	0	0
7-120	2	0	0
7-121	3	1	0
7-122	1	0	0
7-123	2	0	0
7-124	2	0	0
7-127	4	1	0
7-130A	2	0	0
7-133	0	0	1
7-134	2	0	0
7-135	2	0	1
7-135-2	2	0	0
7-135-2A	2	0	0
7-139A	2	0	0
7-139B	5	1	0
7-142	1	0	0
7-147	1	0	0
7-147A	2	0	1
7-153	2	0	0
7-154	2	0	0
7-155	1	0	0
7-157	1	0	1
7-158	2	0	1
7-159	5	1	0
7-160	1	0	0
7-162	4	0	0
7-163	2	0	0
7-164	3	1	1
7-165	2	0	0
7-167	2	0	0
7-169	1	0	0
7-1A-164	0	0	1
7-1A-196A	2	0	1
7-1A-196B	3	1	0
7-1A-196H	2	0	0
7-1A-197B	2	0	2
7-1A-197C	2	0	0
7-1-C7-1-2	2	0	1
7-1-C7-1-4	0	0	1
7-1-C7-1-9	1	0	1

Alexandria VA New Data Drop Distribution By TR

Room (7-1st Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 1A-10X			
7-1E-101	2	0	1
7-1E-102	2	0	0
7-1E-108	2	0	0
7-1E-109	2	0	0
7-1E-110	2	0	0
7-1E-111	2	0	0
7-1E-112	2	0	0
7-1E-113	3	1	0
7-1E-114	2	0	0
7-1E-115	2	0	0
7-1E-118	4	1	0
7-1E-123	2	0	1
7-1E-124	2	0	0
7-1E-125	2	0	0
7-1E-126	3	1	1
7-1E-134	2	0	0
7-1E-136	2	0	0
7-1E-137	2	0	0
7-1E-139	0	0	1
Totals	125	9	17

Alexandria VA New Data Drop Distribution By TR

Room (7-1st Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 1A-184			
7-179	2	0	1
7-180A-7	2	0	0
7-180B	2	0	0
7-180C	2	0	0
7-180E	2	0	0
7-180F	2	0	0
7-180G-7	2	0	0
7-180I-7	2	0	0
7-180N	2	0	1
7-180P	2	0	0
7-180R-7	2	0	0
7-183	2	0	0
7-186	4	1	1
7-186A	2	0	0
7-186B	2	0	0
7-187	2	0	2
7-188	2	0	0
7-188C	2	0	0
7-188D	2	0	0
7-188F	2	0	0
7-188G	2	0	0
7-188H	2	0	0
7-188J	1	0	0
7-188K	2	0	0
7-1G-101	2	0	1
7-1G-102	2	0	0
7-1G-108	4	1	0
7-1G-109	2	0	0
7-1G-110	2	0	0
7-1G-111	2	0	0
7-1G-112	2	0	0
7-1G-114	1	0	0
7-1G-115	2	0	0
7-1G-116	2	0	0
7-1G-124	2	0	0
7-1G-125	2	0	0
7-1G-126	1	0	1
7-1G-132	2	0	0
7-1G-133	2	0	0
7-1G-134	2	0	0
7-1G-136	4	1	1
7-1M13	0	0	1
7-1-V	1	0	0

Alexandria VA New Data Drop Distribution By TR

Room (7-1st Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 1A-184			
7-1-W	0	0	1
7-C7-20	0	0	2
7-ELEV L1	0	0	1
Totals	86	3	13

Alexandria VA New Data Drop Distribution By TR

Room (7-1st Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm D-33			
7-101	2	0	0
7-103	2	0	0
7-103A	2	0	0
7-103B	2	0	0
7-103C	2	0	1
7-103E	2	0	0
7-105	1	0	0
7-106	1	0	0
7-106A	4	1	0
7-106B	1	0	0
7-107	2	0	0
7-108	1	0	0
7-108A	1	0	0
7-108B	1	0	0
7-108C	1	0	0
7-109	2	0	2
7-109A	1	0	0
7-109B	1	0	0
7-109C	1	0	0
7-110	1	0	0
7-110A	1	0	0
7-111	2	0	0
7-113	5	1	0
7-1134	4	1	1
7-114	3	1	2
7-114A	6	1	1
7-114B	1	0	0
7-1-A05	2	0	0
7-1-A07	2	0	0
7-1-A08	2	0	0
7-1-A09	7	1	0
7-1-A09-1	2	0	0
7-1-A09-2	2	0	0
7-1-A09-3	2	0	2
7-1-A10	1	0	0
7-1-A11	2	0	0
7-1-A12	10	2	0
7-1-A12C	2	0	0
7-1-A13	1	0	0
7-1-A14	1	0	0
7-1-A15	1	0	1
7-1-A18	1	0	0
7-1-A18A	3	1	1

Alexandria VA New Data Drop Distribution By TR

Room (7-1st Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm D-33			
7-1-A19	1	0	0
7-1-A21	1	0	0
7-1-A31	1	0	0
7-1-A33	1	0	0
7-1-A34	1	0	0
7-1-A35	1	0	0
7-1-A36	1	0	0
7-1-A36A	1	0	0
7-1-A37	1	0	0
7-1-A37A	1	0	0
7-1-A38	2	0	1
7-1-A39	3	1	0
7-1-A41	1	0	0
7-1-A7	2	0	0
7-1B-102	18	4	5
7-1B-102B	3	1	0
7-1B-103	1	0	0
7-1B-104	1	0	0
7-1B-104A	1	0	0
7-1B-105	3	0	0
7-1B-106	1	0	0
7-1B-107	1	0	0
7-1B-108	1	0	0
7-1B-109	2	0	0
7-1-B7	2	0	0
7-1C-140	0	0	2
7-1-C7-1-10	2	0	1
7-1-C7-1-11	2	0	0
7-1-C7-1-12	2	0	0
Totals	152	15	20

Alexandria VA New Data Drop Distribution By TR

Room (7-2nd Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 2M4			
7-200A	0	0	1
7-200B	3	1	0
7-200D	1	0	0
7-200F	1	0	1
7-200H	1	0	0
7-200I	2	0	1
7-200J	1	0	0
7-200K	1	0	0
7-201	2	0	0
7-202	2	0	1
7-203	2	0	1
7-204	1	0	1
7-205	2	0	0
7-207	1	0	0
7-208	2	0	0
7-209	2	0	1
7-210	2	0	1
7-211	2	0	0
7-212	2	0	0
7-217	1	0	0
7-218	2	0	1
7-219	2	0	0
7-221	2	0	1
7-224	0	0	1
7-226	2	0	0
7-227	2	0	1
7-231	5	1	1
7-231B	3	1	0
7-232	2	0	0
7-233	0	0	1
7-234	2	0	0
7-235	2	0	0
7-236	2	0	0
7-237	2	0	0
7-238	2	0	0
7-239	2	0	0
7-240	2	0	0
7-241	2	0	0
7-242	2	0	0
7-243	3	1	1
7-244	2	0	0
7-246	2	0	0
7-251	2	1	0

Alexandria VA New Data Drop Distribution By TR

Room (7-2nd Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 2M4			
7-251A	1	0	0
7-252	2	0	1
7-253	0	0	2
7-253A	1	0	0
7-253B	2	0	0
7-253C	1	0	2
7-253E	1	0	0
7-253F	2	0	0
7-254	2	0	0
7-255	2	0	0
7-255A	2	0	1
7-256	1	0	0
Totals	95	5	21

Alexandria VA New Data Drop Distribution By TR

Room (7-2nd Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 267A			
7-257	1	0	1
7-257A	1	0	0
7-260	1	0	1
7-265	2	0	1
7-266	1	0	0
7-268	2	0	1
7-271	2	0	0
7-271A	2	0	0
7-272	2	0	0
7-273	2	0	1
7-274	2	0	0
7-275	2	0	0
7-276	2	0	0
7-277	2	0	0
7-278	2	0	1
7-279	2	0	0
7-280	2	0	0
7-283	2	0	1
7-285	2	0	0
7-286	2	0	0
7-287	2	0	0
7-288	2	0	0
7-289	2	0	1
7-290	2	0	1
7-291	2	0	0
7-292	2	0	0
7-293	2	0	0
7-295	1	1	0
7-297	1	0	1
C2-8	1	0	12
S-1	0	0	1
S-2	0	0	1
S-3	0	0	1
S-4	0	0	1
Totals	53	1	26

Alexandria VA New Data Drop Distribution By TR

Room (7-3rd Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 3M4			
7-300	0	0	1
7-300B	2	0	1
7-300C	1	1	0
7-300D	2	0	0
7-300E	2	0	1
7-300F	2	0	0
7-300G	2	0	1
7-301	2	0	0
7-303	3	1	0
7-304	3	1	0
7-305	2	0	1
7-306	1	0	1
7-307	3	1	0
7-307 (Corr)	0	0	1
7-309	2	0	0
7-309a	2	0	0
7-312	2	0	1
7-315	2	0	1
7-316	2	0	0
7-317	2	0	0
7-318	2	0	0
7-319	2	0	0
7-319A	0	0	1
7-320	2	0	0
7-320a	0	0	1
7-321	2	0	0
7-322	2	0	0
7-322a	0	0	1
7-325	2	0	1
7-326	2	0	0
7-329	0	0	1
7-331	1	0	1
7-333	1	0	1
7-334	1	0	1
7-336	1	0	1
7-338	0	0	1
7-338 (Corr)	0	0	1
7-339C	0	0	1
7-339D	1	0	0
7-348	0	0	1
7-351	5	1	3
7-351A	2	0	0
7-351B	2	0	0

Alexandria VA New Data Drop Distribution By TR

Room (7-3rd Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 3M4			
7-354	2	0	0
7-359	1	0	0
7-361	1	0	1
Totals	69	5	26

Alexandria VA New Data Drop Distribution By TR

Room (7-3rd Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 373D			
7-2-381 (Corr)	0	0	2
7-347	1	0	1
7-349	3	1	0
7-350	12	4	3
7-350A	2	0	0
7-350B	1	0	0
7-350C	1	0	0
7-350D	2	0	1
7-350E	1	0	0
7-350F	1	0	1
7-353	1	0	0
7-357	2	0	0
7-358	2	0	0
7-360	2	0	0
7-362	0	0	1
7-363	1	0	1
7-363 (Corr)	1	0	0
7-364	1	0	0
7-365	2	0	0
7-366	1	0	1
7-366 (Corr)	0	0	1
7-367	2	0	0
7-368	2	0	0
7-369	2	0	1
7-370	2	0	0
7-371 (Corr)	1	0	0
7-372	2	0	1
7-374	2	0	0
7-375	0	0	1
7-375A	0	0	1
7-377	1	0	0
7-377 (Corr)	0	0	1
7-378	2	0	1
7-379	2	0	0
7-380	2	0	0
7-381	2	0	0
7-382	2	0	1
7-383	2	0	1
7-384	2	0	0
7-385	2	0	0
7-386	2	0	0
7-387	1	0	1
7-390	1	0	2

Alexandria VA New Data Drop Distribution By TR

Room (7-3rd Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 373D			
7-391	2	0	1
7-393	1	0	0
7-394	4	1	1
7-394 (Corr)	0	0	1
7-394A	2	0	1
7-394B	2	0	0
7-394C	2	0	0
7-394D	2	0	1
7-394E	2	0	0
7-394F	2	0	0
7-394G	2	0	1
7-395	1	0	0
7-397	0	0	1
7-398	0	0	1
C7-2	0	0	1
Totals	93	6	32

Alexandria VA New Data Drop Distribution By TR

Room (7-4th Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 444A			
7-400	2	0	1
7-400A	2	0	0
7-400B	1	0	1
7-400C	2	0	0
7-400D	2	0	1
7-400E	2	0	0
7-401	2	0	0
7-402	2	0	0
7-403	1	0	1
7-404	0	0	1
7-405A	2	0	0
7-405C	2	0	0
7-405E	2	0	0
7-405F	2	0	0
7-405H	2	0	1
7-406B	3	1	0
7-406C	2	0	0
7-406D	2	0	0
7-406F	1	0	0
7-408	2	0	1
7-410	2	0	0
7-412	1	0	0
7-414	2	0	0
7-415A	0	0	1
7-416	2	0	1
7-417	1	0	0
7-418	2	0	0
7-420	2	0	1
7-423	1	0	1
7-424	2	0	0
7-425	2	0	0
7-426	0	0	1
7-427	2	0	0
7-428	2	0	0
7-429	2	0	1
7-430	2	0	0
7-431	2	0	0
7-432	2	0	1
7-436	2	0	1
7-436A	2	0	0
7-437	2	0	1
7-438	1	0	0
7-439	4	1	1

Alexandria VA New Data Drop Distribution By TR

Room (7-4th Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 444A			
7-439A	2	0	0
7-439C	1	0	0
7-439D	2	0	0
7-439E	2	0	1
7-439F	2	0	0
7-439G	0	0	1
7-439H	2	0	0
7-440	2	0	0
7-441	1	0	0
7-442	2	0	0
7-444A	2	0	0
7-458	8	1	4
7-458F	2	0	0
C7-19	1	0	4
Totals	105	3	27

Alexandria VA New Data Drop Distribution By TR

Room (7-4th Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 471T			
7-445	1	0	0
7-446	2	0	1
7-448	2	0	0
7-449	1	0	1
7-449A	1	0	0
7-450	1	0	0
7-451	1	0	0
7-454	1	0	1
7-457	2	0	0
7-459	2	0	1
7-459B	1	0	0
7-460	2	0	0
7-461	2	0	1
7-463	2	0	0
7-464A	2	0	0
7-464B	2	0	1
7-465	2	0	1
7-467	2	0	0
7-469	2	0	0
7-470	2	0	1
7-471	5	1	1
7-472	2	0	1
7-474	2	0	0
7-475	1	0	0
7-476A	1	0	0
7-476B	1	0	0
7-478	1	0	0
7-479	1	0	0
7-480	1	0	0
7-482 (Corr)	1	0	0
7-482A	1	0	0
7-482B	1	0	0
7-483	1	0	1
7-484	1	0	0
7-484 (Corr)	0	0	2
7-485	2	0	0
7-486	0	0	1
7-487	1	0	0
7-488	1	0	1
7-489	2	0	0
7-490	2	0	0
7-491	1	0	0
7-491A	3	0	1

Alexandria VA New Data Drop Distribution By TR

Room (7-4th Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 471T			
7-492	3	1	1
7-492A	2	0	0
7-493	1	0	0
7-494	1	0	0
7-495	2	0	0
7-499D	2	0	0
7-C4-9	0	0	1
7-S-3	0	0	1
7-S-4	0	0	1
C7-14	0	0	1
Totals	76	2	21

Alexandria VA New Data Drop Distribution By TR

Room (Building 8)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 8-105			
8-102	0	0	1
8-104	1	0	1
8-105A	2	0	0
8-113	0	0	1
8-115	2	0	1
8-116	1	0	1
8A-1	0	0	2
8A-2	1	0	2
Totals	7	0	9

Alexandria VA New Data Drop Distribution By TR

Room (9-1st Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 137			
9-1 (Corr)	0	0	1
9-107	2	0	0
9-108	2	0	1
9-109	2	0	0
9-110	1	0	1
9-110A	1	0	0
9-111	0	0	1
9-111A	1	0	0
9-112	0	0	1
9-115	0	0	1
9-116	0	0	1
9-118	1	0	0
9-121D	2	0	0
9-121E	2	0	0
9-121F	2	0	0
9-121G	2	0	0
9-121H	2	0	0
9-121J	2	0	0
9-121K	2	0	0
9-121N	2	0	1
9-122	0	0	3
9-122A	0	0	1
9-123	2	0	0
9-123(Lobby)	0	0	1
9-124A	2	0	0
9-124B	1	0	0
9-124C	2	0	1
9-124D	2	0	0
9-125	3	1	0
9-125D	2	0	1
9-125E	2	0	0
9-125F	2	0	0
9-125G	2	0	1
9-127A	2	0	0
9-127B	2	0	0
9-127C	2	0	0
9-127D	2	0	1
9-128	2	0	0
9-130	2	0	0
9-131	2	0	0
9-132	2	0	0
9-133	2	0	0
9-134	2	0	1

Alexandria VA New Data Drop Distribution By TR

Room (9-1st Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 137			
9-135	2	0	0
9-136	2	0	0
9-137	2	0	0
9-S-1	0	0	1
9-S-2	0	0	1
9-S-3	0	0	1
Totals	72	1	21

Alexandria VA New Data Drop Distribution By TR

Room (9-2nd Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 218			
9-2 (Corr)	0	0	2
9-200	0	0	1
9-200A	6	1	2
9-200B	1	0	0
9-206	0	0	1
9-216	2	0	1
9-217	2	0	0
9-218	2	0	1
9-221	2	0	0
9-222	2	0	1
9-230 (Corr)	0	0	1
9-231	2	0	0
9-233	2	0	1
Totals	21	1	11

Alexandria VA New Data Drop Distribution By TR

Room (9-3rd Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 315			
9-3 (Corr)	0	0	3
9-300	1	0	2
9-300A	1	0	1
9-300B	1	0	0
9-301	2	0	0
9-302C	0	0	1
9-303	1	0	0
9-304	0	0	1
9-305	1	0	0
9-308	2	0	0
9-312	0	0	1
9-313	2	0	0
9-315	2	0	0
9-318	0	0	1
9-321	0	0	1
9-325	2	0	1
9-326	2	0	0
9-328	0	0	1
9-331	2	0	0
9-337 (Corr)	0	0	1
9-S-1	0	0	1
9-S-2	0	0	1
9-S-3	0	0	1
Totals	19	0	17

Alexandria VA New Data Drop Distribution By TR

Room (Building 13)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 13-6			
13-1	2	0	1
13-1A	0	0	1
13-2	0	0	1
13-4	1	0	1
13-6	2	0	0
Totals	5	0	4

Alexandria VA New Data Drop Distribution By TR

Room (Building 14)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 14-1A107			
14-2			0
14-3			0
Totals	0	0	0

Alexandria VA New Data Drop Distribution By TR

Room (Building 15)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 15-7F			
15-1	3	1	0
15-1A	2	0	1
15-2	2	0	0
15-2A	2	0	1
15-4	1	0	0
15-5	1	0	1
15-6	0	0	1
15-7	0	0	1
15-7A	1	0	0
15-7C	1	0	1
15-7F	1	0	0
Totals	14	1	6

Alexandria VA New Data Drop Distribution By TR

Room (Building 16)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 16-110B			
16-101			0
16-102			0
16-103			0
16-104			0
16-104A			0
16-105			0
16-105A			0
16-106			0
16-107			0
16-109	4	1	0
16-110	2	0	0
16-111			0
16-112			0
Totals	6	1	0

Alexandria VA New Data Drop Distribution By TR

Room (45-1st Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 170			
45-131	2	0	0
45-132	2	0	0
45-133	2	0	0
45-134	2	0	0
45-135	2	0	0
45-136	2	0	0
45-137	2	0	0
45-138	2	0	0
45-139	2	0	0
45-142	4	1	1
45-143	4	1	1
45-144	2	0	0
45-145	2	0	0
45-149	0	0	1
45-151	2	0	0
45-152	3	1	1
45-155	4	1	0
45-156	3	1	0
45-157	0	0	1
45-160	2	0	0
45-161	2	0	0
45-162	2	0	0
45-163	2	0	1
45-164	2	0	0
45-164A	2	0	1
45-165	2	0	0
45-166	2	0	0
45-166A	2	0	0
45-169	2	0	0
45-170	2	0	0
45-1-STAIR 5	0	0	1
Totals	64	5	8

Alexandria VA New Data Drop Distribution By TR

Room (45-1st Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 173			
45-1 (Corr)	0	0	3
45-100	1	0	3
45-100C	1	0	0
45-100D	1	0	0
45-104	2	0	0
45-106	2	0	0
45-107	0	0	1
45-112	2	0	1
45-113	2	0	0
45-113 (Corr)	0	0	2
45-116	2	0	0
45-116 (Corr)	1	0	3
45-117	0	0	2
45-117B	1	0	0
45-118	2	0	0
45-119	1	0	1
45-120	2	0	0
45-121	2	0	0
45-122	2	0	0
45-123	2	0	1
45-124	2	0	0
45-125	2	0	0
45-171	4	1	0
45-172	2	0	0
45-173	2	0	0
45-174	2	0	0
45-176	2	0	0
45-178	2	0	0
45-184	2	0	0
45-185	2	0	0
45-187	2	0	0
45-188	2	0	0
45-189	1	0	1
45-190	2	0	0
45-191	2	0	0
45-192	2	0	0
45-193	2	0	0
45-194	1	0	1
45-195	2	0	0
45-196	2	0	0
45-197	1	0	0
45-198	1	0	0
45-199	2	0	0

Alexandria VA New Data Drop Distribution By TR

Room (45-1st Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 173			
45-199A	2	0	0
45-199B	2	0	0
45-199C	1	0	2
45-1-STAIR 1	0	0	1
45-1-STAIR 2	0	0	1
45-1-STAIR 2 (Corr)	0	0	1
45-1-STAIR 4	0	0	1
45-C1-1	0	0	1
Totals	75	1	26

Alexandria VA New Data Drop Distribution By TR

Room (45-2nd Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 268			
45-240	2	0	0
45-241	2	0	0
45-242	2	0	0
45-243	2	0	0
45-245	0	0	1
45-249	0	0	1
45-250	2	0	0
45-253	5	1	1
45-254	2	0	0
45-258	2	0	0
45-259	2	0	0
45-260	2	0	1
45-261	2	0	0
45-262	2	0	0
45-263	2	0	1
45-264	1	0	2
45-265	2	0	0
45-267 (Corr)	0	0	1
45-268	2	0	0
45-2-STAIR 5	0	0	1
Totals	34	1	9

Alexandria VA New Data Drop Distribution By TR

Room (45-2nd Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 271			
45-2 (Corr)	2	0	2
45-200	1	0	0
45-200A	2	0	0
45-200C	2	0	0
45-203	3	1	1
45-204	2	0	0
45-204 (Corr)	0	0	2
45-205	1	0	0
45-206	1	0	1
45-209	1	0	1
45-210	2	0	1
45-211	2	0	0
45-214	2	0	0
45-214 (Corr)	0	0	1
45-215	2	0	1
45-215 (Corr)	2	0	0
45-216	2	0	0
45-217	2	0	0
45-218	2	0	0
45-219	2	0	1
45-220	2	0	1
45-221	2	0	0
45-222	2	0	1
45-223	2	0	0
45-229	2	0	0
45-230	2	0	0
45-231	2	0	0
45-232	2	0	0
45-233	2	0	0
45-234	2	0	0
45-235	2	0	0
45-236	2	0	0
45-237	2	0	0
45-238	0	0	1
45-269	7	2	0
45-269 (Lobby)	0	0	1
45-270	2	0	0
45-272	2	0	0
45-274	2	0	0
45-276	2	0	0
45-282	3	1	1
45-283	2	0	0
45-285	2	0	0

Alexandria VA New Data Drop Distribution By TR

Room (45-2nd Floor)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 271			
45-286	2	0	2
45-287	2	0	0
45-288	2	0	0
45-289	2	0	0
45-290	2	0	1
45-291	2	0	1
45-292	2	0	0
45-293	2	0	1
45-294	2	0	0
45-296	1	0	0
45-297	3	1	1
45-298	0	0	1
45-299	0	0	3
45-2-STAIR 1	0	0	1
45-2-STAIR 2	0	0	1
45-2-STAIR 3	0	0	1
45-2-STAIR 4	0	0	1
Totals	103	5	30

Alexandria VA New Data Drop Distribution By TR

Room (Building 46)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 46-302			
46-106	1	0	0
46-109	1	0	1
46-110	1	0	0
Totals	3	0	1

Alexandria VA New Data Drop Distribution By TR

Room (Building 49)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 143			
49-100	2	0	0
49-101A	1	0	0
49-106	4	1	1
49-109	2	0	0
49-110B	2	0	0
49-111	2	0	0
49-112	2	0	0
49-113	2	0	0
49-115	2	0	0
49-116	2	0	0
49-117	2	0	0
49-118	1	0	0
49-120	2	0	0
49-121	2	0	0
49-123	2	0	0
49-124	2	0	0
49-125	1	0	0
49-126	2	0	0
49-129A	0	0	0
49-130	2	0	0
49-131	2	0	3
49-132	2	0	0
49-134	1	0	0
49-135	1	1	0
49-136	2	0	0
49-138	1	0	0
49-149	2	0	0
49-150	2	0	0
49-151	1	0	0
49-152	2	0	0
49-153A	2	0	2
49-154	2	0	0
49-155	2	0	1
49-156	2	0	0
49-157	2	0	0
49-160	1	0	0
49-161	2	0	0
49-162	2	0	0
49-164	2	0	1
49-167	2	0	0
49-168	2	0	1
49-169	1	1	0
Totals	75	3	9

Alexandria VA New Data Drop Distribution By TR

Room (Building 136)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 136-32			
136-1	3	1	2
136-1A	0	0	2
136-1B	0	0	1
136-1C	1	0	1
136-1D	1	0	0
136-2	1	0	1
136-3A	0	0	1
136-6	0	0	2
136-8	1	0	1
136-9	4	1	5
Totals	11	2	16

Alexandria VA New Data Drop Distribution By TR

Room (Building 142)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 142T-12			
142T-1	3	1	1
142T-10	1	0	1
142T-11	1	0	0
142T-13	1	0	1
142T-15	2	0	0
142T-17	2	0	1
142T-18	3	1	0
142T-18A	0	0	1
142T-19	2	0	0
142T-1B	2	0	0
142T-2	1	0	0
142T-2 (Corr)	0	0	1
142T-3	1	0	2
142T-4A (Corr)	1	0	0
142T-6	1	0	0
142T-7	1	0	1
142T-8	2	0	0
142T-8 (Corr)	1	0	0
Totals	25	2	9

Alexandria VA New Data Drop Distribution By TR

Room (Building 147)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 147-102			
147 (Office)	2	0	1
Totals	2	0	1

Alexandria VA New Data Drop Distribution By TR

Room (Building 171)	2-Port Wall Plate	4-Port Wall Plate	Wireless AP
Rm 171-108			
171-101	2	0	0
171-106	2	0	0
171-107	2	0	0
171-108	0	0	1
171-110	3	1	0
Totals	9	1	1

SECTION 27 15 13
COMMUNICATIONS COPPER HORIZONTAL CABLING

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies requirements for telecommunications copper (UTP) horizontal distribution cabling outside of the computer room.

1.1 SUMMARY

A. Section Includes:

B. Copper (UTP) Horizontal Cables.

1.1 REFERENCES

A. VA Infrastructure Standard for Telecommunications Spaces.

1.1 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.

1.1 SUBMITTALS:

A. Submit in accordance with Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

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 ANSI/TIA-568.2-D.

C. Limited Power (LP) Certification. UL Listed as x-LP (0.5A).

D. Termination. Field terminated T568B pinout.

E. Testing. Following installation, each cable shall be field certified to meet performance category requirements per ANSI/TIA-568.2-D.

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.

- - E N D - - -

SECTION 27 16 19
COMMUNICATIONS PATCH CORDS, STATION CORDS, AND CROSS CONNECT WIRE

PART 1 - GENERAL

1.1 DESCRIPTION:

A. 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 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

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 T568B pinout.

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.

E. Quantity. Provide one patch cord for every two horizontal cables listed in specification section 27 15 10.2 plus 25% spare.

2.2 FIBER OPTIC PATCH CABLES.

A. Construction. Fiber patch cords shall be constructed of pairs (2-strands) of multimode laser-enhanced 50/125µm and single mode laser-optimized 9/125µm fiber.

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.

F. Quantity. Provide five patch cords per TR/TE plus 25% spare.

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.

---END---

SECTION 27 78 00
CLOSEOUT SUBMITTALS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section includes submittal requirements for communications installations and applies to all sections of Division 27. This section is intended to supplement 27 05 11 Requirements for Communications Installations until such time as that section can be coordinated and republished.

1.2 REFERENCES

A. VA Infrastructure Standard for Telecommunications Spaces.

1.3 RELATED WORK

The requirements of this specification shall apply to all sections of Division 27.

A. General requirements: Section 01 00 00, GENERAL REQUIREMENTS.

B. Submittal requirements: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Assign a single communications project manager to serve as point of contact for Government, contractor, and design professional.

B. Contact the project Contracting Officer’s Representative (COR) to have reviewers from the VA Office of Information Technology (OIT) Data Center & Infrastructure Engineering team assigned to review project submittals and designs.

1.5 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Government preapproval is required for submittals with a “G” designation; submittals not having a “G” designation are for information only. When used, a designation following the “G” designation identifies the office(s) that will review the submittal for the Government.

C. Submittal Drawings (G): All drawings shall utilize current equipment and telecommunications space nomenclature. G: Data Center & Infrastructure Operations (DCIE), local site Facility Management Service (FMS), local site Office of Information Technology (OIT), and Healthcare Environment and Facilities Program (HEFP).

1. 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).
   b. Demarcation Room.
   c. Main Computer Room.
2. 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.
3. Computer Room Structured Cabling Plans: Provide logical, schematic, and plan drawings of the structured cabling system in the facility computer room showing diverse path distribution pathways, distances, media types, and equipment.
4. Logical Drawings: Provide logical riser or schematic drawings for cable plant and grounding/bonding systems. Show termination points and identify wiring connections.
5. 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.

D. Submittal Components (G): Provide manufacturer’s cut sheets or similar for each element below showing conformance with Division 27 and VA Infrastructure Standard for Telecommunications Spaces salient characteristics and requirements. G: Data Center & Infrastructure Operations (DCIE), local site Facility Management Service (FMS), local site Office of Information Technology (OIT), and Healthcare Environment and Facilities Program (HEFP).

1. Bonding Busbars (Primary, Secondary, Rack)
2. Overvoltage Surge Protectors
3. Wire Basket Cable Tray and Accessories
4. Server Cabinets and Accessories

5. Network Channel Racks or Network Cabinets and Accessories
6. Telecommunications Enclosures and Accessories
7. Copper UTP Patch Panels and Accessories
8. Fiber Distribution Panels and Accessories
9. Horizontal Cable Managers
10. Blanking Panels
11. Zone Power Distribution Units (zPDUs)
12. Rack Power Distribution Units (rPDUs)
13. Rack-Mounted Uninterruptible Power Supply (UPS) Units
14. Temperature/Humidity Sensors
15. Multimode Optical Fiber Backbone Cables (data center backbone)
16. Single Mode Optical Fiber Backbone Cable Media (campus backbone)
17. Copper UTP Horizontal Cable Media
18. Copper UTP Patch Cords
19. Fiber Optic Patch Cords

E. Provide parts list including quantity of spare parts.

F. Provide manufacturer product information. Government reserves the right to require a list of installations where products have been in operation.

G. Submittals are required for all equipment anchors and supports, including seismic support design.

H. Furnish electronic certified test reports to COR prior to final inspection and not more than 90 days after completion of tests.

1.6 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 (as appropriate for each item):
   a. Approved shop drawing for each item of equipment.
   b. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of equipment.
   c. A control sequence describing start-up, operation, and shutdown.
   d. Description of function of each principal item of equipment.
   e. Installation and maintenance instructions.
   f. Safety precautions.
   g. Diagrams and illustrations.
   h. Test Results and testing methods.
   i. Performance data.
   j. 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.
   k. Warranty documentation indicating end date and equipment protected under warranty.
   l. Appendix: List qualified permanent servicing organizations for support of equipment, including addresses and certified personnel qualifications.

1.7 QUALITY ASSURANCE

A. System Supplier Qualifications: System supplier must be authorized by OEM to warranty installed equipment.

B. 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:
   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.
4. Identify factory wiring on equipment being furnished and on wiring diagrams.

C. 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.

1.8 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 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:
   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.

C. Coordinate storage.

1.9 FIELD CONDITIONS

A. Where variations from documents are requested in accordance with Section 01 00 00, GENERAL CONDITIONS and Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, connecting work and related components must include additions or changes to equipment, components, and installation methods.

1.10 WARRANTY

A. Comply with FAR clause 52.246-21.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 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. 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.

D. Install equipment according to manufacturers' written instructions.

E. 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.

F. Provide supplementary or miscellaneous items, appurtenances, devices and materials for a complete installation.

3.2 FIELD QUALITY CONTROL

A. 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.

B. Conduct project acceptance inspections, final completion inspections, substantial completion inspections, and acceptance testing and demonstrations after verification of system operation and completeness by Contractor.

C. Interim Inspection:

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 and technical requirements of construction documents.
3. Where applicable, check each item of installed (special telecommunications system) equipment to ensure appropriate NRTL listing labels and markings are fixed in place.
4. Verify cabling terminations in telecommunications spaces and end-user Work Area Outlets (WAOs) adhere to T568B pin assignments and cabling connections are in compliance with TIA standards.
5. Visually confirm minimum performance category cable marking of backbone, horizontal, and patch cabling for both copper UTP and fiber optic cabling.
6. Review communications bonding system in each telecommunications space.
7. Review cable tray installation practices.
8. Provide results of interim inspections to COR.
9. If major or multiple deficiencies are discovered, additional interim inspections may be required until deficiencies are corrected, before permitting further system installation.
   a. Additional inspections are scheduled at direction of COR.
   b. Re-inspection of deficiencies noted during interim inspections, must be part of system’s Final Acceptance Proof of Performance Test.
   c. The interim inspection cannot affect the system’s completion date unless directed by COR.
10. Facility COR will ensure test documents become a part of system’s official documentation package.

3.3 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.

3.4 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.

- - - E N D - - -

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 : 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. Requirements for power cables.

G. Section 26 05 33 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS. Requirements for infrastructure.
H. Section 28 05 13 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for conductors and cables.
I. Section 28 05 26 - GROUNDING AND BONDING FOR ELECTRONIC SAFETY AND SECURITY. Requirements for grounding of equipment.
J. Section 28 05 28.33 - CONDUITS AND BOXES FOR ELECTRONIC SAFETY AND SECURITY. Requirements for infrastructure.
K. Section 28 08 00 - COMMISIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS. Requirements for Commissioning.
L. Section 28 13 00 - PHYSICAL ACCESS CONTROL SYSTEMS (PACS). For physical access control integration.
M. 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 shall be 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 Nonventilated 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 three (3) 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 4 hours 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 Contracting Officer of Record(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.

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 eight 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. 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.
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 COR 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 COR 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. 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 COR 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.

All entries must be verified against the field devices. Copies of the floor plans shall be forwarded under separate cover.

d. 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
e. 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
f. 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)
   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)

g. 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)
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)

h. 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)
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)

i. 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 COR 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 :
   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
   g. Group III Technical Data Package
3. 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 COR for approval at least 60 calendar days prior to the requested test date.

H. 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 COR 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.
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 COR for review and approval at least 90 calendar days prior to the scheduled date the Contractor requires them.

I. Group V Technical Data Package: Final copies of the manuals shall be delivered to the COR 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 COR 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. 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, troubleshooting 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 COR 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 COR for review and approval of all changes or modifications to the documents. Each sheet shall have COR 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 COR review and inspection at any time.
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 shall 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 COR prior to development of Record construction documents. The COR 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 COR, the COR will initial and date each sheet and turn redlines over to the contractor for as built development.
    b. The Contractor shall provide the COR 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).

J. FIPS 201 Compliance Certificates

1. Provide Certificates for all software components and device types utilizing credential verification. Provide certificates for:
   a. Card Readers

K. Approvals will be based on complete submission of manuals together with shop drawings.

L. After approval and prior to installation, furnish the COR 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.

M. 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.

1.7 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

J. VA BIM Guide, V1.0 10

K. Federal Communications Commission (FCC):

L. (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. Federal Specifications (Fed. Spec.):

A-A-59544-08.....Cable and Wire, Electrical (Power, Fixed Installation)

O. Government Accountability Office (GAO):

GAO-03-8-02.....Security Responsibilities for Federally Owned and Leased Facilities

P. Homeland Security Presidential Directive (HSPD):

HSPD-12.....Policy for a Common Identification Standard for Federal Employees and Contractors

Q. 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

R. 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

S. National Electrical Contractors Association

303-2005.....Installing Closed Circuit Television (CCTV) Systems

T. 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

U. National Fire Protection Association (NFPA):

70-2021..... National Electrical Code (NEC)

731-2017.....Standards for the Installation of Electric Premises Security Systems

99-2018.....Health Care Facilities

V. 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

W. 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

X. Occupational and Safety Health Administration (OSHA):

29 CFR 1910.97.....Nonionizing radiation

Y. Section 508 of the Rehabilitation Act of 1973

Z. Security Industry Association (SIA):

AG-01 .....Security CAD Symbols Standards

AA. 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

BB. Uniform Federal Accessibility Standards (UFAS) 1984

CC. 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 COR shall be advised in

writing of the name of the designated service representative, and of any change in personnel. The COR 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 arrival on site. 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 COR. No system modifications, including operating parameters and control settings, shall be made without prior written approval from the COR. 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 COR, placed in first class operating condition or be returned to the source of supply for repair or replacement.
3. 3. Painted surfaces shall be protected with factory installed removable heavy craft paper, sheet vinyl or equal.

4. 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 COR 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 COR 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 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 COR 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 COR 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 COR 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 COR 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.

1.15 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.

1.16 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 its 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.

1.17 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.

B. 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.

C. 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.

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, , 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 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.

3.5 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 COR on data entry forms and an approved electronic medium, utilizing data from the contract documents. The completed forms shall be delivered to the COR 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 COR 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 shall be responsible for uploading personnel information (e.g., ID Cards backgrounds, names, access privileges, personnel photos, access schedules, personnel groupings) along with coordinating with COR 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 COR 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 COR 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 COR, any additional data needed to provide a complete and operational system as described in the contract documents.

3.6 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 COR 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 COR 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 COR at the conclusion of each phase of testing and prior to COR 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 COR 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 COR at the conclusion of pre-delivery testing and prior to COR'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 shall 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 COR (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 COR 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 COR's acceptance testing procedures. The Contractor shall provide the COR 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 the COR 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 contractor's 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 COR, then the Contractor shall schedule an acceptance test to date and give the COR 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 COR. 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 COR or Contractor, the Contractor shall commence an assessment period as described for Endurance Testing Phase II.
4. Upon successful completion of the acceptance test, the Contractor shall deliver test reports and other documentation, as specified, to the COR prior to commencing the endurance test.
5. Additional Components of the PVT shall include:
   a. 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 CORs 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.

6. Partial PVT - At the discretion of COR, 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 COR 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 COR 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 COR 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

COR. If the system experiences no failures, the Contractor may proceed directly to Phase III testing after receiving written permission from the COR.

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 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 shall 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 the COR 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 COR 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 COR 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 COR 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 COR may require, the Phase IV assessment shall be repeated as if Phase III had just been completed.

G. Exclusions

1. 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.
   b. Failure of an Owner furnished equipment or communications link, provided the failure was not due to Contractor furnished equipment, installation, or software.
   c. Failure of existing Owner owned equipment, provided the failure was not due to Contractor furnished equipment, installation, or software.

---END---

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.

G. Section 31 20 00 - EARTH MOVING. For excavation and backfill for cables that are installed in conduit.

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 COMMON WORKS RESULTS FOR ELECTRONIC SAFETY AND SECURITY, 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 Contracting Officer’s Representative (COR) 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):

70-21.....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 TDR
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, spools, J-hooks, and D-rings.
3. Straps and other devices.

C. Conduit and Boxes: Comply with requirements in Division 28 Section "Conduits and Backboxes for Electronic Safety and Security. "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-116-732 for mechanical properties.
   2. Comply with ANSI/TIA-568.1-D for performance specifications.
   3. Comply with ANSI/TIA-568.2-D, Category 6A.
   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 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.

2.5 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.

2.6 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.

2.7 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, power-limited cable, concealed in building finishes or power-limited tray cable, in cable tray complying with UL 83.

C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or TF, complying with UL 83.

2.8 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 or 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.

2.9 IDENTIFICATION PRODUCTS

A. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.10 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test optical fiber cables on reels according to ANSI/TIA-568.3-D.

C. Cable shall be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

2.11 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.

2.12 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 ANSI/TIA-568.1-D.
2. Comply with BICSI ITSIM, 7th Edition.
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 shall 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, 7th Edition. 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, 7th Edition Monitor cable pull tensions.
   b. Provide installation equipment that shall 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. 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.

D. Unless otherwise specified in other sections install wiring and connect to equipment/devices to perform the required functions as shown and specified.

E. Except where otherwise required, install a separate power supply circuit for each system so that malfunctions in any system shall not affect other systems.

F. 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.

G. 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.

H. System voltages shall be 120 volts or lower where shown on the drawings or as required by the NEC.

I. UTP Cable Installation:
   1. Comply with ANSI/TIA-568.2-D.
   2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.

J. Optical Fiber Cable Installation:
   1. Comply with ANSI/TIA-568.3-D.
   2. Cable shall be terminated on connecting hardware that is rack or cabinet mounted.

K. 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.

L. 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.
   3. Coil cable 72 inches (1830 mm)long shall be neatly coiled not less than 12 inches (300 mm) in diameter below each feed point.

M. Separation from EMI Sources:
   1. Comply with BICSI TDMM 14th Edition and ANSI/TIA-569-E 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 ELECTRONIC SAFETY AND SECURITY."
   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, shall 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 permitted.
3. Signaling Line Circuits: Power-limited fire alarm cables shall not be installed in the same cable or raceway as signaling line circuits.

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 "VIDEO SURVEILLANCE" for connecting, terminating, and identifying wires and cables.
C. 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 ANSI/TIA-569-E, "Firestopping" Annex A.
C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.6 GROUNDING

A. For communications wiring, comply with ANSI/TIA-607-D 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 ANSI/TIA-606-C.
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 ANSI/TIA-568.1-D.
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 ANSI/TIA-568.2-D. 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 ANSI/TIA-568.3-D. 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 one 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 ANSI/TIA-568.3-D.

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 shall 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 shall be reused. If existing wiring does not meet these requirements, existing wiring shall 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 - COMMISIONING 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):

70-21.....National Electrical Code (NEC)

99-2018.....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 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 lock washers.
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.

2.3 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).

2.4 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.

2.5 SPLICE CASE GROUND ACCESSORIES

A. Splice case grounding and bonding accessories shall be supplied by the splice case manufacturer when available. Otherwise, use 16 mm^2 (6 AWG) insulated ground wire with shield bonding connectors.

2.6 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.

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 mm^2 (6AWG) bonding jumpers.
2. Bond at all intermediate metallic enclosures and across all joints using 16 mm^2 (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 LIGHTNING PROTECTION SYSTEM

A. Bond the lightning protection system to earth ground externally to the building. Under no condition shall the electrical system's third of fourth ground electrode system, or the telecommunications system circulating ground system be connected to the lightning protection system. The Facility's structural steel shall be used to connect the lightning protection system at the direction of the Contracting Officers Representative certified by an independent certified grounding contractor.

3.8 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 shall be removed for any reason, notify the facility manager."
   2. All ground Busses shall be labeled "Main Ground Bus", "Telecom Room Ground Bus."
   3. All grounding cabling shall be labeled, "Ground Cable Bonded from Main TGB," "Ground Cable Bonded from the Main Electrical Ground Bus"

"Ground Cable Bonded from Electrical Panel XXX", "Ground Cable Bonded to the Building Steel."

3.9 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 shall 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.

---END---

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 92 00 - JOINT SEALANTS. Requirements for sealing around conduit penetrations through the building envelope to prevent moisture migration into the building.

E. Section 09 91 00 - PAINTING. Requirements for identification and painting of conduit and other devices.

F. 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.

G. 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.

H. Section 28 08 00 - COMMISIONING OF ELECTRONIC SAFETY AND SECURITY SYSTEMS. Requirements for commissioning - systems readiness checklists, and training.

I. Section 31 20 00 - EARTHWORK. For bedding of conduits.

1.3 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 items proposed and its area of application shall be identified on the catalog cuts.

C. Certification: Prior to final inspection, deliver to the Contracting Officer’s Representative (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, shall 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 shall remain in place without separation of any parts when subjected to the seismic forces specified and the unit shall 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):

70-21	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 intermediate steel conduit (IMC): Shall Conform to UL 1242, ANSI C80.6.

C. 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.

D. Flexible galvanized steel conduit: Shall Conform to UL 1.

E. Liquid-tight flexible metal conduit: Shall Conform to UL 360.

F. 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. 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.

C. Flexible steel conduit fittings:
1. Conform to UL 514B. Only steel or malleable iron materials are acceptable.
2. Clamp type, with insulated throat.

D. 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 shall incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.

E. Direct burial plastic conduit fittings:
1. Fittings shall meet the requirements of UL 514C and NEMA TC3.
2. As recommended by the conduit manufacturer.

F. Surface metal raceway fittings: As recommended by the raceway manufacturer.

G. 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 polymer concrete or reinforced concrete or cast iron or hot-dip galvanized-steel diamond plate.

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 Section 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: Remarks: Remarks: Stainless steel. Include two for each sealing element.

3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

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. Do not use aluminum conduits in wet locations.
12. 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 shall 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.

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 shall 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 Remarks: 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, 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 Section 09 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.

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 green ground bonding jumper installed.

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):

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)

J. Furnish and install 19mm (3/4 inch) AC grade (A-side out) fire retardant plywood specified on the walls of telecommunications spaces where shown and noted on drawings. Mount the plywood with the bottom edge 150 mm (6 inches) above the furnished floor.

K. 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 shall 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 shall 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 shall 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 shall 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 shall provide a list of submittals that shall be reviewed by the Commissioning Agent. This list shall 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 shall 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 shall 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 shall 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 shall 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 shall 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 shall 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 shall 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 shall 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.

B. The instruction shall be scheduled in coordination with the VA COR 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.

3.6 PROVIDE COMMISSIONING FOR THE FOLLOWING SYSTEMS:

A. Section 28 13 00 PACS

B. Section 28 23 00 VIDEO SURVEILLANCE SYSTEM

---END---

SECTION 28 13 00
PHYSICAL ACCESS CONTROL SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

A. Contractor Scope of Work – Provide dual-authentication type card reader(s) at the new TR as indicated on the drawings for access control system (PACS), software, licenses, conduits, junction boxes, fire and smoke rated sleeve assemblies, cabling, covers, jacks, terminations, cover plates, labeling, testing and related materials, VLAN connection for monitoring at the main Alexandria Campus, for a complete operational PACS system as shown on the contract documents and as described in the specifications. Contractor to program the system to the master control system at the Alexandria campus.

B. This section specifies the finishing, installation, connection, testing and certification of a complete and fully operating extension of the existing Physical Access Control System, hereinafter referred to as the PACS.

C. This Section includes a Physical Access Control System consisting of a system server, 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 anti-passback
   b. Surge and tamper protection
   c. Credential cards and readers
   d. Monitoring of field-installed devices

D. 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.

E. PACS shall provide secure and reliable identification of Federal employees and contractors by utilizing credential authentication per FIPS-201.

F. Physical Access Control System (PACS) shall consist of:

1. Card readers,

2. Door locks and sensors,
3. Power supplies,

G. Controllers shall be connected by a high-speed electronic data transmission network.

H. 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.

I. For locations where secure side processing is not applicable the tamper switches and certified cryptographic processing shall be provided per FIPS-140-2.

J. System Software: Based on existing central-station, workstation operating system, server operating system, and application software.

K. Software and controllers shall be capable of matching full 256 bit FASC-N plus minimum of 64 bits of public key certificate data.

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. 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.

1.3 QUALITY ASSURANCE

A. Refer to 28 05 00 COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY, Part 1

B. The Contractor shall be responsible for providing, installing, and the operation of the PACS as shown. The Contractor shall also provide certification as required.

C. 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.

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 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.

F. Contractor Qualifications:

1. The Contractor or security sub-contractor shall be a licensed security Contractor with a minimum of three (3) 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 4 hours 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.

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 shall 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 eight hours of receipt of notification that service is needed. Submit name and address of service organizations.

1.4 SUBMITTALS

A. Refer to 28 05 00 COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY, Part 1

B. 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.

C. Provide certificates of compliance with Section 1.3, Quality Assurance.

D. 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.

E. Shop drawing and as-built packages shall include:

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).

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).
   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.

F. Pre-installation design packages shall go through a full review process conducted by the Contractor along with a COR 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

G. 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.

H. 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.

I. 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.

J. General: Submittals shall be in full compliance of the Contract Documents. All submittals shall be provided in accordance with this section. Submittals lacking the breadth or depth of 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 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES , which outline basic submittal requirements and coordination.

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) 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 COR 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 COR for approval before the initiation of work.
6. 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.
7. 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.
8. Product Data: Within 15 calendar days after execution of the contract, the Contractor shall submit for approval a complete list

of all 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.

K. 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. 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.
i. 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. Section II - 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.
3. Section III - 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.
4. Section IV - 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.

5. Section V – 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".

L. Group II Technical Data Package

1. The Contractor shall prepare a report of "Current Site Conditions" and submit a report to the COR 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:
   a. Baseline configuration
   b. Access levels
   c. Schedules (intrusion detection, physical access control, and holidays)
   d. Badge database
   e. System monitoring and reporting (unit level and central control)
   f. Naming conventions and descriptors

M. Group III Technical Data Package

1. Development of Test Procedures: The Contractor shall 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 shall deliver the test procedures to the Contracting Officer's Representative for approval at least 60 calendar days prior to the requested test date.

N. 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 COR for approval. The Contractor shall 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. 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 into 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.

3. 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 COR for review and approval at least 90 calendar days prior to the scheduled date the Contractor requires them.

O. Group V Technical Data Package: 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. 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 shall provide access to redline documents anytime during the project for review and inspection by the COR 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 shall submit the Master Redline document to the COR for review and approval of all changes or modifications to the documents. Each sheet shall have COR 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”.

2. 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 COR review and inspection at any time.
3. 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.

4. 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
5. Record Construction Documents (Record As Built)
   a. Upon project completion, the contractor shall submit the project master redlines to the COR prior to development of Record construction documents. The COR 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 COR, the COR shall initial and date each sheet and turn redlines over to the contractor for as built development.
   b. The Contractor shall provide the COR 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 100 mm (4 inches).

P. FIPS 201 Compliance Certificates

1. Provide Certificates for all software components and device types utilizing credential verification. Provide certificates for:

a. Card Readers

Q. Approvals will be based on complete submission of manuals together with shop drawings.

R. 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. Refer to 28 05 00 COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY, Part 1

B. 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.

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

TVAC-01.....CCTV to Access Control Standard - Message Set for System Integration

D. American National Standards Institute (ANSI)/ International Code Council (ICC):

A117.1.....Standard on Accessible and Usable Buildings and Facilities

E. Department of Justice American Disability Act (ADA)

28 CFR Part 36.....ADA Standards for Accessible Design 2010

F. Department of Veterans Affairs (VA):

G. PACS-R: Physical Access Control System (PACS) Requirements

H. VA Handbook 0730 Security and Law Enforcement

I. Government Accountability Office (GAO):

J. GAO-03-8-02 Security Responsibilities for Federally Owned and Leased Facilities

K. National Electrical Contractors Association

303-2019.....Installing Closed Circuit Television (CCTV) Systems

L. National Electrical Manufactures Association (NEMA):

250-08.....Enclosures for Electrical Equipment (1000 Volts Maximum)

M. National Fire Protection Association (NFPA):

70-2021..... National Electrical Code

N. 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

O. Homeland Security Presidential Directive (HSPD):

HSPD-12.....Policy for a Common Identification Standard for Federal Employees and Contractors

P. Federal Communications Commission (FCC):

Q. (47 CFR 15) Part 15 Limitations on the Use of Wireless Equipment/Systems

R. Federal Information Processing Standards (FIPS):

FIPS-201-1.....Personal Identity Verification (PIV) of Federal Employees and Contractors

S. 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)

T. Institute of Electrical and Electronics Engineers (IEEE):
C62.41.....IEEE Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits

U. 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

V. Uniform Federal Accessibility Standards (UFAS) 1984

W. ADA Standards for Accessible Design 2010

X. Section 508 of the Rehabilitation Act of 1973

1.6 DEFINITIONS

A. Refer to 28 05 00 COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY, Part 1

B. 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.

C. 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.

D. Access Control: A function or a system that restricts access to authorized persons only.

E. API Application Programming Interface

F. 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

G. 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.

H. 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.

I. Authorization: A process that associates permission to access a resource or asset with a person and the person's identifier(s).

J. 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.

K. Biometric: An authenticator produced from measurable qualities of a living person.

L. CAC EP – CAC End Point with end point PIV applet

M. CAC NG – CAC Next Generation with transitional PIV applet

N. 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.

O. CCTV: Closed-circuit television.

P. 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.

Q. 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.

R. CPU: Central processing unit.

S. Credential: Data assigned to an entity and used to identify that entity.

T. File Server: A PC in a network that stores the programs and data files shared by users.

U. FIPS Federal Information Processing Standards

V. FRAC – First Responder Authentication Credential

W. HSPD Homeland Security Presidential Directive

X. I/O: Input/Output.

Y. 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.

Z. IEC International Electrotechnical Commission

AA. ISO International Organization for Standardization

BB. KB Kilobyte

CC. kbit/s Kilobits / second

DD. LAN: Local area network.

EE. LED: Light-emitting diode.

FF. Legacy CAC – Contact only Common Access Card with v1 and v2 applets

GG. 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.

HH. NIST: National Institute of Standards and Technology

II. PACS: Physical Access Control System

JJ. PC/SC: Personal Computer / Smart Card

KK. PC: Personal computer. This acronym applies to the Central Station, workstations, and file servers.

LL. 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).

MM. PDF: (Portable Document Format.) The file format used by the Acrobat document exchange system software from Adobe.

NN. PIV: Personal Identification Verification

OO. PIV-I – PIV Interoperable credential

PP. PPS: Protocol and Parameters Selection

QQ. RF: Radio frequency.

RR. ROM: Read-only memory. ROM data are maintained through losses of power.

SS. RS-232: A 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.

TT. RS-485: A TIA/EIA standard for multipoint communications.

UU. TCP/IP: Transport control protocol/Internet protocol incorporated into Microsoft Windows.

VV. TPDU: Transport Protocol Data Unit

WW. TWIC – Transportation Worker Identification Credential

XX. UPS: Uninterruptible power supply.

YY. Vcc: Voltage at the Common Collector

ZZ. WAN: Wide area network.

AAA. WAV: The digital audio format used in Microsoft Windows.

BBB. Wiegand: Patented magnetic principle that uses specially treated wires embedded in the credential card.

CCC. Windows: Operating system by Microsoft Corporation.

DDD. Workstation: A PC with software that is configured for specific limited security system functions.

1.7 COORDINATION

A. Refer to 28 05 00 COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY, Part 1

B. 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. Ensure connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

C. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

D. 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. Refer to 28 05 00 COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY, Part 1

B. 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.
2. The Contractor shall repair any piece of equipment during the product warranty period.

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. Data 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. 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.

M. 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.

N. 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.

O. 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.

P. Data Line Supervision: System shall initiate an alarm in response to opening, closing, shorting, or grounding of data transmission lines.

Q. 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.

R. References to industry and trade association standards and codes are minimum installation requirement standards.

S. 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. Refer to 28 05 00 COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY, Part 1

B. 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.

C. When more than one unit of the same class of equipment is required, such units shall be the product of a single manufacturer.

D. 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.

E. Factory wiring shall be identified on the equipment being furnished and on all wiring diagrams.

F. When Factory Testing Is Specified:

1. The Government shall have the option of witnessing factory tests. The contractor shall notify the VA through the COR 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 COR 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
8. Like Items.

PART 2 - PRODUCTS

2.1 GENERAL

A. All equipment and materials for the system will be compatible to ensure correct operation as outlined in FIPS 201, March 2006 and HSPD-12.

B. 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 shall approve the acceptance of prior to an installation.

C. PACS equipment shall meet or exceed all requirements listed below.

D. A PACS shall be comprised of the following components:

1. Controllers (Data Gathering Panel)
2. Card Readers
3. Cables
4. Transformers

2.2 APPLICATION SOFTWARE

A. 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 offline.

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.

B. 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.

C. 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.

D. 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 or zone or sensor.
   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.

E. 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 through 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.

2.3 SURGE AND TAMPER PROTECTION

A. Refer to 28 05 00 COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

B. 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.

C. 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.

2.4 PACS SERVER HARDWARE

A. Existing to remain.

2.5 DOOR 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 shall 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 OR by monitoring for abnormal open, grounded, or shorted conditions using dc change measurements. System shall initiate an alarm in response to an abnormal current, which is a dc change of 10 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 pushbuttons.
   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, 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 time listed in a schedule, 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.

7. New controllers shall match the existing PACS system.

2.6 CARD READERS

A. Power: Card reader shall be powered from its associated Controller, including its standby power source.

B. 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.

C. 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.

D. 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.

E. 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.

F. Shall be fully programmable and addressable, locally and remotely, and hardwired to the system.

G. Shall be individually home run to the main panel.

H. 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

I. Shall support a variety of card readers that shall encompass a wide functional range. The PACS shall 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). 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.

J. Shall be housed in an aluminum bezel with a wide lead-in for easy card entry.

K. Shall contain read head electronics, and a sender to encode digital door control signals.

L. LEDs shall be utilized to indicate card reader status and access status.

M. Shall be able to support a user defined downloadable off-line mode of operation (e.g. locked, unlocked), which shall go in effect during loss of communication with the main control panel.

N. 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.

O. Shall have a minimum of two programmable inputs and two programmable outputs.

P. 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.

Q. 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.

R. 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 shall 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 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.

S. 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, 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. Readability Range: The reader shall not be able to read PIV card more than 10cm(4inch) from the reader

T. Provide anti-ligature covers for all card readers in the Mental Health Buildings or and as shown on the drawings.

2.7 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.

2. Provide recessed REX for Mental Health buildings, or provide anti-ligature cover (slope dome)
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.

C. 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.

D. 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 its place of a DPDT switch.
   d. Switches for doors not operated by the PACS shall be SPDT and report directly to the PACS.
   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).

2.8 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 shall 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 shall 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 number 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 shall 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, except for 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 shall indicate to the system if the strike/bolt is not engaged or is unlocked when it shall 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. Have integrated Request to Exit switch for new doors receiving physical access control devices.
   c. Provide integration of the Electric Mortise Locks with the PACS for:
      1) Lock Power
      2) Request to Exit switch.

2.9 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.

2.10 WIRES AND CABLES

A. Refer to section 280513 "CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY".

A. Comply with Division 28 Section "CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY."

B. All in one composite cable.
   1. This cable is composite construction of 6 conductor 18 AWG strand bare copper conductor insulated with color coded FPR, shielded with a drain wire and FPR jacket; 4 conductors 18 AWG standard bare copper conductors insulated with color coded FPR, shielded with a drain wire and FPR jacket; 2 conductors 16 AWG stranded bare copper conductor insulated with color coded FPR, shielded with drain wire and FPR jacket and 4 conductors 22 AWG stranded bare copper conductor insulated with color coded FPR, shielded with drain wire

and an FPR Jacket; a yellow overall SGPVC jacket is applied overall, Type CMP, UL listed 444, NEC 800 and 910 Plenum.

2. Reader Cable: 6 conductor 18 AWG, bare copper, insulated, shielded with drain wire and FPR jacket.
3. RX/Motion cable: 4 conductor 18 AWG, bare copper, insulated, shielded with drain wire and FPR jacket
4. Lock Power cable: 2 conductor 16 AWG, bare copper, insulated, shielded with drain wire and FPR jacket.
5. Door contact/switch cable: 4 conductor 22 AWG, bare copper, insulated, shielded with drain wire and FPR Jacket.
6. Overall Jacket, yellow, .46 O.D., with Ripcord under jacket.
7. UL listed
8. 300 volts

C. 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.

D. 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.

E. RS-485 communications require 2 twisted pairs, with a distance limitation of 4000 feet (1220 m).

F. 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.

G. 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.

H. Multiconductor, Readers and Wiegand Keypads Cables: No. 22 AWG, paired and twisted multiple conductors, stranded (7x30) tinned copper conductors, semi-rigid 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.

I. 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.

J. 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.

K. 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.

L. 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.

M. 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.
N. 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.
O. 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.
P. 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.
Q. 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.
R. 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.
S. 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.
T. 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.

U. LAN (Ethernet) Cabling: Comply with Division 27.

PART 3 - EXECUTION

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, and physical equipment sizes 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 agree 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 5E rating of components and that ensure Category 5E 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 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-E, "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 an 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 standalone or a network.

E. 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.

F. The Contractor shall visit the site and verify that site conditions agree 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.

G. The Contractor shall visit the site and verify that site conditions agree/comply 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.

H. 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.

I. 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.

J. 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.

K. 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.

L. 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.

M. 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.

N. 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).

O. 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.

P. 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 because 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 COR and Commissioning Agent. Provide a minimum of 7 days prior notice.

Q. 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 shall 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.
5. Keypad shall arm and disarm the PACS door, coordinate with COR.

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 6A tester. Test for faulty connectors, splices, and terminations. Test according to TIA/EIA-568.1-D, "Commercial Building Telecommunications Cabling Standards - Part 1 General Requirements." Link performance for UTP cables must comply with minimum criteria in TIA/EIA-568.2-D.
2. Test each circuit and component of each system. Tests shall include, 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.

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SECTION 28 23 00
SECURITY SURVEILLANCE TELEVISION SYSTEM (SSTV)

PART 1 - GENERAL

1.1 DESCRIPTION

A. Contractor Scope of Work – Provide multi-sensor, panoramic type surveillance camera equal to Avigilon H5A series for the new TR as indicated on the drawings for Security Surveillance Television System (SSTV). Provide switch equal to Cisco 9300 series for Power Over Ethernet (PoE) connection, software, programming, licenses, conduits, junction boxes, fire and smoke rated sleeve assemblies, cabling, covers, jacks, terminations, cover plates, labeling, testing and related materials, VLAN connection for monitoring at the main Alexandria Campus, for a complete operational SSTV system as shown on the contract documents and as described in the specifications. Contractor to program the system to the master control system at the Alexandria campus.

B. Provide and install Security Surveillance Television System (SSTV) PoE type camera for the new Telecom Room to match the existing system, which is identified as the Video Assessment and Surveillance System hereinafter referred to as the SSTV System as specified in this section. Connect the new camera to the nearest existing SSTV PoE headend equipment in the area utilizing CAT 6A cabling for distances up to 90 meters.

C. This Section includes Security Surveillance Television System consisting of panoramic multisensor cameras, camera housing, camera mounts, patch panels, data transmission wiring both copper and fiber, fiber transceivers, all related material for a complete operational system, and control station with its associated equipment.

D. Security Surveillance Television System (SSTV)system Video assessment & surveillance system shall be integrated with monitoring and control system specified in Division 28 PHYSICAL ACCESS CONTROL that specifies systems integration.

1.2 PROJECT SCOPE

A. The scope of this projects is to provide a complete operational SSTV system that is tied to the existing system with the following:
   1. Cameras/housing/mounting with IR capabilities
   2. Copper and fiber cabling
   3. Patch panel

4. Grounding
5. Programming
6. All related material.
7. For distance longer than 90 meters tie in with 6 strand OS2 fiber to the existing head end equipment in Main Hospital Building.
8. Spare parts.
9. Record drawings.
10. Labeling.
11. Testing reports.

1.3 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 13 00 - PHYSICAL ACCESS CONTROL SYSTEM. Requirements for physical access control system integration.

1.4 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.(Refer to specification 27 11 26 for additional information)
L. 90/180/270/360 PANORAMIC MULTISENSOR CAMERA
M. NDAA: National Defense Authorization Act.

1.5 QUALITY ASSURANCE

A. The Contractor shall be responsible for providing, installing, and the operation of the SSTV System as shown. The Contractor shall also provide certification as required.
B. The Security Surveillance Television 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 and shall be a certified installer by the camera manufacturer.
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 surveillance television system contractor with a minimum of three (3) 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 (SSTV) 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 shall 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 SSTV. 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 4 hours 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 shall 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 shall render satisfactory service to this installation within eight hours of receipt of notification that service is needed. Submit name and address of service organizations.

1.6 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:

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. 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.

3. 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).
   d. Power supply or circuit breaker and power panel number.
   e. In addition, for the SSTV 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.
4. 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 the COR 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.

1.7 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)/Electronic Industries Alliance (EIA):

330-09	Electrical Performance Standards for SSTV Cameras
375A-76	Electrical Performance Standards for SSTV 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 Commission (FCC):

E. (47 CFR 15) Part 15 Limitations on the Use of Wireless Equipment/Systems

F. National Electrical Contractors Association (NECA):

303-2019	Installing Closed Circuit Television (SSTV) Systems

G. National Fire Protection Association (NFPA):

70-2021	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

1.8 COORDINATION

A. Coordinate arrangement, mounting, and support of Security surveillance television system 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. To connecting raceways, cables, wireways, cable trays, and busways shall 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 Security Surveillance Television System items that are behind finished surfaces or otherwise concealed.

1.9 WARRANTY OF CONSTRUCTION

A. Warrant SSTV 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.

C. The SSTV camera shall be warranty for one year labor and 5-year material from the day that is accepted by the VA.

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 for the SSTV.

B. Equipment Standards and Testing:

1. Equipment shall be listed by a NRTL where a UL standard is in existence; active and passive equipment shall conform to each UL standard in effect for equipment, on the submittal date.
2. Each item of electronic equipment shall be labeled by a NRTL that warrants equipment has been tested in accordance with and conforms to specified standards.
   a. Reference specification section 27 11 26 Communications Rack Mounted Power Protection and Power Strips.

2.2 GENERAL

A. Video signal format shall comply with Ethernet IP signal at 100 Ohms.

B. 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.

C. 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.

D. 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.

2.3 CAMERAS

A. All Cameras shall 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.

B. 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. Cameras shall be color and the primary choice for monitoring following the activities described below. Multisensor/fisheye cameras shall be color and shall be utilized to complement the dome 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 SSTV 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 SSTV 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 SSTV 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. Will be fitted with AI/DC lenses to ensure the image quality under different light conditions.
11. Multi sensor panoramic (90,180,270 and 360) cameras shall be utilized in a manner that they complement dome multi sensor cameras and shall not be used as a primary means of monitoring activity.
12. Dummy or fake cameras shall not be utilized at any time.
13. Appropriate signage shall be designed, provided, and posted that notifies people that an area is under security surveillance television system.
14. HW Platform:
    a. Minimum 3.1 GHz CPU, RAM 1 GB (8 GB or higher recommended on Microsoft Windows Vista).

2.4 IP COLOR DOME CAMERAS

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. IP base multi sensor cameras shall be between 9MP and 32 MP (MPixels) either dome or 90/180/270/360 panoramic multisensory camera.
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 provide usable images in low-light conditions, delivering an image at a scene illumination of 1.5 lux at .9 f-stop of lens, with the camera AGC off.

H. 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.

I. Manually selectable modes for backlight compensation or normal lighting.

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. 90/180/270/360 PANORAMIC MULTISENSOR CAMERA

P. NETWORK CAMERAS

1. Shall be IEEE 802.3af compliant.
   a. Shall be utilized for interior and exterior purposes.
   b. A Category CAT6A cable shall 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 shall be required:
      1) A local or remote 12 VDC or 24 VAC power source shall be required from a Class 2, UL compliant power supply.
      2) A signal converter shall be required to convert from a CAT6A cable over to a fiber optic cable. The signal shall need to be converted back to a CAT6A 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.

Q. 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

R. 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 Security Surveillance Television System 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, and parking areas.
   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

S. 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 shall 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.

T. 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 shall be unobtrusive, unable to cause personal harm, and prevents tampering and vandalism.
   b. The mount shall contain a manual shall 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.

U. 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 than 1 f-stop.
3. The housing shall be equipped with integral capabilities complete with wiring, wiring harness, connectors, receiver/driver, control system, pre-position cards, or any other hardware and equipment as needed to fully provide a fully functional panoramic multisensory camera.

2.5 POE POWER SUPPLIES

A. Camera power supplies shall be from an enhance PoE data switches to be part of the SSTV for a complete operational system.
B. Provide PoE switches as required for the number of cameras shown plus 25% spare capacity.
C. Provide power transceiver as required to convert fiber to copper for camera distance of over 295 feet and provide 120 volt emergency power as required.
D. PoE switch B.O.D.: Cisco 9300+ series with 2-10Gig network Uplink and software.

2.6 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: 12-VAC/DC or 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.

2.7 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 shall be sized and installed per the NEC. All security system signal and power cables that traverse or originate in a high security office space shall 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 shall 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 than 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 line 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. Cables:

1. SSTV video signal cables shall be copper 4 PR UTP/SUTP for up to 295 feet and have a characteristic impedance of 100 ohms plus or minus 5 ohms. See Division 27 for cable information and requirements.
2. SSTV video camera cables for cameras that are over 295 feet shall be Fiber optic cable, provide transceiver at each camera, and provide 4 PR UTP for power.
3. Cables:
   a. Signal wiring for PoE cameras depends on the distance the camera is being installed from either a switch or the server.
   b. If the camera is up to 295 ft from a switch or the server, then use a shielded UTP category 6A 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 50 microns.
   d. Provide a separate cable for power.
   e. CAT-6A Technical Characteristics:

Number of Pairs	4
Total Number of Conductors	8
AWG	22-24
Stranding	Solid
Conductor Material	BC - Bare Copper
Insulation Material	PO – Polyolefin
Overall Nominal Diameter	.26-.32 in.
IEC Specification	11801 Category 6A
ANSI/TIA Specification	568.2-D 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

4. Fiber Optic Cables Technical Characteristics:

Fiber Type	50 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

5. Power Cables
   a. Will be sized accordingly and shall comply with the NEC. High voltage power cables shall be a minimum of three conductors, 14 AWG, stranded, and coated with a non-conductive polyvinylchloride (PVC) jacket. Low voltage cables shall be a minimum of 18 AWG, stranded and non-conductive polyvinylchloride (PVC) jacket.
   b. Will be utilized for all components of the SSTV System that require either a 110 VAC 60 Hz or 220 VAC 50 Hz input. Each feed shall 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 be 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 shall 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-premises 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 SSTV System shall 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 SSTV 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 hour 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. 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 hour basis.
   c. The SSTV System shall have facial recognition software to assist in identifying individuals for current and future purposes.

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 SSTV System shall be comprised of 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 shall 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 SSTV 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 shall comply with VA Master Specification for 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. 90/180/270/360 PANORAMIC MULTISENSOR CAMERA cameras shall have all preset positions and privacy areas defined and programmed.

O. 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 SSTV network.
   5. Connect video decoder to video matrix, DVR, and monitor.
   6. Connect unit to AC power (UPS). (Refer to specification 27 11 26 for additional information)
   7. Configure the video encoder/decoder per manufacturer’s recommendation and project requirements.

P. 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 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.

3. Connect signal lines and AC power to the housing interfaces.

3.3 SYSTEM START-UP

A. The Contractor shall not apply power to the SSTV System until the following items have been completed:
   1. SSTV System equipment items and have been set up in accordance with manufacturer's instructions.
   2. A visual inspection of the SSTV 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 SSTV System have been verified as the correct voltage, phasing, and frequency as indicated.

B. The Commissioning Agent shall observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the Contracting Officer’s Representative 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 SSTV System; and are approved by the Contracting Officer.

B. The Contractor shall 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 for 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 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.

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SECTION 31 20 00
EARTHWORK

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

A. This section specifies the requirements for furnishing all equipment, materials, labor, tools, and techniques for earthwork including, but not limited to, the following:
   1. Site preparation.
   2. Excavation.
   3. Underpinning.
   4. Filling and backfilling.
   5. Grading.
   6. Soil Disposal.
   7. Clean Up.

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 material, including silts, which are unstable; and inorganic materials, including silts, too wet to be stable and any material with a liquid limit and plasticity index exceeding 40 and 15 respectively. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction, as defined by ASTM D1557
   2. Existing Subgrade (Except Footing Subgrade): Same materials as 1.2.A.1, that are not capable of direct support of slabs, pavement, and similar items with possible exception of improvement by compaction, proof rolling, or similar methods.
   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 Resident Engineer's approval.

B. Building Earthwork: Earthwork operations required in area enclosed by a line located 1500 mm (5 feet) outside of principal building perimeter. It also includes earthwork required for auxiliary structures and buildings.

C. Trench Earthwork: Trenchwork required for utility lines.

D. Site Earthwork: Earthwork operations required in area outside of a line located 1500 mm (5 feet) outside of principal building perimeter and within new construction area with exceptions noted above.

E. Degree of compaction: Degree of compaction is expressed as a percentage of maximum density obtained by laboratory test procedure. This percentage of maximum density is obtained through use of data provided from results of field test procedures presented in ASTM D1556, ASTM D2167, and ASTM D6938.

F. Fill: Satisfactory soil materials used to raise existing grades. In the Construction Documents, the term “fill” means fill or backfill as appropriate.

G. Backfill: Soil materials or controlled low strength material used to fill an excavation.

H. Unauthorized excavation: Removal of materials beyond indicated sub-grade elevations or indicated lines and dimensions without written authorization by the Resident Engineer. No payment will be made for unauthorized excavation or remedial work required to correct unauthorized excavation.

I. Authorized additional excavation: Removal of additional material authorized by the Resident Engineer based on the determination by the Government’s soils testing agency that unsuitable bearing materials are encountered at required sub-grade elevations. Removal of unsuitable material and its replacement as directed will be paid on basis of Conditions of the Contract relative to changes in work.

J. Subgrade: The undisturbed earth or the compacted soil layer immediately below granular sub-base, drainage fill, or topsoil materials.

K. Structure: Buildings, foundations, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

L. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.

M. Drainage course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.

N. Bedding course: Layer placed over the excavated sub-grade in a trench before laying pipe. Bedding course shall extend up to the springline of the pipe.

O. Sub-base Course: Layer placed between the sub-grade and base course for asphalt paving or layer placed between the sub-grade and a concrete pavement or walk.

P. Utilities include on-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

Q. Debris: Debris includes all materials located within the designated work area not covered in the other definitions and shall include but not be limited to items like vehicles, equipment, appliances, building materials or remains thereof, tires, any solid or liquid chemicals or products stored or found in containers or spilled on the ground.

R. Contaminated soils: Soil that contains contaminates as defined and determined by the Resident Engineer or the Government’s testing agency.

1.3 RELATED WORK:

A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.

B. Safety requirements: Section 01 35 26, SAFETY REQUIREMENTS.

C. Protection of existing utilities, fire protection services, existing equipment, roads, and pavements: Section 01 00 00, GENERAL REQUIREMENTS.

1.4 CLASSIFICATION OF EXCAVATION:

A. Unclassified Excavation: Removal and disposal of pavements and other man-made obstructions visible on 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.

1.7 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Furnish to Resident Engineer:

1. Contactor shall furnish resumes with all personnel involved in the project including Project Manager, Superintendent, and on-site Engineer. Project Manager and Superintendent should have at least 3 years of experience on projects of similar size.
2. Soil samples.

a. Classification in accordance with ASTM D2487 for each on-site or borrow soil material proposed for fill, backfill, engineered fill, or structural fill.
b. Laboratory compaction curve in accordance with ASTM D1557 for each on site or borrow soil material proposed for fill, backfill, engineered fill, or structural fill.
c. Test reports for compliance with ASTM D2940 requirements for subbase material.
d. Pre-excavation photographs and videotape in the vicinity of the existing structures to document existing site features, including surfaces finishes, cracks, or other structural blemishes that might be misconstrued as damage caused by earthwork operations.
e. The Contractor shall submit a scale plan daily that defines the location, limits, and depths of the area excavated.

3. 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.

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 Association of State Highway and Transportation Officials (AASHTO):

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 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

C. American Society for Testing and Materials (ASTM):

C33-03.....Concrete Aggregate

D448-08.....Standard Classification for Sizes of Aggregate for Road and Bridge Construction

D698-07e1.....Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft. lbf/ft^3 (600 kN m/m^3))

D1140-00.....Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve

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 (56,000 ft-lbf/ft^3 (2700 kN m/m^3))

D2167-08.....Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method

D2487-11.....Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)

D2940-09.....Standard Specifications for Graded Aggregate Material for Bases or Subbases for Highways or Airports

D6938-10.....Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth

D. Louisiana Department of Transportation, Standard Specifications for Roads and Bridges, Section 710 Flowable Fill

E. Society of Automotive Engineers (SAE):

J732-07.....Specification Definitions - Loaders

J1179-08.....Hydraulic Excavator and Backhoe Digging Forces

PART 2 - PRODUCTS

2.1 MATERIALS:

A. General: Provide borrow soil material when sufficient satisfactory soil materials are not available from excavations.

B. Fills: Material in compliance with ASTM D2487 Soil Classification Groups GW, GP, GM, SW, SP, SM, SC, and ML, or any combination of these groups; free of rock or gravel larger than 75 mm (3 inches) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter. Material approved from on site or off site sources

having a minimum dry density of 1760 kg/m3 (110 pcf), a maximum Plasticity Index of 15, and a maximum Liquid Limit of 40.

C. Engineered Fill: Naturally or artificially graded mixture of compliance with ASTM D2487 Soil Classification Groups GW, GP, GM, SW, SP, SM, SC, and ML, or any combination of these groups, or as approved by the Engineer or material with at least 90 percent passing a 37.5-mm (1 1/2-inch) sieve and not more than 12 percent passing a 75-µm (No. 200) sieve, per ASTM D2940;

D. The flowable fill shall be a cementitious mixture of Portland cement, fly ash (depending on application and mix design), fine aggregate, water, entrained air, and appropriate admixtures for the particular application in accordance with LADOTD Standard Specification for Roads and Bridges, Section 710 Flowable Fill.

E. Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; except with 100 percent passing a 25 mm (1 inch) sieve and not more than 8 percent passing a 75-µm (No. 200) sieve.

F. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D448; coarse-aggregate grading Size 57; with 100 percent passing a 37.5 mm (1 1/2-inch) sieve and 0 to 5 percent passing a 2.36 mm (No. 8) sieve.

G. 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 C 33 with a maximum of 3 percent by weight passing ASTM D 1140, 75 micrometers (No. 200) sieve, or37.5 mm (1-1/2 inches) and no more than 2 percent by weight passing the 4.75 mm (No. 4) size sieve or 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), per ASTM D2940.

G. 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, Toluene, 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 Method 5030/8020. 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.

H. 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:

Red:	Electric
Yellow:	Gas, Oil, Dangerous Materials
Orange:	Telephone and Other Communications
Blue:	Water Systems
Green:	Sewer Systems
White:	Steam Systems
Gray:	Compressed Air

I. 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.

J. 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.

K. 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: Clear within limits of earthwork operations as shown. Work includes removal of trees, shrubs, fences, foundations, incidental structures, paving, debris, trash, and other obstructions. Remove materials from Medical Center.

B. Grubbing: Remove stumps and roots 75 mm (3 inch) and larger diameter. Undisturbed sound stumps, roots up to 75 mm (3 inch) diameter, and nonperishable solid objects 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 areas within 4500 mm (15 feet) of new construction and 2250 mm (7.5 feet) of utility lines when removal is approved in advance by Resident Engineer. Remove materials from Medical Center. Trees and shrubs, shown to be transplanted, shall be dug with a ball of earth and burlapped in accordance with latest issue of, "American Standard for Nursery Stock" of the American Association of Nurserymen, Inc. Transplant trees and shrubs to a permanent or temporary position within two hours after digging. Maintain trees and shrubs held in temporary locations by watering as necessary and feeding semiannually with liquid fertilizer with a minimum analysis of 5 percent nitrogen, 10 percent phosphorus, and 5 percent potash. Maintain plants moved to permanent positions as specified for plants in temporary locations until conclusion of contract. Box, and otherwise protect from damage, existing trees and shrubs which are not shown to be removed in construction area. Immediately repair damage to existing trees and shrubs by trimming, cleaning and painting damaged areas, including roots, in accordance with standard industry horticultural practice for the geographic area and plant species. Do not store building materials closer to trees and shrubs, that are to remain, than farthest extension of their limbs.

D. Stripping Topsoil: Strip topsoil from within limits of earthwork operations as specified. Topsoil shall be a fertile, friable, natural topsoil of loamy character and characteristic of locality. Topsoil shall be capable of growing healthy horticultural crops of grasses. Stockpile topsoil and protect as directed by Resident Engineer. Eliminate foreign materials, 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 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 soil is wet so that the composition of the soil will be destroyed.

E. 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 Medical Center.

F. Lines and Grades: Registered Professional Land Surveyor or Registered Civil Engineer, specified in Section 01 00 00, GENERAL REQUIREMENTS, shall establish lines and grades.

1. Grades shall conform to elevations indicated on plans within the tolerances herein specified. Generally, grades shall be established to provide a smooth surface, free from irregular surface changes. Grading shall comply with compaction requirements and grade cross sections, lines, and elevations indicated. Where spot grades are indicated the grade shall be established based on interpolation of the elevations between the spot grades while maintaining appropriate transition at structures and paving and uninterrupted drainage flow into inlets.
2. Locations of existing and proposed elevations indicated on plans except spot elevations, are approximate from a site survey that measured spot elevations and subsequently generated existing contours and spot elevations. Proposed spot elevations and contour lines have been developed utilizing the existing conditions survey

and developed contour lines and may be approximate. Contractor is responsible to notify Resident Engineer of any differences between existing elevations shown on plans and those encountered on site by Surveyor/Engineer described above. Notify Resident Engineer of any differences between existing or constructed grades, as compared to those shown on the plans.

3. Subsequent to establishment of lines and grades, Contractor will be responsible for any additional cut and/or fill required to ensure that site is graded to conform to elevations indicated on plans.

G. 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.

3.2 EXCAVATION:

A. Shoring, Sheeting and Bracing: Shore, brace, or slope, its angle of repose or to an angle considered acceptable by the Resident Engineer, banks of excavations to protect workmen, banks, adjacent paving, structures, and utilities.

1. Design of the temporary support of excavation system is the responsibility of the Contractor. The Contractor shall submit a Shoring and Sheeting plan for approval 15 days prior to starting work. Submit drawings and calculations, certified by a registered professional engineer, describing the methods for shoring and sheeting of excavations. Shoring, including sheet piling, shall be furnished, and installed as necessary to protect workmen, banks, adjacent paving, structures, and utilities. Shoring, bracing, and sheeting shall be removed as excavations are backfilled, in a manner to prevent caving.
2. Construction of the support of excavation system shall not interfere with the permanent structure and may begin only after a review by the Resident Engineer.
3. Extend shoring and bracing to a minimum of 1500 mm (5 feet) below the bottom of excavation. Shore excavations that are carried below elevations of adjacent existing foundations.
4. If bearing material of any foundation is disturbed by excavating, improper shoring or removal of existing or temporary shoring, placing of backfill, and similar operations, the Contractor shall

underpin the existing foundation, per Section 3.3 provide a concrete fill support in compliance with specifications 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 required to keep excavation free of water and subgrade dry, firm, and undisturbed until approval of permanent work has been received from Resident Engineer. Approval by the Resident Engineer is also required before placement of the permanent work on all subgrades. 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 5 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. Subgrade Protection: Protect subgrades from softening, undermining, washout, or damage by rain or water accumulation. Reroute surface water runoff from excavated areas and not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches. When subgrade for foundations has been disturbed by water, remove disturbed material to firm undisturbed material after water is brought under control. Replace disturbed subgrade in trenches with concrete or material approved by the Resident Engineer.

E. Proofrolling:

1. After rough grade has been established in cut areas and prior to placement of fill in fill areas under building and pavements, proofroll exposed subgrade with a fully loaded dump truck to check for pockets of soft material.
2. Proof rolling shall be done on an exposed subgrade free of surface water (wet conditions resulting from rainfall) which would promote degradation of an otherwise acceptable subgrade. After stripping, proof roll the existing subgrade with six passes of a dump truck loaded with 6 cubic meters (4 cubic yards) of soil 13.6 meter tons (15 ton), pneumatic-tired roller. Operate the roller or truck in a systematic manner to ensure the number of passes over all areas, and at speeds between 4 to 5.5 km/hour (2 1/2 to 3 1/2 mph). When proof rolling, one-half of the passes made with the roller shall be in a direction perpendicular to the other passes. Notify the Resident Engineer a minimum of 3 days prior to proof rolling. Proof rolling shall be performed in the presence of the Resident Engineer. Rutting or pumping of material shall be undercut as directed by the Resident Engineer to a depth of 6 inches) and replaced with fill and backfill satisfactory material.

F. 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 materials to a 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.
6. Slope grades to direct water away from excavations and to prevent ponding.
7. Capillary water barrier (granular fill) under concrete floor and area-way slabs on grade shall be placed directly on the subgrade and shall be compacted with a minimum of two passes of a hand-operated plate-type vibratory compactor.
8. Ensure that footing subgrades have been inspected and approved by the Resident Engineer prior to concrete placement. Excavate to

bottom of pile cap prior to placing or driving piles, unless authorized otherwise by the Resident Engineer. Backfill and compact over excavations and changes in grade due to pile driving operations to 95 percent of ASTM D698 maximum density.

G. 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. Length of open trench in advance of piping laying shall not be greater than is authorized by 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 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 D 698 maximum 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 noncohesive, either wet or dry. Soil Types GW, GP, SW, and SP are included in this class as specified in ASTM D2487.
3) Clean, coarse-grained sand classified as SW or SP by ASTM D2487 for bedding and backfill as indicated.
4) Clean, coarsely graded natural gravel, crushed stone or a combination thereof identified as having a classification of GW GP in accordance with ASTM D2487 for bedding and backfill as indicated. Maximum particle size shall not exceed 75 mm (3 inches).

2. Sanitary and storm sewer trenches:
   a. Trench width below a point 150 mm (6 inches) above top of pipe shall be 600 mm (24 inches) maximum for pipe 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 (12 inches). Width of trench above that level shall be as necessary for sheeting and bracing and proper performance of the work.
      1) Bed bottom quadrant of pipe 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 pipe to 300 mm (12 inches) above top of pipe. Place and tamp fill material by hand.

c. Place and compact as specified 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 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 noncohesive, either wet or dry. Soil Types GW, GP, SW, and SP are included in this class as specified in ASTM D2487.
3) Clean, coarse-grained sand classified SW or SP by ASTM D2487 for bedding and backfill as indicated.
4) Clean, coarsely graded natural gravel, crushed stone or a combination thereof identified as having a classification of GW GP in accordance with ASTM D2487 for bedding and backfill as indicated. Maximum particle size shall not exceed 75 mm (3 inches).

H. Site Earthwork: Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation. Excavation shall be accomplished as required by drawings and specifications. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 25 mm (1 inch). Extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, complying with OSHA requirements, and for inspections. Remove subgrade materials that are determined by Resident Engineer 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, 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 volume in cut section only.

1. Site Grading:
   a. Provide a smooth transition between adjacent existing grades and new grades.
   b. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
   c. Slope grades to direct water away from buildings and to prevent ponds from forming where not designed. Finish subgrades to required elevations within the following tolerances:
      1) Lawn or Unpaved Areas: Plus or minus 25 mm (1 inch).
      2) Walks: Plus or minus 25 mm (1 inch).
      3) Pavements: Plus or minus 13 mm (1 inch).
   d. Grading Inside Building Lines: Finish subgrade to a tolerance of 13 mm (1/2 inch) when tested with a 3000 mm (10 foot) straightedge.

3.4 FILLING AND BACKFILLING:

A. General: Do not fill or backfill until all debris, water, unsatisfactory soil materials, obstructions, and deleterious materials have been removed from excavation. For fill and backfill, use excavated materials and borrow meeting the criteria specified herein, as applicable. Borrow will be supplied at no additional cost to the Government. Do not use unsuitable excavated materials. Do not backfill until foundation walls have been completed above grade and adequately braced, waterproofing or dampproofing applied, foundation drainage, and pipes coming in contact with backfill have been installed and work inspected and approved by Resident Engineer.

B. Placing: Place materials in horizontal layers not exceeding 200 mm (8 inches) in loose depth for material compacted by heavy compaction equipment, and not more than 100 mm (4 inches) in loose depth for material compacted by hand-operated tampers and then compacted. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure. Place no material on surfaces that are muddy, frozen, or contain frost.

C. Compaction: Compact with approved tamping rollers, sheepsfoot rollers, pneumatic tired rollers, steel wheeled rollers, vibrator compactors, or other approved equipment (hand or mechanized) well suited to soil being compacted. Do not operate mechanized vibratory compaction equipment

within 3000 mm (10 feet) of new or existing building walls without prior approval of Resident Engineer. Moisten or aerate material as necessary to provide moisture content that will readily facilitate obtaining specified compaction with equipment used. 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. Compact soil to not less than the following percentages of maximum dry density, according to ASTM D1557 as specified below:

1. Fills, Embankments, and Backfill
   a. Under proposed structures, building slabs, steps, and paved areas, scarify and recompact top 300 mm (12 inches) of existing subgrade and each layer of backfill or fill material in accordance with D1557 95 percent.
   b. Curbs, curbs and gutters, D1557 95 percent.
   c. Under Sidewalks, scarify and recompact top 150 mm (6 inches) below subgrade and compact each layer of backfill or fill material in accordance with D1557 95 percent.
   d. Landscaped areas, top 400 mm (16 inches), ASTM D1557 85 percent.
   e. Landscaped areas, below 400 mm (16 inches) of finished grade, ASTM D1557 90 percent.
2. Natural Ground (Cut or Existing)
   a. Under building slabs, steps and paved areas, top 150 mm (6 inches), ASTM D1557 95 percent.
   b. Curbs, curbs and gutters, top 150 mm (6 inches), ASTM D1557 95 percent.
   c. Under sidewalks, top 150 mm (6 inches), ASTM D1557 95 percent.

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 shown on drawings within the limits of the project site, selected by the Contractor or 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 Resident Engineer 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.

3.5 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 pipe spaces or other unfinished areas, fill low spots and level off with coarse sand or fine gravel.

C. Slope backfill outside building away from building walls for a minimum distance of 1800 mm (6 feet).

D. Finish grade earth floors in pipe basements as shown to a level, uniform slope and leave clean.

E. Finished grade shall be at least 150 mm (6 inches) below bottom line of window or other building wall openings unless greater depth is shown.

F. Place crushed stone or gravel fill under concrete slabs on grade, tamped, and leveled. Thickness of fill shall be 150 mm (6 inches) unless otherwise shown.

G. Finish subgrade in a condition acceptable to Resident Engineer at least one day in advance of paving operations. Maintain finished subgrade in a smooth and compacted condition until succeeding operation has been accomplished. Scarify, compact, and grade subgrade prior to further construction when approved compacted subgrade is disturbed by Contractor's subsequent operations or adverse weather.

H. Grading for Paved Areas: Provide final grades for both subgrade and base course to +/- 6 mm (0.25 inches) of indicated grades.

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. Disposal: Transport surplus satisfactory soil to designated storage areas on Medical Center property. Stockpile or spread soil as directed by Resident Engineer.

1. Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Medical Center property.

C. Place excess excavated materials suitable for fill and/or backfill on site where directed.

D. Remove from site and dispose of any excess excavated materials after all fill and backfill operations have been completed.

E. Segregate all excavated contaminated soil designated by the Resident Engineer 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:

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 all debris, rubbish, and excess material from Medical Center.

----- E N D -----

SECTION 32 05 23
CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Subbase for concrete pavements.
2. Curbs, gutters, and combination curbs and gutters.
3. Vehicular Pavement: driveways, parking lots.

1.2 RELATED REQUIREMENTS

A. Field Testing: Section 01 45 29, TESTING LABORATORY SERVICES.

B. Subgrade Preparation and Subbase Compaction: Section 31 20 00, EARTHWORK.

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. C989/C989M-14 - Slag Cement for Use in Concrete and Mortars.
14. C1240-15 - Silica Fume Used in Cementitious Mixtures.
15. D1751-04(2013)e1 - Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
16. D5893/D5893M-10 - Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements.
17. 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. Architect/Engineer.
      c. Inspection and Testing Agency.
      d. Contractor.
      e. Installer.
   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.

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. 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. Silica Fume: ASTM C1240.

C. Coarse Aggregate: ASTM C33/C33M; size 1” to 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, deformed.

I. Welded Wire Fabric: ASTM A1064/A1064M, plain; Grade 450 (65) sized as indicated.

J. Expansion Joint Filler: ASTM D1751.

K. Sheet Materials for Curing Concrete: ASTM C171.

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 1-D ; 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 31 20 00, EARTHWORK.

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 31 20 00, EARTHWORK.

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. 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. Locate construction joints between slabs of vehicular pavement as shown on approved submittal Drawings.

B. Place transverse construction joints of type shown, where indicated, and whenever concrete placement is suspended for more than 30 minutes.

C. Provide butt-type joint with dowels in curb and gutter at planned joint locations.

D. Provide keyed joints with tie bars when joint occurs in middle third of planned curb and gutter joint interval.

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 CURB AND GUTTER, 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 PLACING CONCRETE FOR VEHICULAR PAVEMENT

A. Deposit concrete as close as possible to its final position.

B. Place concrete continuously between construction joints without cold joints.

C. Strike and consolidate concrete with finishing machine, vibrating screed, or by hand-finishing.

D. Finish concrete surface to elevation and crown shown on drawings.

E. Deposit concrete near joints without disturbing joints. Do not place concrete directly onto joint assemblies.

F. Obtain Contracting Officer's Representative's approval before placing adjacent lanes.

3.12 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.

3.13 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.

3.14 CONCRETE FINISHING - VEHICULAR PAVEMENT

A. Align finish surfaces where new and existing pavements abut.

B. Longitudinally float pavement surface to profile and grade indicated on drawings.

C. Straighten surface removing irregularities and maintaining specified tolerances while concrete is plastic.

D. Finish pavement edges and joints with edging tool.

E. Broom finish concrete surface after bleed water dissipates and before concrete hardens.

1. Broom surface transverse to traffic direction.
   a. Use brooming to eliminate flat surface produced by edger.
   b. Produce uniform corrugations, maximum 3 mm (1/8 inch) deep profile.

F. Pavement Tolerances:

1. Variation from Indicated Plane: Maximum 6 mm in 3000 mm (1/4 inch in 10 feet) tested parallel and perpendicular to traffic direction at maximum 1500 mm (5 feet) intervals.
2. Variation from Indicated Thickness: Maximum 6 mm (1/4 inch).

G. Replace paving within joint boundary when paving exceeds specified tolerances.

3.15 CONCRETE FINISHING - CURBS AND GUTTERS

A. Round edges of gutter and top of curb with edging tool.

B. Gutter and Curb Top:

1. Float surfaces and finish with smooth wood or metal float until true to grade and section and uniform color.
2. Finish surfaces, while still plastic, longitudinally with bristle brush.

C. Curb Face:

1. Remove curb form and immediately rub curb face with wood or concrete rubbing block removing blemishes, form marks, and tool marks and providing uniform color.
2. Brush curb face, while still plastic, matching gutter and curb top.

D. Curb and Gutter Tolerances: Except at grade changes or curves.

1. Variation from Indicated Plane and Grade:
   a. Gutter: Maximum 3 mm in 3000 mm (1/8 inch in 10 feet).
   b. Curb Top and Face: Maximum 6 mm in 3000 mm (1/4 inch in 10 feet).

E. Replace curbs and gutters within joint boundary when curbs and gutters exceed specified tolerances.

F. Correct depressions causing standing water.

3.16 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.

3.17 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.

3.18 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 12 16
ASPHALT PAVING

PART 1 - GENERAL

1.1 DESCRIPTION

This work shall cover the composition, mixing, construction upon the prepared subgrade, and the protection of hot asphalt concrete pavement. The hot asphalt concrete pavement shall consist of an aggregate or asphalt base course and asphalt surface course constructed in conformity with the lines, grades, thickness, and cross sections as shown. Each course shall be constructed to the depth, section, or elevation required by the drawings and shall be rolled, finished, and approved before the placement of the next course.

1.2 RELATED WORK

A. Laboratory and field testing requirements: Section 01 45 29, TESTING LABORATORY SERVICES.

B. Subgrade Preparation: Paragraph 3.3 and Section 31 20 00, EARTH MOVING.

C. Pavement Markings: Section 32 17 23, PAVEMENT MARKINGS.

1.3 INSPECTION OF PLANT AND EQUIPMENT

The Resident Engineer shall have access at all times to all parts of the material producing plants for checking the mixing operations and materials and the adequacy of the equipment in use.

1.4 ALIGNMENT AND GRADE CONTROL

The Contractor’s Registered Professional Land Surveyor shall establish and control the pavement (aggregate or asphalt base course and asphalt surface course) alignments, grades, elevations, and cross sections as shown on the Drawings.

1.5 SUBMITTALS

A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:

B. Data and Test Reports:

1. Aggregate Base Course: Sources, gradation, liquid limit, plasticity index, percentage of wear, and other tests required by State Highway Department.
2. Asphalt Base/Surface Course: Aggregate source, gradation, soundness loss, percentage of wear, and other tests required by State Highway Department.
3. Job-mix formula.

C. Certifications:

1. Asphalt prime and tack coat material certificate of conformance to State Highway Department requirements.
2. Asphalt cement certificate of conformance to State Highway Department requirements.
3. Job-mix certification - Submit plant mix certification that mix equals or exceeds the State Highway Specification.

D. One copy of State Highway Department Specifications.

E. Provide MSDS (Material Safety Data Sheets) for all chemicals used on ground.

PART 2 - PRODUCTS

2.1 GENERAL

A. Aggregate base, Asphaltic base, and asphalt concrete materials shall conform to the requirements of the following and other appropriate sections of the latest version of the State Highway Material Specifications, including amendments, addenda and errata. Where the term "Engineer" or "Commission" is referenced in the State Highway Specifications, it shall mean the VA Resident Engineer or VA Contracting Officer.

2.2 AGGREGATES

A. Provide aggregates consisting of crushed stone, gravel, sand, or other sound, durable mineral materials processed and blended, and naturally combined.

B. Subbase aggregate (where required) maximum size: 38mm(1-1/2").

C. Base aggregate maximum size:

1. Base course over 152mm(6") thick: 38mm(1-1/2");
2. Other base courses: 19mm(3/4").

D. Asphaltic base course:

1. Maximum particle size not to exceed 25.4mm(1”).
2. Where conflicts arise between this specification and the requirements in the latest version of the State Highway Specifications, the State Specifications shall control.

E. Aggregates for asphaltic concrete paving: Provide a mixture of sand, mineral aggregate, and liquid asphalt mixed in such proportions that the percentage by weight will be within:

Sieve Sizes	Percentage Passing
12.5mm (1/2")	95-100
9.5mm (3/8")	60 to 80
2.4mm (No. 8 mesh)	0 to 5
75µm (No. 200 mesh)	0 to 2

plus 50/60 penetration liquid asphalt at 5 percent to 6-1/2 percent of the combined dry aggregates.

2.3 ASPHALTS

A. Comply with provisions of Asphalt Institute Specification SS2:
   1. Asphalt cement: Penetration grade 50/60
   2. Prime coat: Cut-back type, grade MC-250
   3. Tack coat: Uniformly emulsified, grade SS-1H

2.4 SEALER

A. Provide a sealer consisting of suitable fibrated chemical type asphalt base binders and fillers having a container consistency suitable for troweling after thorough stirring and containing no clay or other deleterious substance.

B. Where conflicts arise between this specification and the requirements in the latest version of the State Highway Specifications, the State Specifications shall control.

PART 3 - EXECUTION

3.1 GENERAL

The Asphalt Concrete Paving equipment, weather limitations, job-mix formula, mixing, construction methods, compaction, finishing, tolerance, and protection shall conform to the requirements of the appropriate sections of the State Highway Specifications for the type of material specified.

3.2 MIXING ASPHALTIC CONCRETE MATERIALS

A. Provide hot plant-mixed asphaltic concrete paving materials.
   1. Temperature leaving the plant: 143 degrees C(290 degrees F) minimum, 160 degrees C(320 degrees F) maximum.
   2. Temperature at time of placing: 138 degrees C(280 degrees F) minimum.

3.3 SUBGRADE

A. Shape to line and grade and compact with self-propelled rollers.

B. All depressions that develop under rolling shall be filled with acceptable material and the area re-rolled.

C. Soft areas shall be removed and filled with acceptable materials and the area re-rolled.

D. Should the subgrade become rutted or displaced prior to the placing of the subbase, it shall be reworked to bring to line and grade.

E. Proof-roll the subgrade with maximum 45 tonne (50 ton) gross weight dump truck as directed by VA Resident Engineer or VA Contracting Officer. If pumping, pushing, or other movement is observed, rework the area to provide a stable and compacted subgrade.

3.4 BASE COURSES

A. Subbase (when required)

1. Spread and compact to the thickness shown on the drawings.
2. Rolling shall begin at the sides and continue toward the center and shall continue until there is no movement ahead of the roller.
3. After completion of the subbase rolling there shall be no hauling over the subbase other than the delivery of material for the top course.

B. Base

1. Spread and compact to the thickness shown on the drawings.
2. Rolling shall begin at the sides and continue toward the center and shall continue until there is no movement ahead of the roller.
3. After completion of the base rolling there shall be no hauling over the base other than the delivery of material for the top course.

C. Thickness tolerance: Provide the compacted thicknesses shown on the Drawings within a tolerance of minus 0.0mm (0.0") to plus 12.7mm (0.5").

D. Smoothness tolerance: Provide the lines and grades shown on the Drawings within a tolerance of 5mm in 3m (3/16 inch in ten feet).

E. Moisture content: Use only the amount of moisture needed to achieve the specified compaction.

3.5 PLACEMENT OF ASPHALTIC CONCRETE PAVING

A. Remove all loose materials from the compacted base.

B. Apply the specified prime coat, and tack coat where required, and allow to dry in accordance with the manufacturer’s recommendations as approved by the Architect or Engineer.

C. Receipt of asphaltic concrete materials:

1. Do not accept material unless it is covered with a tarpaulin until unloaded, and unless the material has a temperature of not less than 130 degrees C(280 degrees F).
2. Do not commence placement of asphaltic concrete materials when the atmospheric temperature is below 10 degrees C (50 degrees F), not during fog, rain, or other unsuitable conditions.

D. Spreading:
1. Spread material in a manner that requires the least handling.
2. Where thickness of finished paving will be 76mm (3") or less, spread in one layer.

E. Rolling:
1. After the material has been spread to the proper depth, roll until the surface is hard, smooth, unyielding, and true to the thickness and elevations shown own the drawings.
2. Roll in at least two directions until no roller marks are visible.
3. Finished paving smoothness tolerance:
   a. No depressions which will retain standing water.
   b. No deviation greater than 3mm in 1.8m (1/8" in six feet).

3.6 APPLICATION OF SEAL COAT

A. Prepare the surfaces, mix the seal coat material, and apply in accordance with the manufacturer’s recommendations as approved by the Architect or Engineer.

B. Achieve a finished surface seal which, when dry and thoroughly set, is smooth, tough, resilient, of uniform black color, and free from coarse textured areas, lap marks, ridges, and other surface irregularities.

C. When sealing new asphalt paving wait an entire year to allow for the expansion and contraction of a year’s cycle of both warm and cool temperatures. This allows for the asphalt’s oils to properly cure and begin oxidation before applying a seal coat.

D. When seal coating in less than a year apply two coats, spray applied. This application method is preferred for less than a year application when there is still plenty of asphalt cement present for the seal coat to bond to.

3.7 PROTECTION

Protect the asphaltic concrete paved areas from traffic until the sealer is set and cured and does not pick up under foot or wheeled traffic.

3.8 FINAL CLEAN-UP

Remove all debris, rubbish, and excess material from the work area.

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SECTION 32 17 23
PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Paint and reflective glass beads on pavement surfaces, in form of traffic lanes, parking bays, areas restricted to handicapped persons, crosswalks, and other detail pavement markings.

1.2 RELATED REQUIREMENTS (not used)

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. Federal Specifications (Fed. Spec.):

1. TT-B-1325D - Beads (Glass Spheres) Retro-Reflective.
2. TT-P-1952F - Paint, Traffic and Airfield Marking, Waterborne.

C. Master Painters Institute (MPI):

1. No. 97 - Traffic Marking Paint, Latex.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:

1. Show pavement marking configuration and dimensions.
2. Show international symbol of accessibility at designated parking spaces.

C. Manufacturer's Literature and Data:

1. Description of each product.
2. Application instructions.

D. Samples:

1. Paint: 200 mm (8 inches) square, each type and color.

E. Certificates: Certify products comply with specifications.

F. Qualifications: Substantiate qualifications comply with specifications.

1. Installer with project experience list.

1.5 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.

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 conditioned facility.

B. Protect products from damage during handling and construction operations.

1.8 FIELD CONDITIONS

A. Environment:

1. Product Temperature: Minimum 13 degrees C (55 degrees F) for minimum 48 hours before installation.

a. Surface to be painted and ambient temperature: Minimum 10 degrees C (50 degrees F) and maximum 35 degrees C (95 degrees F).

B. Field Measurements: Verify field conditions affecting traffic marking installation. Show field measurements on Submittal Drawings.

1.9 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

A. Design paint complying with specified performance:

1. Application: Fed. Spec. TT-P-1952.

2.2 PRODUCTS - GENERAL

A. Provide each product from one manufacturer and from one production run.

2.3 SANDBLASTING EQUIPMENT

A. Air compressor, hoses, and nozzles of proper size and capacity as required for cleaning painted surfaces. Compressor to provide minimum 0.08 cu. m/s (150 cfm) of air at pressure of minimum 625 kPa (90 psi) at each nozzle used.

2.4 PAINT APPLICATOR

A. Apply marking paint with approved mechanical equipment. Provide equipment with constant agitation of paint and travel at controlled

speeds. Synchronize one or more paint "guns" to automatically begin and cut off paint flow in case of skip lines. Equipment to have manual control to apply continuous lines of varying length and marking widths as indicated on Drawings. Provide pneumatic spray guns for hand application of paint in areas where mobile paint applicator cannot be used. Use separate piece of equipment when equipment does not have glass bead dispenser. Adjust and synchronize equipment with paint applicator to distribute reflective beads on paint lines uniformly within ten seconds without any waste.

2.5 PAINT

A. Paint: MPI No. 97. For obliterating existing markings comply with Fed. Spec. TT-P-1952. Provide minimum 18 L (5 gallons) containers.

2.6 REFLECTIVE GLASS BEADS

A. Beads: Comply with Fed. Spec. TT-B-1325, Type I, Gradation A. In regions of high humidity, coat beads with silicone or other suitable waterproofing material to ensure free flow. Provide glass beads in containers suitable for handling and strong enough to prevent loss during shipment.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.
   1. Allow new pavement surfaces to cure for period of minimum 14 days before application of marking materials.
B. Protect existing construction and completed work from damage.
C. Clean substrates. Remove contaminants capable of affecting subsequently installed product's performance.
   1. Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or combination of these methods.
   2. Completely remove rubber deposits, existing paint markings, and other coatings adhering to pavement with scrapers, wire brushings, sandblasting, mechanical abrasion, or approved chemicals as directed by Contracting Officer's Representative.
   3. As an option, comply with Fed. Spec. TT-P-1952 for removal of existing paint markings on asphalt pavement. Apply black paint in as many coats as necessary to completely obliterate existing markings.

4. Scrub affected areas with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinse thoroughly after each application, where oil or grease are present on old pavements to be marked, .
   a. After cleaning, seal oil-soaked areas with cut shellac to prevent bleeding through new paint.
5. Clean and dry surface before pavement marking. Do not begin any marking until Contracting Officer's Representative inspected surface and gives permission to proceed.

3.2 TEMPORARY PAVEMENT MARKING

A. Apply Temporary Pavement Markings of colors, widths and lengths shown on drawings or directed by Contracting Officer's Representative. After temporary marking has served its purpose and when so ordered by Contracting Officer's Representative, remove temporary marking by carefully controlled sandblasting, approved grinding equipment, or other approved method to prevent damage on applied surface.

B. As an option, provide approved preformed pressure sensitive, reflective, adhesive tape type of temporary pavement marking of required colors, widths and lengths in lieu of temporary painted and reflective marking. Continuous durability and effectiveness of such marking is required during period for which its use is required. Remove any unsatisfactory tape type marking and replace with painted and reflective markings.

3.3 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.

3.4 PAINT APPLICATION

A. Apply uniformly painted and reflective pavement marking of required colors, length, and width with true, sharp edges and ends on properly cured, prepared, and dried surfaces.

B. Comply with details as indicated on drawings and established control points.

C. Apply paint at wet film thickness of 0.4 mm (0.015 inch). Disperse reflective glass beads evenly on wet paint at rate of 720 g/L (6 pounds

per gal.) of paint. Apply paint in one coat. When directed by Contracting Officer's Representative, apply additional coats at markings showing light spots. Comply with paint manufacturer's maximum drying time requirements to prevent undue softening of asphalt, and pick-up, displacement, or discoloration by tires of traffic.

D. When deficiency in marking drying occurs, discontinue paint operations until cause of slow drying is determined and corrected.

E. Remove and replace marking applied less than minimum material rates, deviates from true alignment, exceeds stipulated length and width tolerances, or shows light spots, faulty distribution of beads, smears, or other deficiencies or irregularities.

F. Remove marking by carefully controlled sandblasting, approved grinding equipment, or other approve method to prevent damage on applied surface.

3.5 DETAIL PAVEMENT MARKING APPLICATION

A. Apply Detail Pavement Markings, exclusive of actual traffic lane marking as follows:

1. At exit and entrance islands and turnouts.
2. On curbs.
3. At crosswalks.
4. At parking bays.
5. Other locations as indicated on drawings.

B. Apply International Handicapped Symbol at indicated parking spaces. Color as shown on drawings. Apply paint for symbol using suitable template that will provide pavement marking with true, sharp edges and ends.

C. Install detail pavement markings of colors, widths and lengths, and design pattern at locations indicated on drawings.

3.6 TOLERANCES

A. Length and Width of Lines: Plus, or minus 75 mm (3 inches) and plus or minus 3 mm (1/8 inch), respectively, in case of skip markings.

B. Length of intervals exceeding line length tolerance are not acceptable.

3.7 CLEANING

A. Remove excess paint before paint sets.

3.8 PROTECTION

A. Protect pavement markings from traffic and construction operations.

1. Protect newly painted markings from vehicular traffic until paint is dry and track free.
2. Place warning signs at beginning of wet line, and at points well in advance of marking equipment for alerting approaching traffic from both directions.
3. Place small flags or other similarly effective small objects near freshly applied markings at frequent intervals to reduce crossing by traffic.

B. Repair damage.

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